# ATME College of Engineering

## C1.1.1 - The Institution ensures effective curriculum delivery through a well-planned and documented process

## Supporting Documents

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# Department of Electrical & Electronics Engineering

**ATME COLLEGE OF ENGINEERING**
13th Kilometer, Mysore-Kanakapura-Bangalore Road, Mysore – 570 028 P : 0821-2593335 F: 0821-2593328
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# ATME COLLEGE OF ENGINEERING, MYSURU

## Revised Academic Calendar (ODD SEMESTER, 2020-21)

| WEEK | MONTH | SUN | MON | TUE | WED | THU | FRI | SAT | HOLIDAY (H) | COLLEGE EVENTS |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | SEPTEMBER | | | 1 | 2 | 3 | 4 | 5 | | 3rd , 5th & 7th Semster : commencement of Online Classes |
| 2 | | 6 | 7 | 8 | 9 | 10 | 11 | 12 | | |
| 3 | | 13 | 14 | 15 | 16 | 17 | 18 | 19 | Mahalaya Amavasya | |
| 4 | | 20 | 21 | 22 | 23 | 24 | 25 | 26 | | |
| 5 | | 27 | 28 | 29 | 30 | | | | | |
| 5 | OCTOBER | | | | | 1 | 2 | 3 | Gandhi Jayanthi | |
| 6 | | 4 | 5 | 6 | 7 | 8 | 9 | 10 | | First I A for 3rd , 5th and 7th Semester |
| 7 | | 11 | 12 | 13 | 14 | 15 | 16 | 17 | | |
| 8 | | 18 | 19 | 20 | 21 | 22 | 23 | 24 | | |
| 9 | | 25 | 26 | 27 | 28 | 29 | 30 | 31 | Ayudha Pooja, Vijaya Dashami, Eid-Milad , Valmiki Jayanthi | |
| 10 | NOVEMBER | 1 | 2 | 3 | 4 | 5 | 6 | 7 | Kannada Rajyotsava | |
| 11 | | 8 | 9 | 10 | 11 | 12 | 13 | 14 | Naraka Chaturdashi | Second IA for 3rd , 5th and 7th Semester |
| 12 | | 15 | 16 | 17 | 18 | 19 | 20 | 21 | Balipadyami | Commencement of On-Campus Classes for Semseter 7. |
| 13 | | 22 | 23 | 24 | 25 | 26 | 27 | 28 | | |
| 14 | | 29 | 30 | | | | | | | |

Non Working Saturdays

# ATME COLLEGE OF ENGINEERING, MYSURU

**Revised Academic Calendar (ODD SEMESTER, 2020-21)**

| WEEK | MONTH | SUN | MON | TUE | WED | THU | FRI | SAT | HOLIDAY (H) | COLLEGE EVENTS |
|---|---|---|---|---|---|---|---|---|---|---|
| 14 | DECEMBER | | | 1 | 2 | 3 | 4 | 5 | Kanakadasa Jayanthi | |
| 15 | | 6 | 7 | 8 | 9 | 10 | 11 | 12 | | |
| 16 | | 13 | 14 | 15 | 16 | 17 | 18 | 19 | | |
| 17 | | 20 | 21 | 22 | 23 | 24 | 25 | 26 | Christmas | |
| 18 | | 27 | 28 | 29 | 30 | 31 | | | | Third IA for Semesters 3, 5 and 7 |
| 18 | JANUARY | | | | | | 1 | 2 | | |
| 19 | | 3 | 4 | 5 | 6 | 7 | 8 | 9 | | LAB Interenals for Semesters 3,5 and 7 |
| 20 | | 10 | 11 | 12 | 13 | 14 | 15 | 16 | Makra Sankranthi | Improvement IA for Semesters 3,5 and 7, LAST working day for ODD Sem 2020-21 |
| 21 | | 17 | 18 | 19 | 20 | 21 | 22 | 23 | | Comencement of Odd Semester Practical Exams |
| 22 | | 24 | 25 | 26 | 27 | 28 | 29 | 30 | Republic Day | |
| 23 | | 31 | | | | | | | | |
| 23 | FEBRUARY | | 1 | 2 | 3 | 4 | 5 | 6 | | End of Odd Semester Practical Exams |
| 24 | | 7 | 8 | 9 | 10 | 11 | 12 | 13 | | Commencement of Odd Semester Theory Exams |
| 25 | | 14 | 15 | 16 | 17 | 18 | 19 | 20 | | |
| 26 | | 21 | 22 | 23 | 24 | 25 | 26 | 27 | | |
| 27 | | 28 | | | | | | | | |
| | | | | | | | | Non Working Saturdays | | |
| No. Of Working Days | | | 17 | 20 | 20 | 17 | 17 | 9 | Total No. Of Working Days | 100 |

# ATME COLLEGE OF ENGINEERING, MYSURU

## Revised Academic Calendar (ODD SEMESTER, 2020-21)

| WEEK | MONTH | SUN | MON | TUE | WED | THU | FRI | SAT | HOLIDAY (H) | COLLEGE EVENTS |
|---|---|---|---|---|---|---|---|---|---|---|
| 14 | MARCH | | 1 | 2 | 3 | 4 | 5 | 6 | | |
| 15 | | 7 | 8 | 9 | 10 | 11 | 12 | 13 | Mahashivaratri | |
| 16 | | 14 | 15 | 16 | 17 | 18 | 19 | 20 | | |
| 17 | | 21 | 22 | 23 | 24 | 25 | 26 | 27 | | 25th End of odd semester Theory exams, 26th Mar 2021 Commencement of Even Semester |
| 18 | | 28 | 29 | 30 | 31 | | | | | |
| 18 | APRIL | | | | | 1 | 2 | 3 | Good Friday | |
| 19 | | 4 | 5 | 6 | 7 | 8 | 9 | 10 | | |
| 20 | | 11 | 12 | 13 | 14 | 15 | 16 | 17 | Chadramana Yugadi, Ambedkar Jayanthi | |
| 21 | | 18 | 19 | 20 | 21 | 22 | 23 | 24 | | |
| 22 | | 25 | 26 | 27 | 28 | 29 | 30 | | Mahavir Jayanthi | |
| 23 | MAY | | | | | | | 1 | May Day (Labour Day) | |
| 23 | | 2 | 3 | 4 | 5 | 6 | 7 | 8 | | |
| 24 | | 9 | 10 | 11 | 12 | 13 | 14 | 15 | Idul-Fitr, Basava Jayathi | |
| 25 | | 16 | 17 | 18 | 19 | 20 | 21 | 22 | | |
| 26 | | 23 | 24 | 25 | 26 | 27 | 28 | 29 | | |
| 27 | | 30 | 31 | | | | | | | |

Non Working Saturdays

Sd-
Dr. L Basavaraj
Principal

# ATME COLLEGE OF ENGINEERING, MYSURU

**Revised Academic Calendar (EVEN SEMESTER, 2020-21)**

| WEEK | MONTH | SUN | MON | TUE | WED | THU | FRI | SAT | HOLIDAY (H) | COLLEGE EVENTS |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | APRIL | | | | | 1 | 2 | 3 | | |
| 2 | | 4 | 5 | 6 | 7 | 8 | 9 | 10 | | |
| 3 | | 11 | 12 | 13 | 14 | 15 | 16 | 17 | | |
| 4 | | 18 | 19 | 20 | 21 | 22 | 23 | 24 | | Commencement of 4th, 6th and 8th Semester Classes |
| 5 | | 25 | 26 | 27 | 28 | 29 | 30 | | | |
| 5 | MAY | | | | | | | 1 | May Day | |
| 6 | | 2 | 3 | 4 | 5 | 6 | 7 | 8 | | |
| 7 | | 9 | 10 | 11 | 12 | 13 | 14 | 15 | Basava Jayanthi, Ramzan | |
| 8 | | 16 | 17 | 18 | 19 | 20 | 21 | 22 | | |
| 9 | | 23 | 24 | 25 | 26 | 27 | 28 | 29 | | FIRST IA 4TH AND 6TH SEM |
| | | 30 | 31 | | | | | | | |
| 10 | JUNE | | | 1 | 2 | 3 | 4 | 5 | | |
| 11 | | 6 | 7 | 8 | 9 | 10 | 11 | 12 | | |
| 12 | | 13 | 14 | 15 | 16 | 17 | 18 | 19 | | |
| 13 | | 20 | 21 | 22 | 23 | 24 | 25 | 26 | | |
| 14 | | 27 | 28 | 29 | 30 | | | | | |

**Non Working Saturdays**

# ATME COLLEGE OF ENGINEERING, MYSURU

## Revised Academic Calendar (EVEN SEMESTER, 2020-21)

| WEEK | MONTH | SUN | MON | TUE | WED | THU | FRI | SAT | HOLIDAY (H) | COLLEGE EVENTS |
|---|---|---|---|---|---|---|---|---|---|---|
| 14 | JULY | | | | | 1 | 2 | 3 | | SECOND IA 4TH AND 6TH SEM |
| 15 | | 4 | 5 | 6 | 7 | 8 | 9 | 10 | | |
| 16 | | 11 | 12 | 13 | 14 | 15 | 16 | 17 | | |
| 17 | | 18 | 19 | 20 | 21 | 22 | 23 | 24 | Bakrid | 8th Sem Last Working Day, 8th Sem Theory Exam Begins |
| 18 | | 25 | 26 | 27 | 28 | 29 | 30 | 31 | | 8th Sem Theory Exam Ends, THIRD IA 4th AND 6th SEM |
| 18 | AUGUST | 1 | 2 | 3 | 4 | 5 | 6 | 7 | | 4th and 6th Sem Last Working Day, 8th Sem Internship Viva Voce. LAB IA 4th and 6th Sem. |
| 19 | | 8 | 9 | 10 | 11 | 12 | 13 | 14 | | Practical Exams Starts for 4th and 6th Sem |
| 20 | | 15 | 16 | 17 | 18 | 19 | 20 | 21 | Muharram | Practical Exams Ends for 4th and 6th Sem |
| 21 | | 22 | 23 | 24 | 25 | 26 | 27 | 28 | | Theory Exams Starts for 4th and 8th Sem |
| 22 | | 29 | 30 | 31 | | | | | | |
| 23 | SEPTEMBER | | | | 1 | 2 | 3 | 4 | | |
| 24 | | 5 | 6 | 7 | 8 | 9 | 10 | 11 | Ganesha Chathurthi | Theory Exams Starts for 4th and 8th Sem |
| 25 | | 12 | 13 | 14 | 15 | 16 | 17 | 18 | | |
| 26 | | 19 | 20 | 21 | 22 | 23 | 24 | 25 | Non Working Saturdays | |
| 27 | | 26 | 27 | 28 | 29 | 30 | 31 | 32 | | |
| WORKING DAYS (8th Sem) | | | 14 | 14 | 13 | 13 | 13 | 6 | 73 | |
| WORKING DAYS(4th & 6th) | | | 16 | 16 | 15 | 16 | 16 | 7 | 86 | Inclusive of IA tests and other activities |

DEAN ACADEMICS
DR. M S GOVINDE GOWDA

PRINCIPAL
DR. L BASAVARAJ

ATME College of Engineering

# Department of Electrical and Electronics Engineering

## Academic Calendar (ODD SEMESTER, 2020-21)

| WEEK | MONTH | SUN | MON | TUE | WED | THU | FRI | SAT | No. of days/week | COLLEGE EVENTS/ Departement Events |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | SEPTEMBER | | | 1 | 2 | 3 | 4 | 5 | 4 | 3rd, 5th & 7th Sem: commencement of Online Classes / Induction program |
| 2 | | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 6 | State Level Quiz Competition |
| 3 | | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 4 | Mahalaya Amavasya |
| 4 | | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 6 | Webinar for 3rd and 5th sem |
| 5 | | 27 | 28 | 29 | 30 | | | | 3 | Final Year Project Synopsis Submission |
| 5 | OCTOBER | | | | | 1 | 2 | 3 | 1 | Commencement of Offline Classes for 3,5 & 7 Sem, 2nd-Gandhi Jayanthi |
| 6 | | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 6 | First I A for 3rd , 5th and 7th Semester |
| 7 | | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 5 | Technical Talk/ workshop for 3rd Sem, Project Phase-1 Review |
| 8 | | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 6 | Workshop for 7th semester |
| 9 | | 25 | 26 | 27 | 28 | 29 | 30 | 31 | 3 | Ayudha Pooja, Vijaya Dashami, Eid-Milad , Valmiki Jayanthi |
| 10 | NOVEMBER | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 5 | Kannada Rajyotsava, Technical Talk/ workshop for 3rd Sem, National Cancer Awareness day |
| 11 | | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 5 | Second IA for 3rd , 5th and 7th Semester, 14th-Naraka Chaturdashi |
| 12 | | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 4 | Balipadyami |
| 13 | | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 6 | Workshop for 5th sem/ Hackathon |
| 14 | | 29 | 30 | | | | | | 1 | |

| WEEK | MONTH | SUN | MON | TUE | WED | THU | FRI | SAT | No. of days/week | COLLEGE EVENTS |
|---|---|---|---|---|---|---|---|---|---|---|
| 14 | DECEMBER | | | 1 | 2 | 3 | 4 | 5 | 3 | Kanakadasa Jayanthi, Webinar for V sem,Virtual Technical Fest:Avagamah |
| 15 | | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 6 | Virtual Technical Fest:Avagamah |
| 16 | | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 4 | |
| 17 | | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 5 | 25th-Christmas |
| 18 | | 27 | 28 | 29 | 30 | 31 | | | 4 | Third I A for 3rd ,5th and 7th Semesters, World science day for peace and development |
| 18 | JANUARY | | | | | | 1 | 2 | 2 | |
| 19 | | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 6 | LAB Interenals for Semesters 3,5 and 7 |
| 20 | | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 6 | Improvement IA for Semesters 3,5 and 7, LAST working day for ODD Sem 2020-21,Makra Sankranthi |
| 21 | | 17 | 18 | 19 | 20 | 21 | 22 | 23 | | |
| 22 | | 24 | 25 | 26 | 27 | 28 | 29 | 30 | | Republic Day |
| 23 | | 31 | | | | | | | | |
| 23 | FEBRUARY | | 1 | 2 | 3 | 4 | 5 | 6 | | End of Odd Semester Practical Exams |
| 24 | | 7 | 8 | 9 | 10 | 11 | 12 | 13 | | Commencement of Odd Semester Theory Exams |
| 25 | | 14 | 15 | 16 | 17 | 18 | 19 | 20 | | |
| 26 | | 21 | 22 | 23 | 24 | 25 | 26 | 27 | | |
| 27 | | 28 | | | | | | | | |

Non Working Saturdays

Holidays
IA Tests

**Dr. Parthasarathy L**
Head & Dept. of EEE

ATME College of Engineering

ISO 9001:2015

# Department of Electrical and Electronics Engineering

## Academic Calendar - Even Semester

| WEEK | MONTH | SUN | MON | TUE | WED | THU | FRI | SAT | Holiday | Departement Events |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | APRIL | | | | | 1 | 2 | 3 | | Seminar Evaluation of 8th sem |
| 2 | | 4 | 5 | 6 | 7 | 8 | 9 | 10 | | Seminar Evaluation of 8th sem |
| 3 | | 11 | 12 | 13 | 14 | 15 | 16 | 17 | | |
| 4 | | 18 | 19 | 20 | 21 | 22 | 23 | 24 | | Commencement of 4 , 6 and 8 Semester Classes/ Induction Program |
| 5 | | 25 | 26 | 27 | 28 | 29 | 30 | | | |
| 5 | MAY | | | | | | | 1 | May day | |
| 6 | | 2 | 3 | 4 | 5 | 6 | 7 | 8 | | |
| 7 | | 9 | 10 | 11 | 12 | 13 | 14 | 15 | Basava Jayanthi, Ramzan | |
| 8 | | 16 | 17 | 18 | 19 | 20 | 21 | 22 | | Project Phase-II Review-I |
| 9 | | 23 | 24 | 25 | 26 | 27 | 28 | 29 | | Technical Talk for IV semester |
| 10 | | 30 | 31 | | | | | | | |
| 10 | JUNE | | | 1 | 2 | 3 | 4 | 5 | | Internship Evaluation |
| 11 | | 6 | 7 | 8 | 9 | 10 | 11 | 12 | | First IA of 4th, 6th & 8th sem |
| 12 | | 13 | 14 | 15 | 16 | 17 | 18 | 19 | | Technical Talk for VI semester |
| 13 | | 20 | 21 | 22 | 23 | 24 | 25 | 26 | | Technical Talk for VIII semester |
| 14 | | 27 | 28 | 29 | 30 | | | | | |
| 14 | JULY | | | | | 1 | 2 | 3 | | |
| 15 | | 4 | 5 | 6 | 7 | 8 | 9 | 10 | | Second IA for 8th Sem |
| 16 | | 11 | 12 | 13 | 14 | 15 | 16 | 17 | | Project Phase-II Review-II |
| 17 | | 18 | 19 | 20 | 21 | 22 | 23 | 24 | Bakrid | Third IA for 8th Sem & Project Competition |
| 18 | | 25 | 26 | 27 | 28 | 29 | 30 | 31 | | Second IA 4TH AND 6TH SEM |
| 19 | AUGUST | 1 | 2 | 3 | 4 | 5 | 6 | 7 | | Lab Test for 4th & 6th sem . Project & internship Viva voce |
| 20 | | 8 | 9 | 10 | 11 | 12 | 13 | 14 | | Third IA 4th & 6th Sem |
| 21 | | 15 | 16 | 17 | 18 | 19 | 20 | 21 | Muharram | Practical Exams Starts for 4th and 6th Sem |
| 22 | | 22 | 23 | 24 | 25 | 26 | 27 | 28 | | VTU Theory Exams |
| 23 | | 29 | 30 | 31 | | | | | | VTU Theory Exams |
| 23 | SEPTEMBER | | | | 1 | 2 | 3 | 4 | | VTU Theory Exams |
| 24 | | 5 | 6 | 7 | 8 | 9 | 10 | 11 | Ganesha Chathurthi | VTU Theory Exams |
| 25 | | 12 | 13 | 14 | 15 | 16 | 17 | 18 | | VTU Theory Exams |
| 26 | | 19 | 20 | 21 | 22 | 23 | 24 | 25 | Non Working Saturdays | VTU Theory Exams |
| 27 | | 26 | 27 | 28 | 29 | 30 | 31 | | | VTU Theory Exams |

**Dr. Parthasarathy L**
Head & Dept. of EEE

ATME College of Engineering

NBA ACCREDITED

## Department of Electrical & Electronics Engineering

### Lesson Plan & Work-done Diary for AY:2020-21, ODD Semester

| Course with Code: Power System Analysis-2 / 17EE71 | | | | Faculty: Mr. Vinod Kumar P | | Semester & Section: VII | | |
|---|---|---|---|---|---|---|---|---|
| Class No. | Date planned (DD/MM) | Topics to be covered | TLP Planned | Date of Conduction (DD/MM) | Topics Covered | TLP Executed | Remarks if any deviation | class no. |
| MODULE-1 & MODULE-2 | | | | | | | | |
| 1 | 02/09 | Introduction to Power systems | ICT | 2/9 | Introduction to power system | ICT | | 1 |
| 2 | 03/09 | Direction of Complex Power | ICT | 3/9 | Directing Complex power | ICT | | 2 |
| 3 | 04/09 | Formation of $Y_{bus}$ by method of inspection: Mesh & Nodal Analysis | ICT | 4/9 | Formation of Ybus method of inspection. | ICT | | 3 |
| 4 | 09/09 | Formation of $Y_{bus}$ by method of inspection including transformer off-nominal tap setting | ICT | 9/9 | Formation of Ybus by method of inspection | ICT | | 4 |
| 5 | 10/09 | Numerical on $Y_{bus}$ formation | ICT | 10/9 | Numericals on Ybus formation | ICT | | 5 |
| 6 | 11/09 | Numerical on $Y_{bus}$ formation | ICT | 11/9 | Numericals Ybus formation | ICT | | 6 |
| 7 | 16/09 | Introduction to network topology, Elementary graph theory – oriented graph, tree, co-tree. | ICT | 16/9 | Introduction to network topology Elementary Graph theory | LCT | | 7 |
| 8 | 18/09 | Elementary graph theory – basic cut-sets, basic loops; Incidence matrices – Element-node, Bus incidence. | ICT | 18/9 | Elementary Graph theory - basic cutset, basic loops - Element-Node, Bus Incidence. | LCT | | 8 |
| 9 | 23/09 | Basic loop and Augmented loop. Primitive network impedance form and admittance form. | ICT | 23/9 | Basic loop and augmented loop Primitive N/w Impedance. | LCT | | 9 |
| 10 | 24/09 | Method of singular transformation ($YBUS = A^T yA$) | ICT | 23/9 | method of Singular t/f. ($Y_{bus} = A^T y A$) | LCT | | 10 |

| Course with Code: Power System Analysis-2 / 17EE71 | | | | Faculty: Mr. Vinod Kumar P | | Semester & Section: VII | | |
|---|---|---|---|---|---|---|---|---|
| Class No. | Date planned (DD/MM) | Topics to be covered | TLP Planned | Date of Conduction (DD/MM) | Topics Covered | TLP Executed | Remarks if any deviation | Class no |
| MODULE-1 & MODULE-2 | | | | | | | | |
| 11 | 25/09 | Introduction to load flow analysis in power system, Power flow equations, Classification of buses. | ICT | 24/9 | Introduction to load flow Analysis | LCT | | 11 |
| 12 | 30/09 | Gauss-Seidal Method – Algorithm and flow chart for PQ buses and Numericals | ICT | 25/9 | Gauss - Seidal method | LCT | | 12 |
| 13 | 01/10 | Gauss-Seidal Method – Algorithm and flow chart for PV buses and Numericals | ICT | 30/9 | Gauss - Seidal method | LCT | | 13 |
| 14 | 07/10 | Numerical problems on Gauss-Seidal Method | ICT | 1/10 | Numerical problems | LCT | | 14 |
| 15 | 14/10 | Numerical problems on Gauss-Seidal Method | ICT | 5/10 | Numerical problem | LCT | | 15 |
| 16 | 15/10 | Newton Raphson's Method – Algorithm and flow chart for NR method in polar coordinates. | ICT | 7/10 | Newton's Raphson's method | LCT | | 16 |
| 17 | 16/10 | Numerical problems on Newton Raphson Method. | ICT | 21/10 | Numerical on NRM. | LCT | TCS NRT training to students | 17 |
| 18 | 21/10 | Numerical problems on Newton Raphson Method. | ICT | 21/10 | NRM – Numericals | LCT | | 18 |
| 19 | 22/10 | Algorithm for Fast Decoupled load flow method. | ICT | 21/10 | Algorithm for Fast | LCT | | 19 |
| 20 | 23/10 | Comparison of Load Flow Methods. Summary of M-1 & 2 | ICT | 28/10 | Load flow method. | LCT | | 20 |

| Course with Code: Power System Analysis-2 / 17EE71 | | | | Faculty: Mr. Vinod Kumar P | | Semester & Section: VII | | |
|---|---|---|---|---|---|---|---|---|
| Class No. | Date planned (DD/MM) | Topics to be covered | TLP Planned | Date of Conduction (DD/MM) | Topics Covered | TLP Executed | Remarks if any deviation | class no. |
| | | | | MODULE 3 | | | | |
| 21 | 28/10 | Introduction to economic operation of Power System & Performance curves | ICT | 29/10 | Introducing Economic operation | LCT | | 21 |
| 22 | 29/10 | Economic generation scheduling without including generator limits and neglecting losses | ICT | 31/10 | Economic generation Scheduling. | LCT | | 22 |
| 23 | 4/11 | Economic generation scheduling including generator limits and neglecting losses. | ICT | 4/11 | Economic generation Scheduling. | LCT | | 23 |
| 24 | 5/11 | Iterative techniques | ICT | 5/11 | Iterative techniques | LCT | | 24 |
| 25 | 6/11 | Numerical problems | ICT | 6/11 | Numerical problem | LCT | | 25 |
| 26 | 18/11 | Economic Dispatch including transmission losses – approximate penalty factor | ICT | 6/11 | Economic Dispatch | LCT | | 26 |
| 27 | 19/11 | Iterative technique for solution of economic dispatch with losses. | ICT | 7/11 | Iterative technique | LCT | | 27 |
| 28 | 20/11 | Numerical problems | ICT | 7/11 | Numerical problems | LCT | | 28 |
| 29 | 25/11 | Derivation of transmission loss formula. | ICT | 11/11 | Derivation of Tm loss. | LCT | | 29 |
| 30 | 26/11 | Reliability Considerations. Summary of M-3 | ICT | 11/11 | Reliability Consideration | LCT | | 30 |

| Course with Code: Power System Analysis-2 / 17EE71 | | | | Faculty: Mr. Vinod Kumar P | | Semester & Section: VII | | |
|---|---|---|---|---|---|---|---|---|
| Class No. | Date planned (DD/MM) | Topics to be covered | TLP Planned | Date of Conduction (DD/MM) | Topics Covered | TLP Executed | Remarks if any deviation | cla no. |
| MODULE 4 | | | | | | | | |
| 31 | 27/11 | Optimal scheduling for Hydrothermal plants – problem formulation. | ICT | 18/4 | problem formulation | LCT | | 31 |
| 32 | 02/12 | Optimal scheduling for Hydrothermal plants Continuation | ICT | 18/4 | Hydrothermal plant | LCT | | 32 |
| 33 | 04/12 | Optimal scheduling for Hydrothermal plants – solution procedure and algorithm. | ICT | 2/12 | Solution procedure | LCT | | 33 |
| 34 | 09/12 | Optimal scheduling for Hydrothermal plants – solution procedure and algorithm. Continuation | ICT | 2/12 | Optimal Scheduling for plants. | LCT | | 34 |
| 35 | 10/12 | Introduction to the concept of power system security | ICT | 19/11 | Introduction to Concept of power s/m Security | LCT | | 35 |
| 36 | 11/12 | Power system security continuation | ICT | 20/11 | power s/m Security | LCT | | 36 |
| 37 | 16/12 | Maintenance Scheduling. | ICT | 27/11 | maintenance Scheduling | LCT | | 37 |
| 38 | 17/12 | Power System Reliability. | ICT | 25/11 | power s/m reliability | LCT | | 38 |
| 39 | 18/12 | Power System Reliability continuation | ICT | 26/11 | power s/m Constraints | LCT | | 39 |
| 40 | 23/12 | Summary of Module-4 & MCQ | ICT | 5/12 | Summary of module 4 | LCT | | 40 |

| Course with Code: Power System Analysis-2 / 17EE71 | | | | Faculty: Mr. Vinod Kumar P | | Semester & Section: VII | | |
|---|---|---|---|---|---|---|---|---|
| Class No. | Date planned (DD/MM) | Topics to be covered | TLP Planned | Date of Conduction (DD/MM) | Topics Covered | TLP Executed | Remarks if any deviation | class no. |
| MODULE 5 | | | | | | | | |
| 41 | 24/12 | Introduction to $Z_{bus}$, Finding Fault current using $Z_{in}$. Relation of $Z_{bus}$ with $Z_{in}$ | ICT | 9/12 | Introduction to Zbus | LCT | | 41 |
| 42 | 01/01 | Formation of Bus Impedance matrix by step by step building algorithm | ICT | 10/12 | Formation of Impedance matrix | LCT | | 42 |
| 43 | 06/01 | Formation of Bus Impedance matrix by step by step building algorithm-Problems | ICT | 11/12 | Bus Impedance matrix | LCT | | 43 |
| 44 | 07/01 | Numericals on Zbus & Algorithm for Short Circuit Studies | ICT | 16/12 | Numericals on Zbus | LCT | | 44 |
| 45 | 07/01 | Derivation of Swing Equation. | ICT | 17/12 | Derivation of Swing Eq$^n$ | LCT | | 45 |
| 46 | 08/01 | Numerical solution of Swing Equation –Modified Euler's method. | ICT | 18/12 | Numerical Solution | LCT | | 46 |
| 47 | 08/01 | Numerical problems on Runge-Kutta method. | ICT | 23/12 | Numerical on RK m | LCT | | 47 |
| 48 | 13/01 | Numerical solution of Swing Equation –Milne's predictor corrector method. | ICT | 24/12 | milne's predictor method | LCT | | 48 |
| 49 | 15/01 | Multi machine systems | ICT | 31/12 | multi m/c S/m | LCT | | 49 |
| 50 | 15/01 | Multi machine transient stability. Summary of M-5 | ICT | 1/1/2021 | multi m/c transient Stability | LCT | | 50 |

| | Activity | Planned | Actual | Remarks |
|---|---|---|---|---|
| 1 | Theory Classes | 50 | 50 | |
| 2 | Assignments/Quizzes/ Self study | 5 | 5 | |
| 3 | Tutorials/ Extra classes | - | - | |
| 4 | Internal Assessments | 3 | 3 | |
| 5 | ICT based Teaching (% of usage in Curriculum) | 100% | 100% | |

| Planning | Execution |
|---|---|
| **Faculty Signature:** | **Faculty Signature:** |
| **HoD Signature:** Dr. PARTHASARATHY L. Professor and HOD Dept. of Electrical & Electronics Engineering ATME College of Engineering, Mysuru | **HoD Signature:** Dr. PARTHASARATHY L. Professor and HOD Dept. of Electrical & Electronics Engineering ATME College of Engineering, Mysuru |

# ATME College of Engineering

**Department of Electrical and Electronics Engineering**

Date: 11/02/2021

**Ref.No.ATME/EEE/AY_2020-21/ODD/Dept_Meeting/15**

| | |
|---|---|
| AGENDA | 1. Discussion on Course Allotment for AY 2020-21 Even<br>2. Roles and Responsibilities for AY 2020-21 Even<br>3. Topics related to the Department |

I. Following points were discussed w.r.t the above agenda

1. Informed faculty to keep the staff handbook
2. Class Teachers & Lab In charges by default will be regarded as Department Academic Council Members
3. Discussed about the faculty Course Allotment for AY 2020-21 Even semester based on the faculty course preference list

2nd Sem:

| Sl. No | Course & Course Code | Faculty Allotted |
|---|---|---|
| 1 | 18ELE23 – BEE | Mr. Shreeshayana R |
| 2 | 18ELE23 – BEE | Ms. Maria Sushma S |

4th Sem: Class Teacher- KRS

| Sl. No | Course & Course Code | Faculty Allotted | |
|---|---|---|---|
| | | A Sec | B Sec |
| 1 | 18EE42 – PGE | Ms. Swapna H | Mr. Raghavendra L |
| 2 | 18EE43 – T&D | HoD | HoD |
| 3 | 18EE44 – EM | Mr. Raghavendra L | Ms. Maria Sushma S |
| 4 | 18EE45 – EFT | Mr. Vinod Kumar P | Mrs. Lakshmi K |
| 5 | 18EE46 - OLIC | Mr. Rajesh K S | Mr. Sathish K R |

6th Sem: Class Teacher- SH

| Sl. No | Course & Course Code | Faculty Allotted |
|---|---|---|
| 1 | 18EE61 – CS | Mr. Rajesh K S |
| 2 | 18EE62 – PSA-I | Mr. Sathish K R |
| 3 | 18EE63 – DSP | Ms. Swapna H |
| 4 | Professional Elective – 18EE645 - OOPs | Mr. Praveen Kumar M |
| 5 | Open Elective – 18EE652 -PLC & SCADA | Mr. Vinod Kumar P |

8th Sem: Class Teacher- LK

| Sl. No | Course & Course Code | Faculty Allotted |
|---|---|---|
| 1 | 17EE81 – PSOC | Mrs. Lakshmi K |
| 2 | 17EE82 - IDA | Mr. Vinod Kumar P |
| 3 | Professional Elective:<br>17EE83x - SG | Mr. Praveen Kumar M |

4. Discussed about faculty R-files and NAAC criteria allotment
5. The activities planned under the decennial banner as per the list dated 28th Oct 2020 for Feb 2021 is postponed to March 2021 and the activities listed under Sl. No 10 to 14 is postponed to AY 2020-21 Even Semester as follows

   Sl.No – 10 & 11 --- Postponed to 1st Month of AY 2020-21 Even Semester

   Sl.No – 12 & 13 --- Postponed to 2nd Month of AY 2020-21 Even Semester

   Sl.No – 14 --- Postponed to 3rd Month of AY 2020-21 Even Semester
6. Counselling Reallotment for AY 2020-21 Odd sem has been carried out for 3rd Semester and 1st Semester students, due to exit of Mrs.Pooja M. The new allotment is as shown below
   - 3rd Sem 'A & B' Sec – MP, LK & RKS [ Detailed Students and Counsellor's List is available in R-26 file]
   - I Sem - KRS
7. Mr. Rajesh K S presented Digital Library Information accessible for faculty and students is mentioned below
   - KOHA Software for books accessibility through the Web Address: 172.16.9.31:8001
   - DSpace access information about Ebooks available, VTU QPs, Project Reports Web Address: 172.16.18.97/jspui
   - ATME Digital Learning access for NPTEL and E-Shikshana [VTU e-Learning] Web Address: 172.16.46.46/atmedigi
8. Informed Department Library Incharge, Mr.Sunil, Instructor to update the Department library Text Book Details as per the Template provided.

Meeting held between 11:15 AM to 1:00 PM

HoD

Faculty Signature:

| RL | KRS | LK | MP | VK | SSR | SH | MS | RKS |
|---|---|---|---|---|---|---|---|---|
| | | | | | | | | |

| SL. No | Faculty Name | Initials |
|---|---|---|
| 1 | Mr. Raghavendra L | RL |
| 2 | Mr. Sathish K R | KRS |
| 3 | Mrs. Lakshmi K | LK |
| 4 | Mr. Praveen Kumar M | MP |
| 5 | Mr. Vinod Kumar P | VK |
| 6 | Mr. Shreeshayana R | SSR |
| 7 | Mr. Mohan M | MG |
| 8 | Mrs. Pooja M | PM |
| 9 | Ms. Swapna H | SH |
| 10 | Mrs. Maria Sushma S | MS |
| 11 | Mr. Rajesh K S | RKS |

## Department of Electrical & Electronics Engineering

**COURSE MODULE OF THE COURSE TAUGHT FOR THE SESSION September-December 2020-21(ODD SEM)**

**Course Syllabi with CO's**

| **Faculty Member : Mr. Vinod Kumar P** | | | **Academic Year**: 2020-2021 (Odd Semester) | | | | |
|---|---|---|---|---|---|---|---|
| **Department**: Electrical & Electronics Engineering | | | | | | | |
| **Course Code** | **Course Title** | **Core/Elective** | **Prerequisite** | **Contact Hours** | | | **Total Hrs/ Sessions** |
| | | | | L | T | P | |
| **17EE71** | **POWER SYSTEM ANALYSIS-II** | **Core** | **POWER SYSTEM ANALYSIS -1** | **4** | **-** | **-** | **50** |
| **Objectives** | This course will enable students to:<br>**1.** To explain formulation of network models and bus admittance matrix for solving load flow problems.<br>**2.** To discuss solution of nonlinear static load flow equations by different numerical techniques and methods to control voltage profile.<br>**3.** To discuss optimal operation of generators on a bus bar, optimal unit commitment, reliability considerations and optimum generation scheduling.<br>**4.** To discuss optimal power flow solution, scheduling of hydro-thermal system, power system security and reliability.<br>**5.** To explain formulation of bus impedance matrix for the use in short circuit studies on power systems.<br>**6.** To explain numerical solution of swing equation for multi-machine stability. | | | | | | |
| **Topics as per Syllabus** | | | | | | | |

**PART – A**

**Module - 1**

**Load Flow Studies:** Introduction, Network Model Formulation, Formation of Ybus by Singular Transformation, Load Flow Problem, Gauss-Seidel Method. **10 Hours**

**Module - 2**

**Load Flow Studies (continued):** Newton-Raphson Method, Decoupled Load Flow Methods, Comparison of Load Flow Methods, Control of Voltage Profile. 10 **Hours**

**Module - 3**

**Optimal System Operation:** Introduction, Optimal Operation of Generators on a Bus Bar, Optimal Unit Commitment, Reliability Considerations, Optimum Generation Scheduling. **10 Hours**

**Module -4**

**Optimal System Operation (continued):** Optimal Load Flow Solution, Optimal Scheduling of Hydrothermal System, Power System Security, Maintenance Scheduling, Power System Reliability. **10 Hours**

| |
|---|
| **Module-5**<br>**Symmetrical Fault Analysis:** Algorithm for Short Circuit Studies, Zbus Formulation. **Power System Stability:** Numerical Solution of Swing Equation, Multi-machine Stability. **10 Hours** |
| **List of Text Books** |
| 1. **Modern Power System Analysis,** Nagrath, I. J., and Kothari, D. P, TMH, 4th Edition, 2011. |
| **List of Reference Books:** |
| 1. **Computer Methods in Power System Analysis,** Stagg, G. W., and EI- Abiad, A. H.- McGraw Hill International Student Edition. 1968<br>2. **Computer Techniques in Power System Analysis**, Pai, M. A- TMH, 2nd edition, 2006.<br>3. **Power System Analysis,** Haadi Sadat, TMH, 2nd Edition, 12th reprint, 2007 |
| **List of URLs, Text Books, Notes, Multimedia Content, etc** |
| 1. https://www.youtube.com/watch?v=7jUihfJkUM0<br>2. https://www.youtube.com/watch?v=fu3K8i29LSo<br>3. https://www.youtube.com/watch?v=20mIjIlY0aI<br>4. https://www.youtube.com/watch?v=u1QioXyRKFU<br>5. https://www.youtube.com/watch?v=7ZzBjI0je_Q<br>6. https://www.youtube.com/watch?v=t9tf-pgac_g<br>7. https://www.youtube.com/watch?v=oDIVUp6NqKs<br>8. https://www.youtube.com/watch?v=P6VwU84q8gU<br>9. https://www.youtube.com/watch?v=tnqgQFulSKo |

| | |
|---|---|
| **Course Outcomes** | After the completion the course, the students will be able to:<br>CO1: **Develop** the Ybus of power system using rule of inspection and graph theory(M-1)[L3]<br>CO2: **Perform** load flow analysis of power system networks using Gauss-Seidel, Newton-Raphson and Fast decoupled iterative methods.(M-1,M-2)[L4]<br>CO3: **Solve** the Unit Commitment problem with various constraints using optimization techniques.(M-3)[L4]<br>CO4. **Analyze** optimal scheduling of hydro-thermal systems, Power system security and reliability.(M-4)[L4]<br>CO5: **Analyze** short circuit faults in power system networks using ZBus(M-5)[L4]<br>CO6: **Interpret** power system stability through solution of swing equation (M-5)[L4] |

**Internal Assessment Marks: CIE:** Internal Assessment Marks (30) + Assignment (10)
**Note:** 30 marks (3 Session Tests are conducted during the semester and marks allotted based on average of all the sessions)

**The Correlation of Course Outcomes (CO's) and Program Outcomes (PO's)**

| **Course Code:** | **17EE71** | **TITLE: POWER SYSTEM ANALYSIS - 2** | | | | | | **Faculty Name:** | | **Mr. Vinod Kumar P** | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Course Outcomes** | **Program Outcomes** | | | | | | | | | | |
| | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** | **PO11** | **PO12** |
| **CO-1** | 3 | - | - | - | 3 | - | - | - | - | - | - | 2 |
| **CO-2** | 3 | 3 | - | - | 3 | - | - | - | - | - | - | 3 |
| **CO-3** | 3 | 3 | 1 | - | 3 | - | - | - | - | - | - | 2 |
| **CO-4** | 3 | 3 | 1 | - | 1 | - | - | - | - | - | - | 2 |
| **CO-5** | 3 | - | -- | - | 3 | - | - | - | - | - | - | 2 |

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO-6** | 3 | 3 | - | - | 1 | - | - | - | - | - | - | 2 |

**Note:** 3 = Strong Contribution 2 = Average Contribution 1 = Weak Contribution - = No Contribution

**The Correlation of Course Outcomes (CO's) and Program Specific Outcomes (PSO's)**

| **Course Code: 17EE71** | **TITLE: POWER SYSTEM ANALYSIS - II** | **Faculty Name:** | **Mr. Vinod Kumar P** |
|---|---|---|---|
| **Course Outcomes** | **Program Specific Outcomes** | | |
| | **PSO1** | **PSO2** | |
| **CO-1** | 2 | - | |
| **CO-2** | 2 | - | |
| **CO-3** | 2 | - | |
| **CO-4** | 2 | - | |
| **CO-5** | 2 | - | |
| **CO-6** | 2 | - | |

**Note:** 3 = Strong Contribution 2 = Average Contribution 1 = Weak Contribution - = No Contribution

A T M E
College of Engineering

**ATME COLLEGE OF ENGINEERING**

**DEPARTMENT OF ELECTRICAL AND ELECTRONICS**

**ONLINE CLASS TIME TABLE FOR ODD SEMESTER - 2020-21**

**Date: 25/08/2020**

**Staff Name: Mr. Vinod Kumar P**

| DAY/TIME | 9:00 - 10:00 | 10:00-11:00 | 11:15 - 12:15 | 12:15 - 1:15 | 1:15- 2:00 | 2:00- 2:55 | 2:55 - 3:50 | 3:50- 4:45 |
|---|---|---|---|---|---|---|---|---|
| MONDAY | | 18EE51 | | | | | | |
| TUESDAY | | | | | | 18EE51 | | |
| WEDNESDAY | | 17EE71 | | 18EE51 | | | | |
| THURSDAY | | 17EE71 | | | Lunch Break | | | |
| FRIDAY | | 17EE71 | | | | 17EEL76-PSS Lab- (VK+MS) | | |
| SATURDAY | | | | | | | | |

| Course Code | Course Title | Semester | Contact Hours |
|---|---|---|---|
| 17EE71 | Power System Analysis – 2 | VII | 3 |
| 18EE51 | Management and Entrepreneurship | V | 3 |
| | PSS Lab- All batches | VII | 1 |
| | Total Contact Hours Weekly | | 7 |

Co-ordinator

HOD

Dr. PARTHASARATHY L.
Professor and HOD
Dept. of Electrical & Electronics Engineering
ATME College of Engineering, Mysuru

# MODULE-1

# NETWORK TOPOLOGY

## 1. INTRODUCTION

The solution of a given linear network problem requires the formation of a set of equations describing the response of the network. The mathematical model so derived, must describe the characteristics of the individual network components, as well as the relationship which governs the interconnection of the individual components. In the bus frame of reference the variables are the node voltages and node currents. The independent variables in any reference frame can be either currents or voltages. Correspondingly, the coefficient matrix relating the dependent variables and the independent variables will be either an impedance or admittance matrix. The formulation of the appropriate relationships between the independent and dependent variables is an integral part of a digital computer program for the solution of power system problems. The formulation of the network equations in different frames of reference requires the knowledge of graph theory. Elementary graph theory concepts are presented here, followed by development of network equations in the bus frame of reference.

### 1.1 ELEMENTARY LINEAR GRAPH THEORY: IMPORTANT TERMS

The geometrical interconnection of the various branches of a network is called the *topology* of the network. The connection of the network topology, shown by replacing all its elements by lines is called a *graph.* A *linear graph* consists of a set of objects called *nodes* and another set called *elements* such that each element is identified with an ordered pair of nodes. An *element* is defined as any line segment of the graph irrespective of the characteristics of the components involved. A graph in which a direction is assigned to each element is called an *oriented graph* or a *directed graph*. It is to be noted that the directions of currents in various elements are arbitrarily assigned and the network equations are derived, consistent with the assigned directions. Elements are indicated by numbers and the nodes by encircled numbers. The ground node is taken as the reference node. In electric networks the convention is to use associated directions for the voltage drops. This means the voltage drop in a branch is taken to be in the direction of the current through the branch. Hence, we need not mark the voltage polarities in the oriented graph.

**Connected Graph :** This is a graph where at least one path (disregarding orientation) exists between any two nodes of the graph. A representative power system and its oriented graph are as shown in Fig 1, with:
e = number of elements = 6
n = number of nodes = 4
b = number of branches = n-1 = 3
l = number of links = e-b = 3
Tree = T(1,2,3) and
Co-tree = T(4,5,6)
**Sub-graph :** sG is a sub-graph of G if the following conditions are satisfied:
· sG is itself a graph
· Every node of sG is also a node of G
· Every branch of sG is a branch of G

For eg., sG(1,2,3), sG(1,4,6), sG(2), sG(4,5,6), sG(3,4),.. are all valid sub-graphs of the oriented graph of Fig.1c.

**Loop :** A sub-graph L of a graph G is a loop if
· L is a connected sub-graph of G
· Precisely two and not more/less than two branches are incident on each node in L

In Fig 1c, the set{1,2,4} forms a loop, while the set{1,2,3,4,5} is not a valid, although the set(1,3,4,5) is a valid loop. The KVL (Kirchhoff's Voltage Law) for the loop is stated as follows: *In any lumped network, the algebraic sum of the branch voltages around any of the loops is zero.*

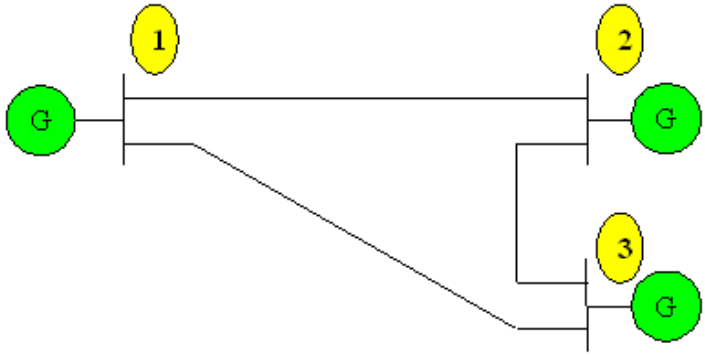



**Fig 1a. Single line diagram of a power system**

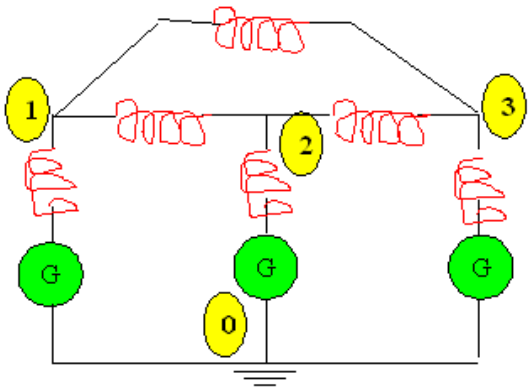



**Fig 1b. Reactance diagram**

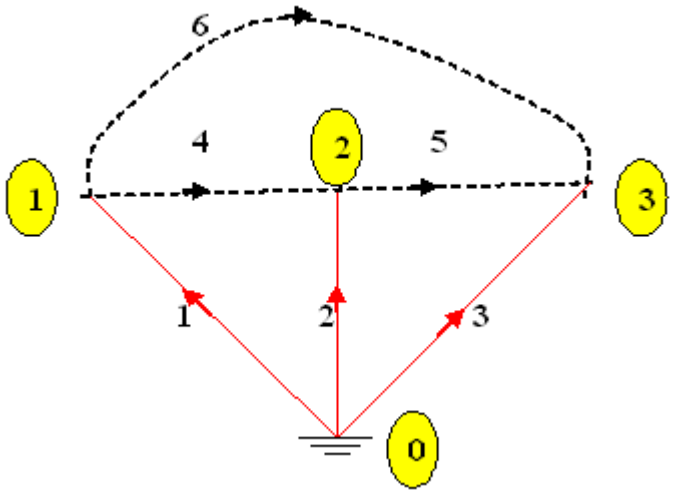



**Fig 1c. Oriented Graph**

**Cutset :** It is a set of branches of a connected graph G which satisfies the following conditions :

· The removal of all branches of the cutset causes the remaining graph to have two separate unconnected sub-graphs.

· The removal of all but one of the branches of the set, leaves the remaining graph connected.

Referring to Fig 1c, the set {3,5,6} constitutes a cutset since removal of them isolates node 3 from rest of the network, thus dividing the graph into two unconnected subgraphs. However, the set(2,4,6) is not a valid cutset! The KCL (Kirchhoff's Current Law) for the cutset is stated as follows: In any lumped network, the algebraic sum of all the branch currents traversing through the given cutset branches is zero.

**Tree:** It is a connected sub-graph containing all the nodes of the graph G, but without any closed paths (loops). There is one and only one path between every pair of nodes in a tree. The elements of the tree are called twigs or branches. In a graph with *n* nodes,

**The number of branches: b** = n-1 **(1)**

For the graph of Fig 1c, some of the possible trees could be T(1,2,3), T(1,4,6), T(2,4,5), T(2,5,6), etc.

**Co-Tree :** The set of branches of the original graph G, not included in the tree is called the *co-tree*. The co-tree could be connected or non-connected, closed or open. The branches of the co-tree are called *links*. By convention, the tree elements are shown as solid lines while the co-tree elements are shown by dotted lines as shown in Fig.1c for tree T(1,2,3). With e as the total number of elements,

**The number of links:** $\boldsymbol{l}$ = e – b = e – n + 1 **(2)**

For the graph of Fig 1c, the co-tree graphs corresponding to the various tree graphs are as shown in the table below:

| Tree | T(1,2,3) | T(1,4,6) | T(2,4,5) | T(2,5,6) |
|---|---|---|---|---|
| Co-Tree | T(4,5,6) | T(2,3,5) | T(1,3,6) | T(1,3,4) |

**Basic loops:** When a link is added to a tree it forms a closed path or a loop. Addition of each subsequent link forms the corresponding loop. A loop containing only one link and remaining branches is called a *basic loop* or a *fundamental loop*. These loops are defined for a particular tree. Since each link is associated with a basic loop, the number of basic loops is equal to the number of links.

**Basic cut-sets:** Cut-sets which contain only one branch and remaining links are called *basic cutsets* or fundamental cut-sets. The basic cut-sets are defined for a particular tree. Since each branch is associated with a basic cut-set, the number of basic cut-sets is equal to the number of branches.

### 1.2 Examples on Basics of LG Theory:

**Example-1:** Obtain the oriented graph for the system shown in Fig. E1. Select any four possible trees. For a selected tree show the basic loops and basic cut-sets.

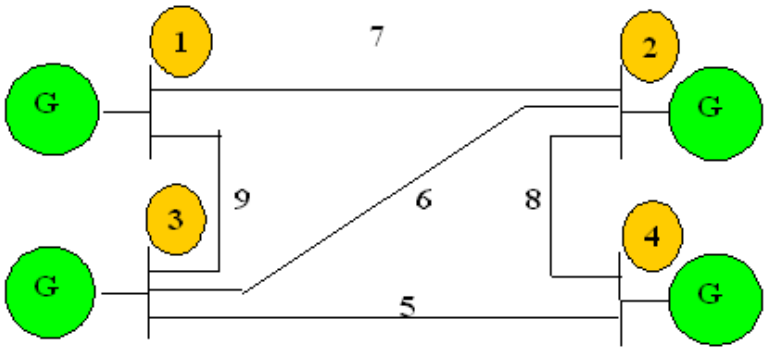



**Fig. E1a. Single line diagram of Example System**

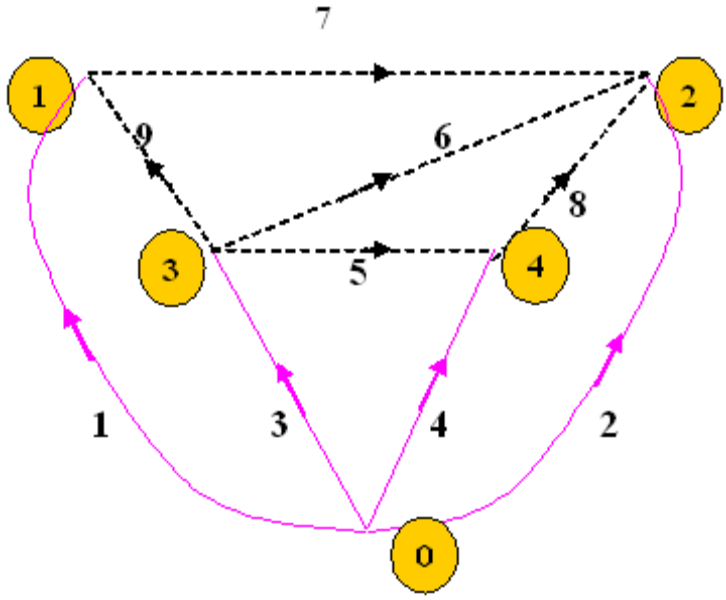



**Fig. E1b. Oriented Graph of Fig. E1a.**

For the system given, the oriented graph is as shown in figure E1b. some of the valid Tree graphs could be T(1,2,3,4), T(3,4,8,9), T(1,2,5,6), T(4,5,6,7), etc. The basic cutsets (A,B,C,D) and basic loops (E,F,G,H,I) corresponding to the oriented graph of Fig.E1a and tree, T(1,2,3,4) are as shown in Figure E1c and Fig.E1d respectively.

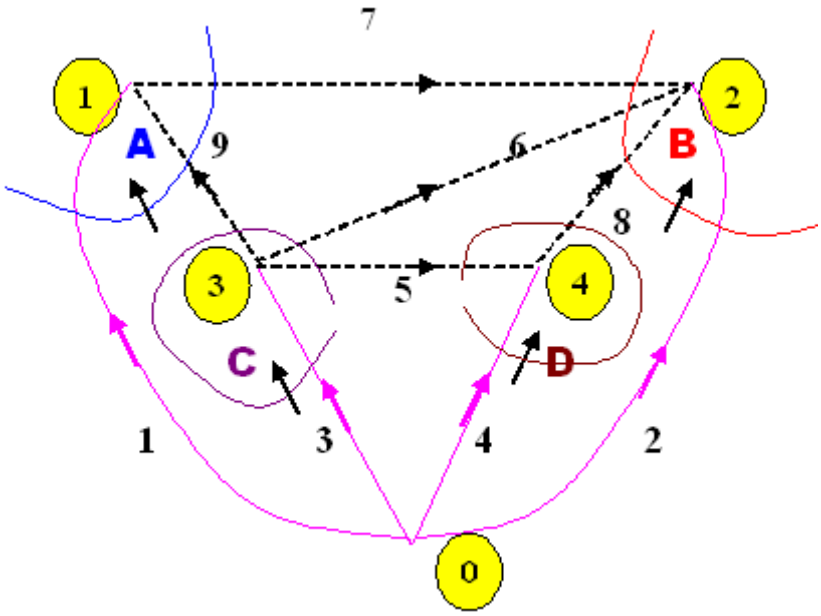



**Fig. E1c. Basic Cutsets of Fig. E1a.**

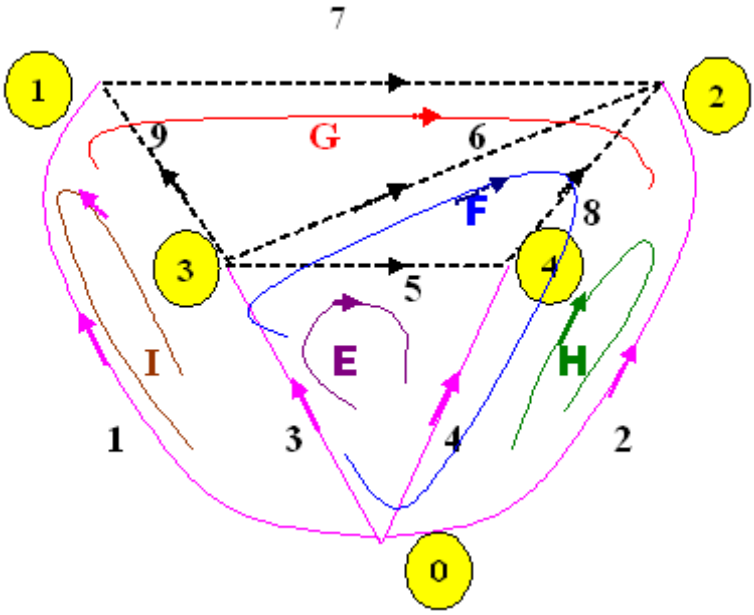



**Fig. E1d. Basic Loops of Fig. E1a.**

### 1.3 INCIDENCE MATRICES

**Element–node incidence matrix:** $A^{\wedge}$

The incidence of branches to nodes in a connected graph is given by the element-node incidence matrix,$A\hat{}$ .

An element aij of $A\hat{}$ is defined as under:

aij = 1 if the branch-i is incident to and oriented away from the node-j.

= -1 if the branch-i is incident to and oriented towards the node-j.

= 0 if the branch-i is not at all incident on the node-j.

Thus the dimension of $A\hat{}$ is e X *n*, where e is the number of elements and *n* is the number of nodes in the network. For example, consider again the sample system with its oriented graph as in fig. 1c. the corresponding element-node incidence matrix, is obtained as under:

$\hat{A} =$

| Nodes / Elements | 0 | 1 | 2 | 3 |
|---|---|---|---|---|
| 1 | 1 | -1 | | |
| 2 | 1 | | -1 | |
| 3 | 1 | | | -1 |
| 4 | | 1 | -1 | |
| 5 | | | 1 | -1 |
| 6 | | 1 | | -1 |

It is to be noted that the first column and first row are not part of the actual matrix and they only indicate the element number node number respectively as shown. Further, the sum of every row is found to be equal to zero always. Hence, the rank of the matrix is less than *n*. Thus in general, the matrix $A\hat{}$ satisfies the identity:

$$\sum_{j=1}^{n} a_{ij} = 0 \quad \forall \ i = 1,2,\ldots..e. \qquad (3)$$

### 1.4 Bus incidence matrix: A

By selecting any one of the nodes of the connected graph as the reference node, the corresponding column is deleted from $A\hat{}$ to obtain the bus incidence matrix, A. The dimensions of A are e *(n-1)* and the rank is *n-1*. In the above example, selecting node-0 as reference node, the matrix A is obtained by deleting the column corresponding to node-0, as under:

$$A = \begin{array}{|c|c|c|c|} \hline \text{Buses} & 1 & 2 & 3 \\ \text{Elements} & & & \\ \hline 1 & -1 & & \\ \hline 2 & & -1 & \\ \hline 3 & & & -1 \\ \hline 4 & 1 & -1 & \\ \hline 5 & & 1 & -1 \\ \hline 6 & 1 & & -1 \\ \hline \end{array} = \begin{array}{|c|c|} \hline A_b & \text{Branches} \\ \hline A_l & \text{Links} \\ \hline \end{array}$$

It may be observed that for a selected tree, say, T(1,2,3), the bus incidence matrix can be so arranged that the branch elements occupy the top portion of the A-matrix followed by the link elements. Then, the matrix-A can be partitioned into two sub matrices Ab and Al as shown, where,
(i) Ab is of dimension (bxb) corresponding to the branches and
(ii) Al is of dimension (lxb) corresponding to links.

A is a rectangular matrix, hence it is singular. Ab is a non-singular square matrix of dimension-b. Since A gives the incidence of various elements on the nodes with their direction of incidence, the KCL for the nodes can be written as

$AT\, i = 0$ **(4)**

where AT is the transpose of matrix A and *i* is the vector of branch currents. Similarly for the branch voltages we can write,

$v = A\ bus\ E$ **(5)**

**Examples on Bus Incidence Matrix:**

**Example-2:** For the sample network-oriented graph shown in Fig. E2, by selecting a tree, T(1,2,3,4), obtain the incidence matrices A and Aˆ . Also show the partitioned form of the matrix-A.

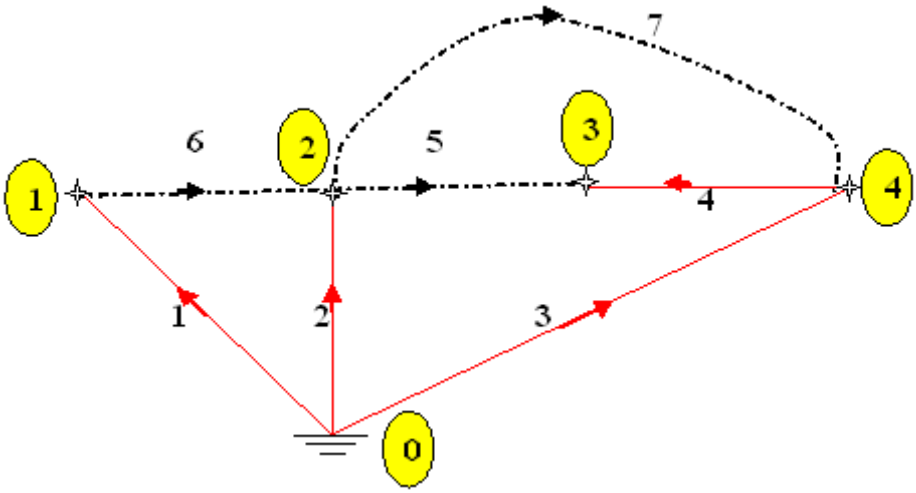



**Fig. E2. Sample Network-Oriented Graph**

$$\hat{A} = \text{Elements} \begin{bmatrix} e \backslash n & 0 & 1 & 2 & 3 & 4 \\ 1 & 1 & -1 & 0 & 0 & 0 \\ 2 & 1 & 0 & -1 & 0 & 0 \\ 3 & 1 & 0 & 0 & 0 & -1 \\ 4 & 0 & 0 & 0 & -1 & 1 \\ 5 & 0 & 0 & 1 & -1 & 0 \\ 6 & 0 & 1 & -1 & 0 & 0 \\ 7 & 0 & 0 & 1 & 0 & -1 \end{bmatrix} \quad \text{nodes}$$

$$\mathbf{A} = \text{Elements} \begin{bmatrix} e \backslash b & 1 & 2 & 3 & 4 \\ 1 & -1 & 0 & 0 & 0 \\ 2 & 0 & -1 & 0 & 0 \\ 3 & 0 & 0 & 0 & -1 \\ 4 & 0 & 0 & -1 & 1 \\ 5 & 0 & 1 & -1 & 0 \\ 6 & 1 & -1 & 0 & 0 \\ 7 & 0 & 1 & 0 & -1 \end{bmatrix} \quad \text{buses}$$

Corresponding to the Tree, T(1,2,3,4), matrix-A can be partitioned into two submatrices as under:

$$A_b = \text{branches}\begin{bmatrix} b\backslash b & \overset{\text{buses}}{1} & 2 & 3 & 4 \\ 1 & -1 & 0 & 0 & 0 \\ 2 & 0 & -1 & 0 & 0 \\ 3 & 0 & 0 & 0 & -1 \\ 4 & 0 & 0 & -1 & 1 \end{bmatrix}$$

$$A_l = \text{links}\begin{bmatrix} l\backslash b & \overset{\text{buses}}{1} & 2 & 3 & 4 \\ 5 & 0 & 1 & -1 & 0 \\ 6 & 1 & -1 & 0 & 0 \\ 7 & 0 & 1 & 0 & -1 \end{bmatrix}$$

**Example-3:** For the sample-system shown in Fig. E3, obtain an oriented graph. By selecting a tree, T(1,2,3,4), obtain the incidence matrices A and$A\hat{}$ . Also show the partitioned form of the matrix-A.

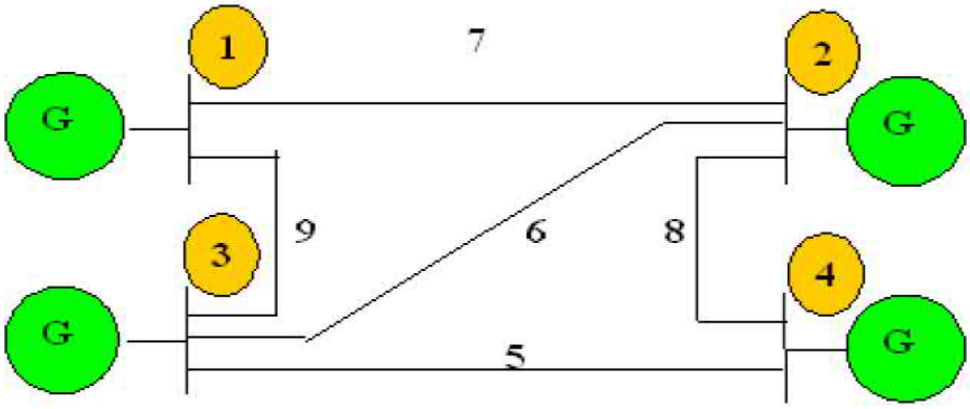



**Fig. E3a. Sample Example network**

Consider the oriented graph of the given system as shown in figure E3b, below.

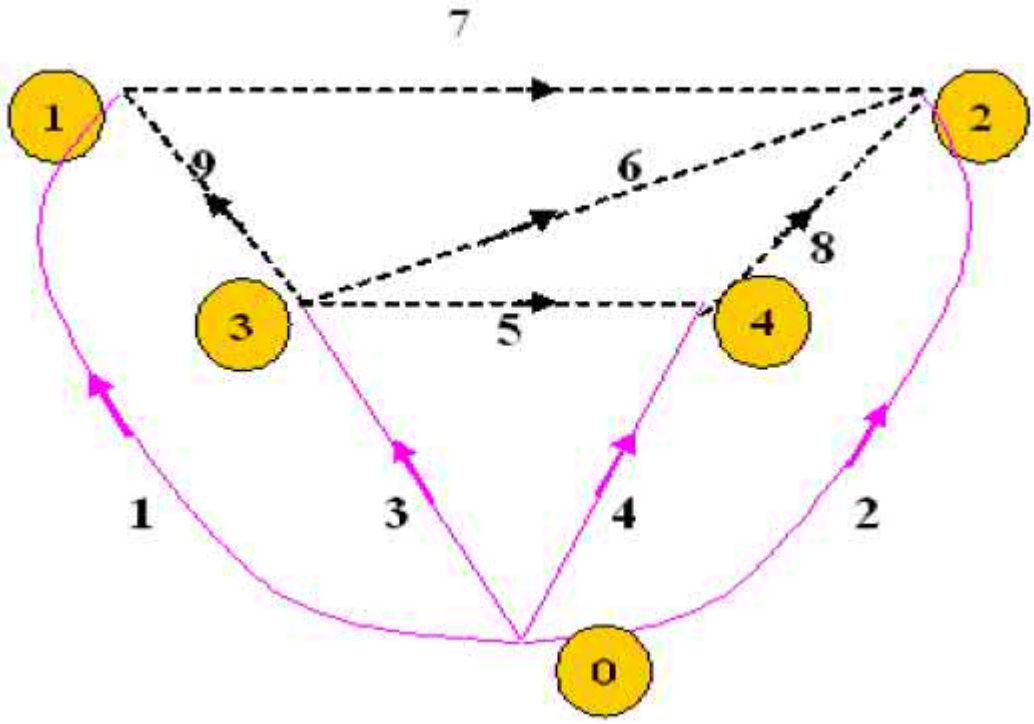



**Fig. E3b. Oriented Graph of system of Fig-E3a.**

Corresponding to the oriented graph above and a Tree, T(1,2,3,4), the incidence matrices • and A can be obtained as follows:

$\hat{A}$ =

| e\n | 0 | 1 | 2 | 3 | 4 |
|---|---|---|---|---|---|
| 1 | 1 | -1 | | | |
| 2 | 1 | | -1 | | |
| 3 | 1 | | | -1 | |
| 4 | 1 | | | | -1 |
| 5 | | | | 1 | -1 |
| 6 | | | -1 | 1 | |
| 7 | | 1 | -1 | | |
| 8 | | | -1 | | 1 |
| 9 | | -1 | | 1 | |

A =

| e\b | 1 | 2 | 3 | 4 |
|---|---|---|---|---|
| 1 | -1 | | | |
| 2 | | -1 | | |
| 3 | | | -1 | |
| 4 | | | | -1 |
| 5 | | | 1 | -1 |
| 6 | | -1 | 1 | |
| 7 | 1 | -1 | | |
| 8 | | -1 | | 1 |
| 9 | -1 | | 1 | |

Corresponding to the Tree, T(1,2,3,4), matrix-A can be partitioned into two submatrices as under:

$A_b =$

| e\b | 1 | 2 | 3 | 4 |
|---|---|---|---|---|
| 1 | -1 | | | |
| 2 | | -1 | | |
| 3 | | | -1 | |
| 4 | | | | -1 |

$A_l =$

| e\b | 1 | 2 | 3 | 4 |
|---|---|---|---|---|
| 5 | | | 1 | -1 |
| 6 | | -1 | 1 | |
| 7 | 1 | -1 | | |
| 8 | | -1 | | 1 |
| 9 | -1 | | 1 | |

### 1.4 PRIMITIVE NETWORKS

So far, the matrices of the interconnected network have been defined. These matrices contain complete information about the network connectivity, the orientation of current, the loops and cutsets. However, these matrices contain no information on the nature of the elements which form the interconnected network. The complete behaviour of the network can be obtained from the knowledge of the behaviour of the individual elements which make the network, along with the incidence matrices. An element in an electrical network is completely characterized by the relationship between the current through the element and the voltage across it.

**General representation of a network element:** In general, a network element may contain active or passive components. Figure 2 represents the alternative impedance and admittance forms of representation of a general network component.

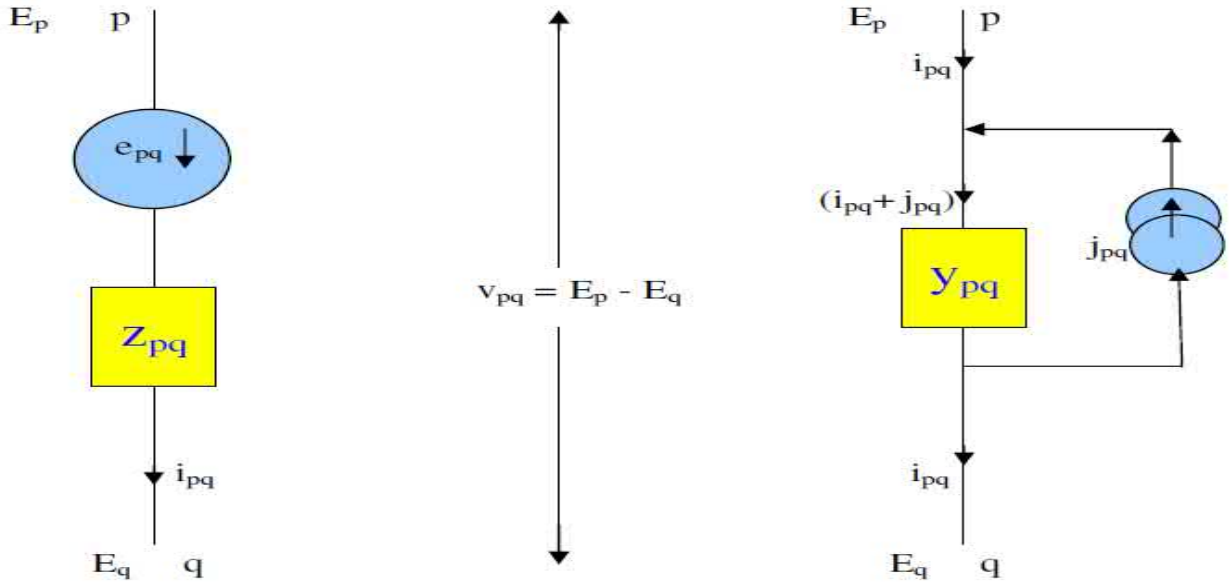



**Fig.2 Representation of a primitive network element (a) Impedance form (b) Admittance form**

The network performance can be represented by using either the impedance or the admittance form of representation. With respect to the element, p-q, let,
vpq = voltage across the element p-q,
epq = source voltage in series with the element p-q,
ipq= current through the element p-q,

jpq= source current in shunt with the element p-q,
zpq= self impedance of the element p-q and
ypq= self admittance of the element p-q.

**Performance equation:** Each element p-q has two variables, Vpq and ipq. The performance of the given element p-q can be expressed by the performance equations as under:

vpq + epq = zpqipq (in its impedance form)
ipq + jpq = ypqvpq (in its admittance form) **(6)**

Thus the parallel source current jpq in admittance form can be related to the series source voltage, epq in impedance form as per the identity:
jpq = - ypq epq **(7)**
A set of non-connected elements of a given system is defined as a *primitive Network and a*n element in it is a fundamental element that is not connected to any other element. In the equations above, if the variables and parameters are replaced by the corresponding vectors and matrices, referring to the complete set of elements present in a given system, then, we get the performance equations of the primitive network in the form as under:
v + e = [z] i
i + j = [y] v **(8)**

**Primitive network matrices:**
A diagonal element in the matrices, [z] or [y] is the self impedance zpq-pq or self admittance, ypq-pq. An off-diagonal element is the mutual impedance, zpq-rs or mutual admittance, ypq-rs, the value present as a mutual coupling between the elements p-q and r-s. The primitive network admittance matrix, [y] can be obtained also by inverting the primitive impedance matrix, [z]. Further, if there are no mutually coupled elements in the given system, then both the matrices, [z] and [y] are diagonal. In such cases, the self impedances are just equal to the reciprocal of the corresponding values of self admittances, and vice-versa.

**Examples on Primitive Networks:**

**Example-4:** Given that the self impedances of the elements of a network referred by the bus incidence matrix given below are equal to: Z1=Z2=0.2, Z3=0.25, Z4=Z5=0.1 and Z6=0.4 units, draw the corresponding oriented graph, and find the primitive network matrices. Neglect mutual values between the elements.

$$A = \begin{bmatrix} -1 & 0 & 0 \\ 0 & -1 & 0 \\ 0 & 0 & -1 \\ 1 & -1 & 0 \\ 0 & 1 & -1 \\ 1 & 0 & -1 \end{bmatrix}$$

**Solution:**

The element node incidence matrix, $A\hat{}$ can be obtained from the given A matrix, by pre-augmenting to it an extra column corresponding to the reference node, as under.

$$\hat{A} = \begin{bmatrix} 1 & -1 & 0 & 0 \\ 1 & 0 & -1 & 0 \\ 1 & 0 & 0 & -1 \\ 0 & 1 & -1 & 0 \\ 0 & 0 & 1 & -1 \\ 0 & 1 & 0 & -1 \end{bmatrix}$$

Based on the conventional definitions of the elements of $A\hat{}$ , the oriented graph can be formed as under:

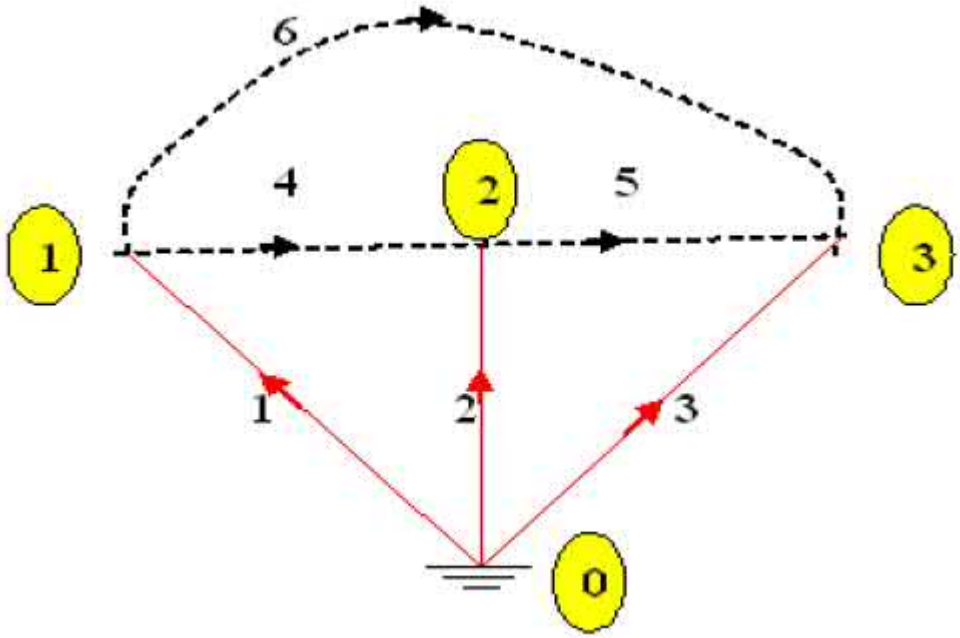



**Fig. E4 Oriented Graph**

Thus the primitive network matrices are square, symmetric and diagonal matrices of order e=no. of elements = 6. They are obtained as follows.

$$[z] = \begin{bmatrix} 0.2 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0.2 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0.25 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0.1 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0.1 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0.4 \end{bmatrix}$$

And

$$[y] = \begin{bmatrix} 5.0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 5.0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 4.0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 10 & 0 & 0 \\ 0 & 0 & 0 & 0 & 10 & 0 \\ 0 & 0 & 0 & 0 & 0 & 2.5 \end{bmatrix}$$

**Example-5:** Consider three passive elements whose data is given in Table E5 below. Form the primitive network impedance matrix.

**Table E5**

| Element number | Self impedance ($z_{pq-pq}$) | | Mutual impedance, ($z_{pq-rs}$) | |
|---|---|---|---|---|
| | Bus-code, (p-q) | Impedance in p.u. | Bus-code, (r-s) | Impedance in p.u. |
| 1 | 1-2 | j 0.452 | | |
| 2 | 2-3 | j 0.387 | 1-2 | j 0.165 |
| 3 | 1-3 | j 0.619 | 1-2 | j 0.234 |

**Solution:**

$$[z] = \begin{array}{c|ccc} & 1\text{-}2 & 2\text{-}3 & 1\text{-}3 \\ \hline 1\text{-}2 & j\,0.452 & j\,0.165 & j\,0.234 \\ 2\text{-}3 & j\,0.165 & j\,0.387 & 0 \\ 1\text{-}3 & j\,0.234 & 0 & j\,0.619 \end{array}$$

**Note:**

· The size of [z] is e´ e, where e= number of elements,
· The diagonal elements are the self impedances of the elements
· The off-diagonal elements are mutual impedances between the corresponding elements.
· Matrices [z] and [y] are inter-invertible.

# NETWORK MATRICES

## 2. FORMATION OF $Y_{BUS}$ AND $Z_{BUS}$

The bus admittance matrix, YBUS plays a very important role in computer aided power system analysis. It can be formed in practice by either of the methods as under:
1. Rule of Inspection
2. Singular Transformation
3. Non-Singular Transformation
4. ZBUS Building Algorithms, etc.

The performance equations of a given power system can be considered in three different frames of reference as discussed below:

**Frames of Reference:**
*Bus Frame of Reference*: There are b independent equations (b = no. of buses) relating the bus vectors of currents and voltages through the bus impedance matrix and bus admittance matrix:

EBUS = ZBUS IBUS
IBUS = YBUS EBUS **(9)**

*Branch Frame of Reference*: There are b independent equations (b = no. of branches of a selected Tree sub-graph of the system Graph) relating the branch vectors of currents and voltages through the branch impedance matrix and branch admittance matrix:

EBR = ZBR IBR
IBR = YBR EBR **(10)**

*Loop Frame of Reference*: There are b independent equations (b = no. of branches of a selected Tree sub-graph of the system Graph) relating the branch vectors of currents and voltages through the branch impedance matrix and branch admittance matrix:

ELOOP = ZLOOP ILOOP
ILOOP = YLOOP ELOOP **(11)**

Of the various network matrices refered above, the bus admittance matrix (YBUS) and the bus impedance matrix (ZBUS) are determined for a given power system by the rule of inspection as explained next.

### 2.1 Rule of Inspection

Consider the 3-node admittance network as shown in figure5. Using the basic branch relation: I = (YV), for all the elemental currents and applying Kirchhoff's Current Law principle at the nodal points, we get the relations as under:

At node 1: I1 =Y1V1 + Y3 (V1-V3) + Y6 (V1 – V2)
At node 2: I2 =Y2V2 + Y5 (V2-V3) + Y6 (V2 – V1)

At node 3: 0 = Y3 (V3-V1) + Y4V3 + Y5 (V3 – V2) **(12)**

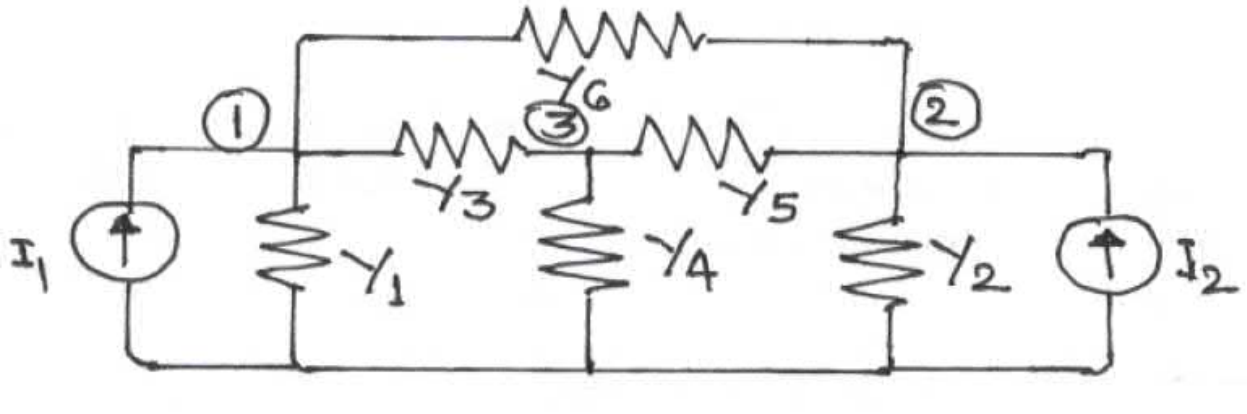



**Fig. 3 Example System for finding YBUS**

These are the performance equations of the given network in admittance form and they can be represented in matrix form as:

$$\begin{vmatrix} I_1 \\ I_2 \\ 0 \end{vmatrix} = \begin{vmatrix} (Y_1+Y_3+Y_6) & -Y_6 & -Y_3 \\ -Y_6 & (Y_2+Y_5+Y_6) & -Y_5 \\ -Y_3 & -Y_5 & (Y_3+Y_4+Y_5) \end{vmatrix} \begin{vmatrix} V_1 \\ V_2 \\ V_3 \end{vmatrix} \quad \textbf{(13)}$$

In other words, the relation of equation (9) can be represented in the form
IBUS = YBUS EBUS **(14)**
Where, YBUS is the bus admittance matrix, IBUS & EBUS are the bus current and bus voltage vectors respectively. By observing the elements of the bus admittance matrix, YBUS of equation (13), it is observed that the matrix elements can as well be obtained by a simple inspection of the given system diagram:
*Diagonal elements*: A diagonal element (Yii) of the bus admittance matrix, YBUS, is equal to the sum total of the admittance values of all the elements incident at the bus/node i,
*Off Diagonal elements*: An off-diagonal element (Yij) of the bus admittance matrix, YBUS, is equal to the negative of the admittance value of the connecting element present between the buses I and j, if any. This is the principle of the rule of inspection. Thus the algorithmic equations for the rule of inspection are obtained as:

Yii = S yij (j = 1,2,…….n)
Yij = - yij (j = 1,2,…….n) **(15)**

For i = 1,2,….n, n = no. of buses of the given system, yij is the admittance of element connected between buses i and j and yii is the admittance of element connected between bus i and ground (reference bus).

## 2.2 Bus impedance matrix

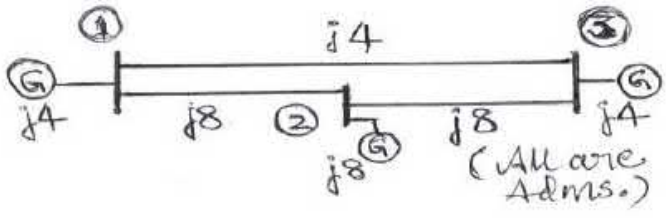
In cases where, the bus impedance matrix is also required, it cannot be formed by direct inspection of the given system diagram. However, the bus admittance matrix determined by the rule of inspection following the steps explained above, can be inverted to obtain the bus impedance matrix, since the two matrices are interinvertible.

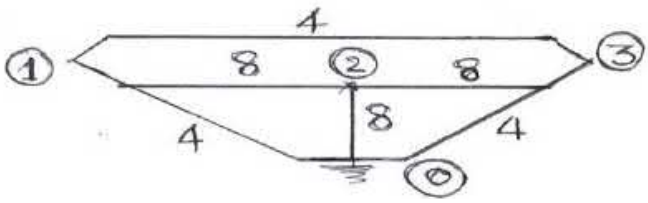
**Note:** It is to be noted that the rule of inspection can be applied only to those power systems that do not have any mutually coupled elements.

**Examples on Rule of Inspection:**

**Example 6:** Obtain the bus admittance matrix for the admittance network shown aside by the rule of inspection

$$Y_{BUS} = j\begin{vmatrix} 16 & -8 & -4 \\ -8 & 24 & -8 \\ -4 & -8 & 16 \end{vmatrix}$$

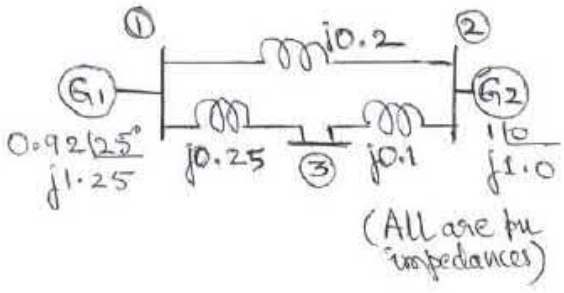


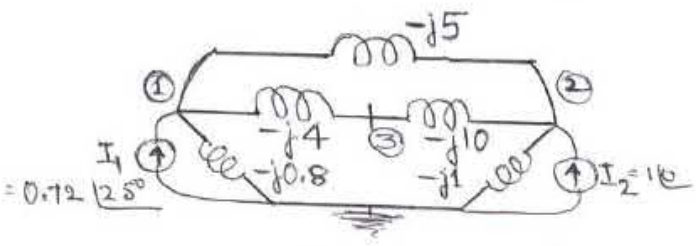



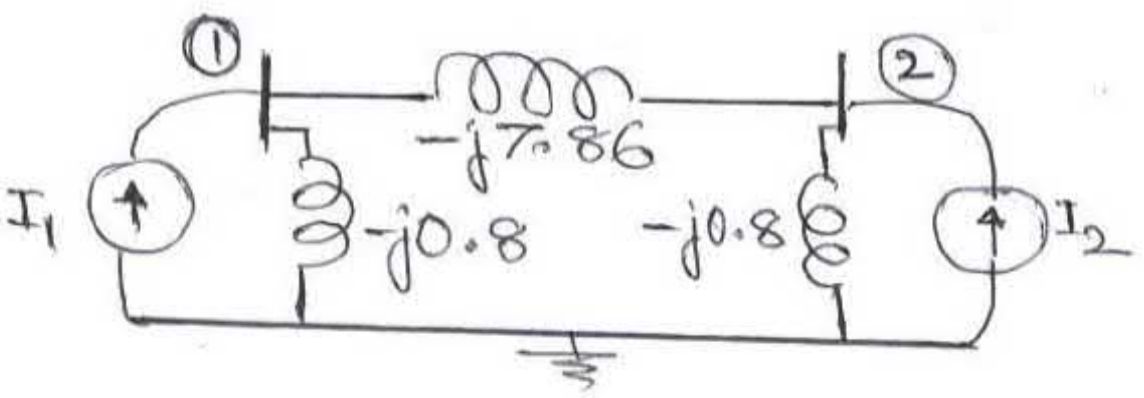

**Example 7**: Obtain YBUS for the impedance network shown aside by the rule of inspection. Also, determine YBUS for the reduced network after eliminating the eligible unwanted node. Draw the resulting reduced system diagram.

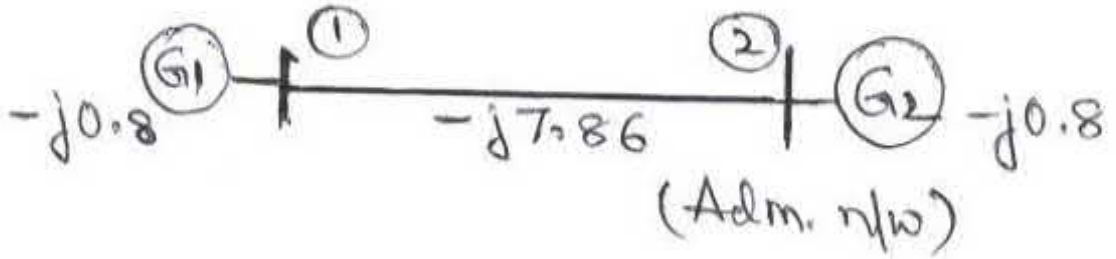
$$Y_{BUS} = j\begin{vmatrix} -9.8 & 5 & 4 \\ 5 & -16 & 10 \\ 4 & 10 & -14 \end{vmatrix}$$

$$Z_{BUS} = Y_{BUS}^{-1}$$






$$Y_{BUS}^{New} = Y_A - Y_B Y_D^{-1} Y_C$$

$$Y_{BUS} = j\begin{vmatrix} -8.66 & 7.86 \\ 7.86 & -8.66 \end{vmatrix}$$

## 2.3 SINGULAR TRANSFORMATIONS

The primitive network matrices are the most basic matrices and depend purely on the impedance or admittance of the individual elements. However, they do not contain any information about the behaviour of the interconnected network variables. Hence, it is necessary to transform the primitive matrices into more meaningful matrices which can relate variables of the interconnected network.

**Bus admittance matrix, YBUS and Bus impedance matrix, ZBUS**

In the bus frame of reference, the performance of the interconnected network is described by *n* independent nodal equations, where *n* is the total number of buses (n+1nodes are present, out of which one of them is designated as the reference node).
For example a 5-bus system will have 5 external buses and 1 ground/ ref. bus). The performance equation relating the bus voltages to bus current injections in bus frame of reference in admittance form is given by

$$IBUS = YBUS\ EBUS \quad \textbf{(17)}$$

Where EBUS = vector of bus voltages measured with respect to reference bus
IBUS = Vector of currents injected into the bus
YBUS = bus admittance matrix
The performance equation of the primitive network in admittance form is given by

$$i + j = [y]\ v$$

Pre-multiplying by At (transpose of A), we obtain

$$At\ i + At\ j = At\ [y]\ v \quad \textbf{(18)}$$

However, as per equation (4),

$At\ i = 0$,
since it indicates a vector whose elements are the algebraic sum of element currents incident at a bus, which by Kirchhoff's law is zero. Similarly, At j gives the algebraic sum of all source currents incident at each bus and this is nothing but the total current injected at the bus. Hence,

$$At\ j = IBUS \quad \textbf{(19)}$$

Thus from (18) we have, $IBUS = At\ [y]\ v$ **(20)**
However, from (5), we have
$v = A\ EBUS$
And hence substituting in (20) we get,

$$IBUS = At\ [y]\ A\ EBUS \quad \textbf{(21)}$$

Comparing (21) with (17) we obtain,

$$YBUS = At\ [y]\ A \quad \textbf{(22)}$$

The bus incidence matrix is rectangular and hence singular. Hence, (22) gives a singular transformation of the primitive admittance matrix [y]. The bus impedance matrix is given by ,

$$ZBUS = YBUS^{-1} \quad \textbf{(23)}$$

Note: This transformation can be derived using the concept of power invariance, however, since the transformations are based purely on KCL and KVL, the transformation will obviously be power invariant.

**Examples on Singular Transformation:**

**Example 8:** For the network of Fig E8, form the primitive matrices [z] & [y] and obtain the bus admittance matrix by singular transformation. Choose a Tree T(1,2,3). The data is given in Table E8.

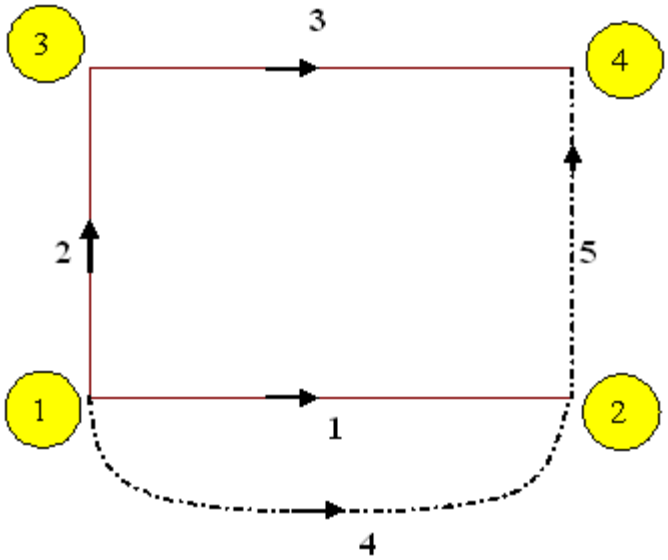



**Fig E8 System for Example-8**

**Table E8: Data for Example-8**

| Elements | Self impedance | Mutual impedance |
|---|---|---|
| **1** | j 0.6 | - |
| **2** | j 0.5 | j 0.1(with element 1) |
| **3** | j 0.5 | - |
| **4** | j 0.4 | j 0.2 (with element 1) |
| **5** | j 0.2 | - |

**Solution:**
The bus incidence matrix is formed taking node 1 as the reference bus.

$$A = \begin{bmatrix} -1 & 0 & 0 \\ 0 & -1 & 0 \\ 0 & 1 & -1 \\ -1 & 0 & 0 \\ 1 & 0 & -1 \end{bmatrix}$$

The primitive incidence matrix is given by

$$[z] = \begin{bmatrix} j0.6 & j0.1 & 0.0 & j0.2 & 0.0 \\ j0.1 & j0.5 & 0.0 & 0.0 & 0.0 \\ 0.0 & 0.0 & j0.5 & 0.0 & 0.0 \\ j0.2 & 0.0 & 0.0 & j0.4 & 0.0 \\ 0.0 & 0.0 & 0.0 & 0.0 & j0.2 \end{bmatrix}$$

The primitive admittance matrix [y] = [z]-1 and given by,

$$[y] = \begin{bmatrix} -j2.0833 & j0.4167 & 0.0 & j1.0417 & 0.0 \\ j0.4167 & -j2.0833 & 0.0 & -j0.2083 & 0.0 \\ 0.0 & 0.0 & -j2.0 & 0.0 & 0.0 \\ j1.0417 & -j0.2083 & 0.0 & -j3.0208 & 0.0 \\ 0.0 & 0.0 & 0.0 & 0.0 & -j5.0 \end{bmatrix}$$

The bus admittance matrix by singular transformation is obtained as

$$Y_{BUS} = A^t [y] A = \begin{bmatrix} -j8.0208 & j0.2083 & j5.0 \\ j0.2083 & -j4.0833 & j2.0 \\ j5.0 & j2.0 & -j7.0 \end{bmatrix}$$

$$Z_{BUS} = Y_{BUS}^{-1} = \begin{bmatrix} j0.2713 & j0.1264 & j0.2299 \\ j0.1264 & j0.3437 & j0.1885 \\ j0.2299 & j0.1885 & j0.3609 \end{bmatrix}$$

**SUMMARY**

The formulation of the mathematical model is the first step in obtaining the solution of any electrical network. The independent variables can be either currents or voltages. Correspondingly, the elements of the coefficient matrix will be impedances or admittances.

Network equations can be formulated for solution of the network using graph theory, independent of the nature of elements. In the graph of a network, the tree-branches and links are distinctly identified. The complete information about the interconnection of the network, with the directions of the currents is contained in the bus incidence matrix.

The information on the nature of the elements which form the interconnected network is contained in the primitive impedance matrix. A primitive element can be represented in impedance form or admittance form. In the bus frame of reference, the performance of the interconnected system is described by *(n-1)* nodal equations, where *n* is the number of nodes. The bus admittance matrix and the bus impedance matrix relate the bus voltages and currents. These matrices can be obtained from the primitive impedance and admittance matrices.

# FORMATION OF BUS IMPEDANCE MATRIX

## 2.4 NODE ELIMINATION BY MATRIX ALGEBRA

Nodes can be eliminated by the matrix manipulation of the standard node equations. However, *only those nodes at which current does not enter or leave the network can be considered for such elimination.* Such nodes can be eliminated either in one group or by taking the eligible nodes one after the other for elimination, as discussed next.

### CASE-A: Simultaneous Elimination of Nodes:

Consider the performance equation of the given network in bus frame of reference in admittance form for a n-bus system, given by:

$$\mathbf{IBUS = YBUS\ EBUS} \qquad \mathbf{(1)}$$

Where IBUS and EBUS are n-vectors of injected bus current and bus voltages and YBUS is the square, symmetric, coefficient bus admittance matrix of order n. Now, of the n buses present in the system, let p buses be considered for node elimination so that the reduced system after elimination of p nodes would be retained with m (= n-p) nodes only. Hence the corresponding performance equation would be similar to (1) except that the coefficient matrix would be of order m now, i.e.,

$$\mathbf{IBUS = YBUS^{new}\ EBUS} \qquad \mathbf{(2)}$$

Where $YBUS^{new}$ is the bus admittance matrix of the reduced network and the vectors

IBUS and EBUS are of order m. It is assumed in (1) that IBUS and EBUS are obtained with their elements arranged such that the elements associated with p nodes to be eliminated are in the lower portion of the vectors. Then the elements of YBUS also get located accordingly so that (1) after matrix partitioning yields,

$$\begin{vmatrix} I_{BUS-m} \\ I_{BUS-p} \end{vmatrix} = \begin{matrix} \\ m \\ p \end{matrix} \begin{matrix} \begin{matrix} m & p \end{matrix} \\ \begin{vmatrix} Y_A & Y_B \\ Y_C & Y_D \end{vmatrix} \end{matrix} \begin{vmatrix} E_{BUS-m} \\ E_{BUS-p} \end{vmatrix} \quad \textbf{(3)}$$

Where the self and mutual values of YA and YD are those identified only with the nodes to be retained and removed respectively and YC=YBt is composed of only the corresponding mutual admittance values, that are common to the nodes m and p.
Now, for the p nodes to be eliminated, it is necessary that, each element of the vector IBUS-p should be zero. Thus we have from (3):

$$I_{BUS-m} = Y_A E_{BUS-m} + Y_B E_{BUS-p}$$
$$I_{BUS-p} = Y_C E_{BUS-m} + Y_D E_{BUS-p} = 0 \quad \textbf{(4)}$$

Solving,

$$\mathbf{E_{BUS-p} = - YD^{-1}Y_C E_{BUS-m}} \quad \textbf{(5)}$$

Thus, by simplification, we obtain an expression similar to (2) as,

$$\mathbf{I_{BUS-m}} = \{Y_A - Y_B Y_D\text{-}1 Y_C\} \mathbf{E_{BUS-m}} \quad \textbf{(6)}$$

Thus by comparing (2) and (6), we get an expression for the new bus admittance matrix in terms of the sub-matrices of the original bus admittance matrix as:

$$\mathbf{Y_{BUSnew} = \{Y_A – Y_B Y_D -1 Y_C\}} \quad \textbf{(7)}$$

This expression enables us to construct the given network with only the necessary nodes retained and all the unwanted nodes/buses eliminated. However, it can be observed from (7) that the expression involves finding the inverse of the sub-matrix YD (of order p). This would be computationally very tedious if p, the nodes to be eliminated is very large, especially for real practical systems. In such cases, it is more advantageous to eliminate the unwanted nodes from the given network by considering one node only at a time for elimination, as discussed next.

**CASE-B: Separate Elimination of Nodes:**

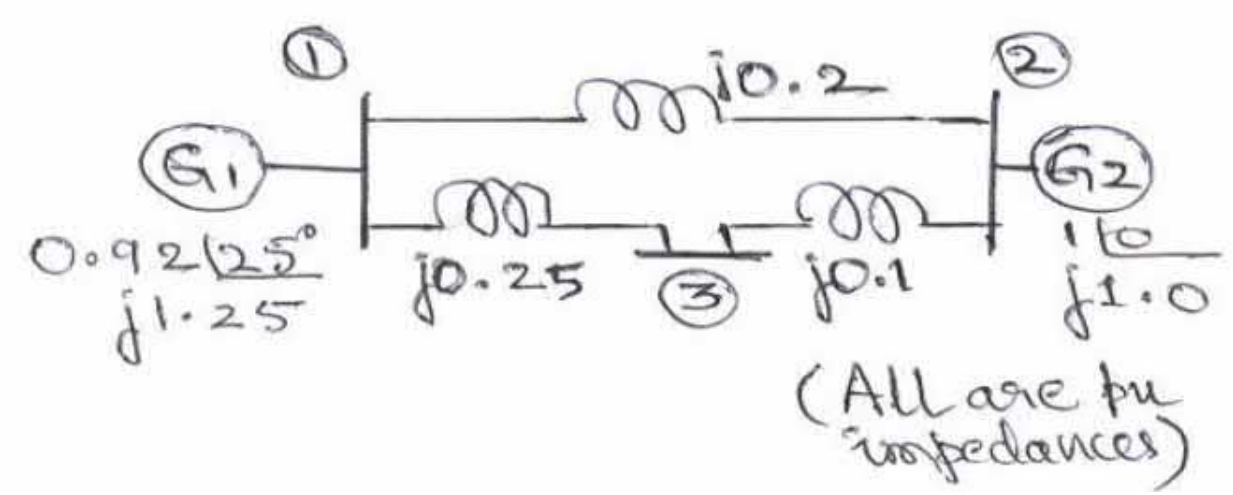
Here again, the system buses are to be renumbered, if necessary, such that the node to be removed always happens to be the last numbered one. The sub-matrix YD then would be a single element matrix and hence it inverse would be just equal to its own reciprocal value. Thus the generalized algorithmic equation for finding the elements of the new bus admittance matrix can be obtained from (6) as,

$$\mathbf{Yij^{new} = Yij^{old} – Yin\ Ynj / Ynn} \text{ " } i,j = 1,2,\ldots\ldots n. \quad \textbf{(8)}$$

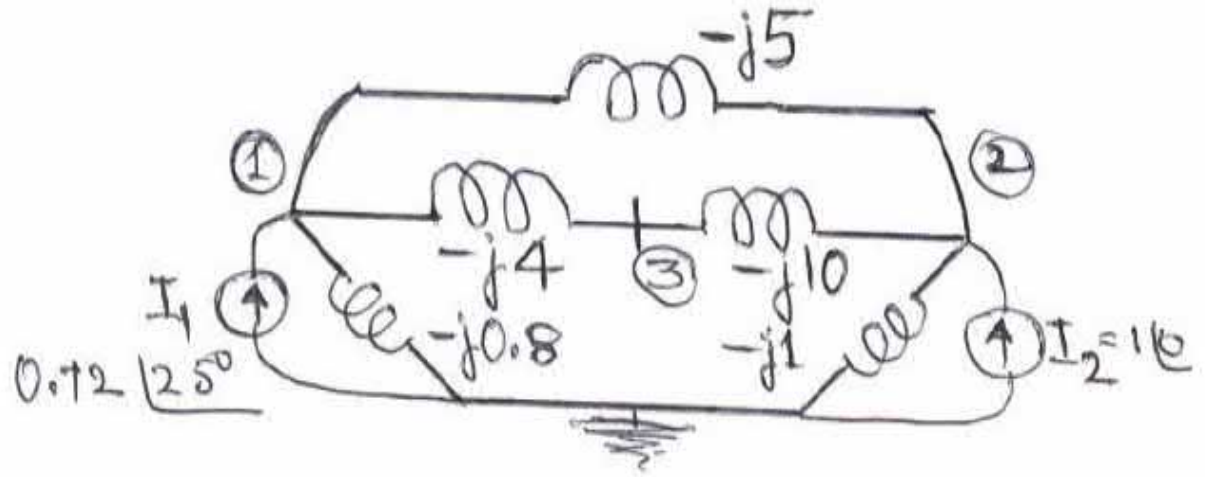
Each element of the original matrix must therefore be modified as per (7). Further, this procedure of eliminating the last numbered node from the given system of n nodes is to be iteratively repeated p times, so as to eliminate all the unnecessary p nodes from the original system.

**Examples on Node elimination:**

**Example-1:** Obtain YBUS for the impedance network shown below by the rule of inspection. Also, determine YBUS for the reduced network after eliminating the eligible unwanted node. Draw the resulting reduced system diagram.




The admittance equivalent network is as follows:




The bus admittance matrix is obtained by RoI as:

$$Y_{BUS} = j\begin{vmatrix} -9.8 & 5 & 4 \\ 5 & -16 & 10 \\ 4 & 10 & -14 \end{vmatrix}$$

The reduced matrix after elimination of node 3 from the given system is determined as per the equation:

$$Y_{BUS}^{New} = Y_A - Y_B Y_D^{-1} Y_C$$

$$Y_{BUS}^{new} = \begin{array}{c|cc} n/n & 1 & 2 \\ \hline 1 & -j8.66 & j7.86 \\ 2 & j7.86 & -j8.66 \end{array}$$

Alternatively,

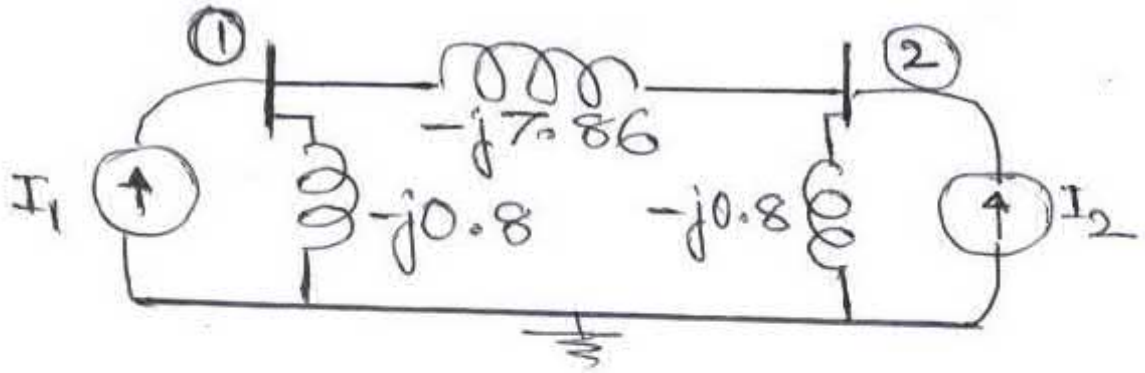
$$Y_{ij}^{new} = Y_{ij}^{old} - Y_{i3}\, Y_{3j} / Y_{33} \qquad \forall\ i,j = 1,2.$$

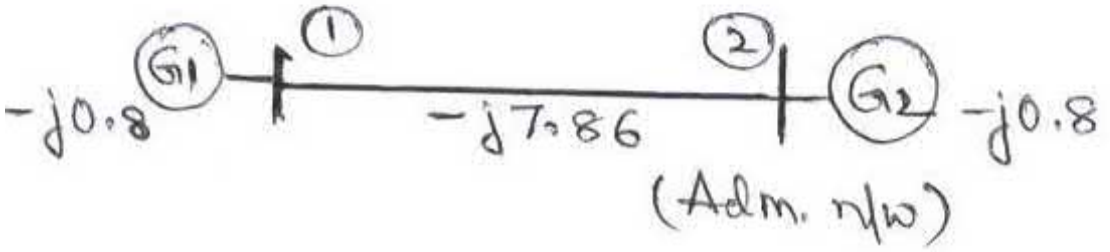
$$Y_{11} = Y_{11} - Y_{13}Y_{31}/ Y_{33} = -j8.66$$

$$Y_{22} = Y_{22} - Y_{23}Y_{32}/ Y_{33} = -j8.66$$

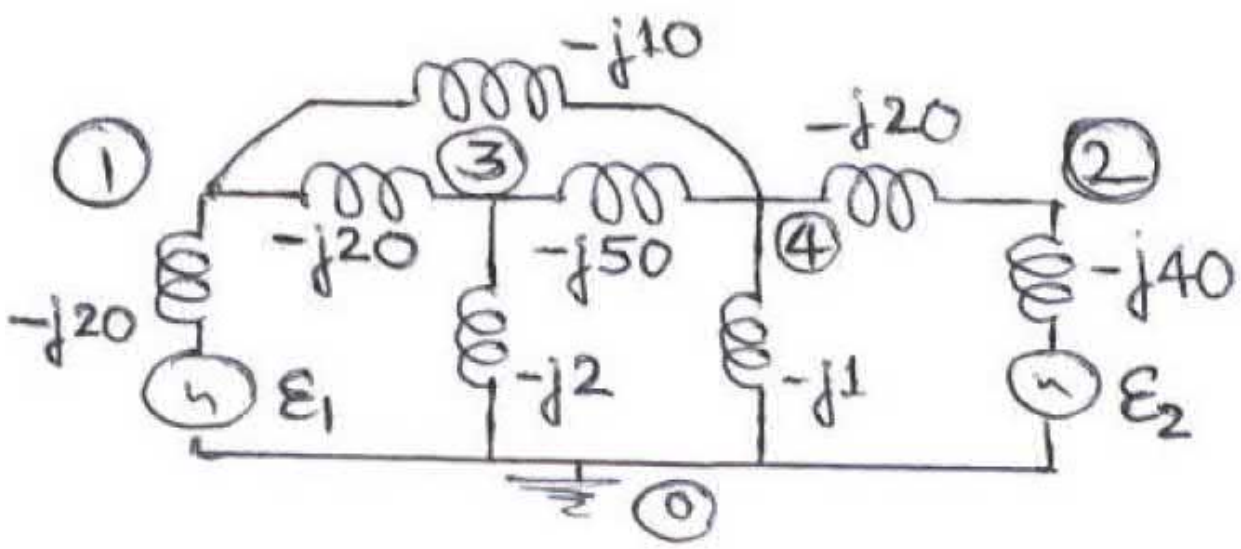
$$Y_{12} = Y_{21} = Y_{12} - Y_{13}Y_{32}/Y_{33} = j7.86$$

Thus the reduced network can be obtained again by the rule of inspection as shown below.




**Example-2:** Obtain YBUS for the admittance network shown below by the rule of inspection. Also, determine YBUS for the reduced network after eliminating the eligible unwanted node. Draw the resulting reduced system diagram.




$Y_{BUS}$=

| n/n | 1 | 2 | 3 | 4 |
|---|---|---|---|---|
| 1 | -j50 | 0 | j20 | j10 |
| 2 | 0 | -j60 | 0 | j72 |
| 3 | j20 | 0 | -j72 | j50 |
| 4 | j10 | j72 | j50 | -j81 |

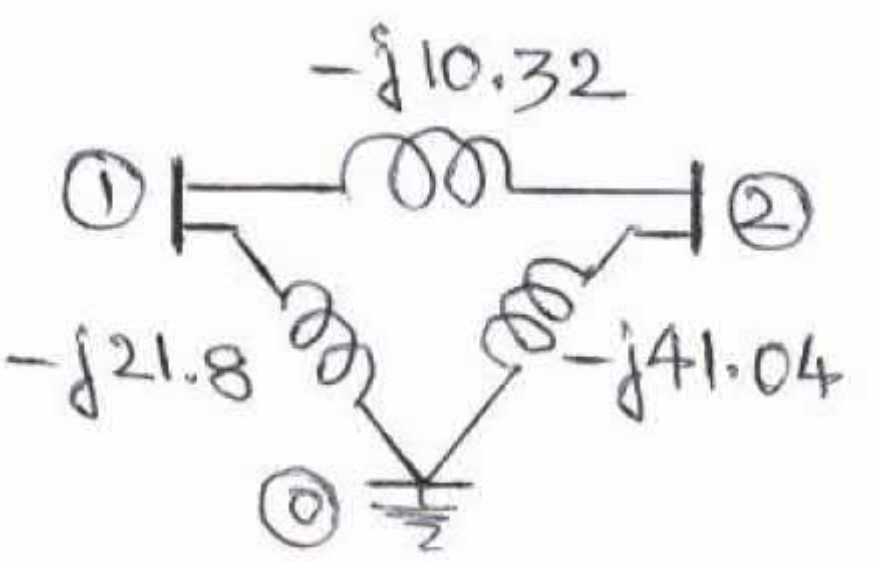
$= \begin{vmatrix} Y_A & Y_B \\ Y_C & Y_D \end{vmatrix}$

$$Y_{BUS}^{New} = Y_A - Y_B Y_D^{-1} Y_C$$

$Y_{BUS}^{new}$=

| n/n | 1 | 2 |
|---|---|---|
| 1 | -j32.12 | j10.32 |
| 2 | j10.32 | -j51.36 |

Thus the reduced system of two nodes can be drawn by the rule of inspection as under:


-j10.32
1
2
-j21.8
-j41.04
0

# LOAD FLOW STUDIES

## REVIEW OF NUMERICAL SOLUTION OF EQUATIONS

The numerical analysis involving the solution of algebraic simultaneous equations forms the basis for solution of the performance equations in computer aided electrical power system analyses, such as during linear graph analysis, load flow analysis (nonlinear equations), transient stability studies (differential equations), etc. Hence, it is necessary to review the general forms of the various solution methods with respect to all forms of equations, as under:

**1. Solution Linear equations**:
* **Direct methods**:
- Cramer's (Determinant) Method,
- Gauss Elimination Method (only for smaller systems),
- LU Factorization (more preferred method), etc.

*** Iterative methods**:
- Gauss Method
- Gauss-Siedel Method (for diagonally dominant systems)

**3. Solution of Nonlinear equations:**
**Iterative methods only:**
- Gauss-Siedel Method (for smaller systems)
- Newton-Raphson Method (if corrections for variables are small)

**4. Solution of differential equations:**
**Iterative methods only:**
- Euler and Modified Euler method,
- RK IV-order method,
- Milne's predictor-corrector method, etc.

It is to be observed that the nonlinear and differential equations can be solved only by the iterative methods. The iterative methods are characterized by the various performance features as under:
_ Selection of initial solution/ estimates
_ Determination of fresh/ new estimates during each iteration
_ Selection of number of iterations as per tolerance limit
_ Time per iteration and total time of solution as per the solution method selected
_ Convergence and divergence criteria of the iterative solution
_ Choice of the Acceleration factor of convergence, etc.

**A comparison of the above solution methods is as under:**
In general, the direct methods yield exact or accurate solutions. However, they are suited for only the smaller systems, since otherwise, in large systems, the possible round-off errors make the solution process inaccurate. The iterative methods are more useful when the diagonal elements of the coefficient matrix are large in comparison with the off diagonal elements. The round-off errors in these methods are corrected at the successive steps of the iterative process.The Newton-Raphson method is very much useful for solution of non –linear equations, if all the values of the corrections for the unknowns are very small in magnitude and the initial values of unknowns are selected to be reasonably closer to the exact solution.

## LOAD FLOW STUDIES

**Introduction:** Load flow studies are important in planning and designing future expansion of power systems. The study gives steady state solutions of the voltages at all the buses, for a particular load condition. Different steady state solutions can be obtained, for different operating conditions, to help in planning, design and operation of the power system. Generally, load flow studies are limited to the transmission system, which involves bulk power transmission. The load at the buses is assumed to be known. Load flow studies throw light on some of the important aspects of the system operation, such as: violation of voltage magnitudes at the buses, overloading of lines, overloading of generators, stability margin reduction, indicated by power angle differences between buses linked by a line, effect of contingencies like line voltages, emergency shutdown of generators, etc. Load flow studies are required for deciding the economic operation of the power system. They are also required in transient stability studies. Hence, load flow studies play a vital role in power system studies. Thus the load flow problem consists of finding the power flows (real and reactive) and voltages of a network for given bus conditions. At each bus, there are four quantities of interest to be known for further analysis: the real and reactive power, the voltage magnitude and its phase angle. Because of the nonlinearity of the algebraic equations, describing the given power system, their solutions are obviously, based on the iterative methods only. The constraints placed on the load flow solutions could be:

_ The Kirchhoff's relations holding good,
_ Capability limits of reactive power sources,
_ Tap-setting range of tap-changing transformers,
_ Specified power interchange between interconnected systems,
_ Selection of initial values, acceleration factor, convergence limit, etc.

**Classification of buses for LFA:** Different types of buses are present based on the specified and unspecified variables at a given bus as presented in the table below:

**Table 1. Classification of buses for LFA**

| Sl. No. | Bus Types | Specified Variables | Unspecified variables | Remarks |
|---|---|---|---|---|
| 1 | Slack/ Swing Bus | $\|V\|$, $\delta$ | $P_G$, $Q_G$ | $\|V\|$, $\delta$: are assumed if not specified as 1.0 and $0^0$ |
| 2 | Generator/ Machine/ PV Bus | $P_G$, $\|V\|$ | $Q_G$, $\delta$ | A generator is present at the machine bus |
| 3 | Load/ PQ Bus | $P_G$, $Q_G$ | $\|V\|$, $\delta$ | About 80% buses are of PQ type |
| 4 | Voltage Controlled Bus | $P_G$,$Q_G$, $\|V\|$ | $\delta$, a | 'a' is the % tap change in tap-changing transformer |

**Importance of swing bus:** The slack or swing bus is usually a PV-bus with the largest capacity generator of the given system connected to it. The generator at the swing bus supplies the power difference between the "specified power into the system at the other buses" and the "total system output plus losses". Thus swing bus is needed to supply the additional real and reactive power to meet the losses. Both the magnitude and phase angle of voltage are specified at the swing bus, or otherwise, they are assumed to be equal to 1.0 p.u. and 00 , as per flat-start procedure of iterative
solutions. The real and reactive powers at the swing bus are found by the computer routine as part of the load flow solution process. It is to be noted that the source at the swing bus is a perfect one, called the swing machine, or slack machine. It is voltage regulated, i.e., the magnitude of voltage fixed. The phase angle is the system reference phase and hence is fixed. The generator at the swing bus has a torque angle and excitation which vary or swing as the demand changes. This variation is such as to produce fixed voltage.

## Importance of YBUS based LFA:

The majority of load flow programs employ methods using the bus admittance matrix, as this method is found to be more economical. The bus admittance matrix plays a very important role in load flow analysis. It is a complex, square and symmetric matrix and hence only n(n+1)/2 elements of YBUS need to be stored for a n-bus system. Further, in the YBUS matrix, Yij = 0, if an incident element is not present in the system connecting the buses 'i' and 'j'. since in a large power system, each bus is connected only to a fewer buses through an incident element, (about 6-8), the coefficient matrix, YBUS of such systems would be highly sparse, i.e., it will have many zero valued elements in it. This is defined by the sparsity of the matrix, as under:

$$\text{Percentage sparsity of a given matrix of } n^{th} \text{ order:} = \frac{\text{Total no. of zero valued elements of } Y_{BUS}}{\text{Total no. of entries of } Y_{BUS}}$$

$$\mathbf{S = (Z / n^2) \times 100\ \%} \qquad \mathbf{(1)}$$

The percentage sparsity of $Y_{BUS}$, in practice, could be as high as 80-90%, especially
for very large, practical power systems. This sparsity feature of YBUS is extensively used in reducing the load flow calculations and in minimizing the memory required to store the

coefficient matrices. This is due to the fact that only the non-zero elements YBUS can be stored during the computer based implementation of the schemes, by adopting the suitable optimal storage schemes. While YBUS is thus highly sparse, it's inverse, ZBUS, the bus impedance matrix is not so. It is a FULL matrix, unless the optimal bus ordering schemes are followed before proceeding for load flow analysis.

**THE LOAD FLOW PROBLEM**

Here, the analysis is restricted to a balanced three-phase power system, so that the analysis can be carried out on a single phase basis. The per unit quantities are used for all quantities. The first step in the analysis is the formulation of suitable equations for the power flows in the system. The power system is a large interconnected system, where various buses are connected by transmission lines. At any bus, complex power is injected into the bus by the generators and complex power is drawn by the loads. Of course at any bus, either one of them may not be present. The power is transported from one bus to other via the transmission lines. At any bus *i*, the complex power Si (injected), shown in figure 1, is defined as

$$S_i = S_{Gi} - S_{Di} \qquad (2)$$

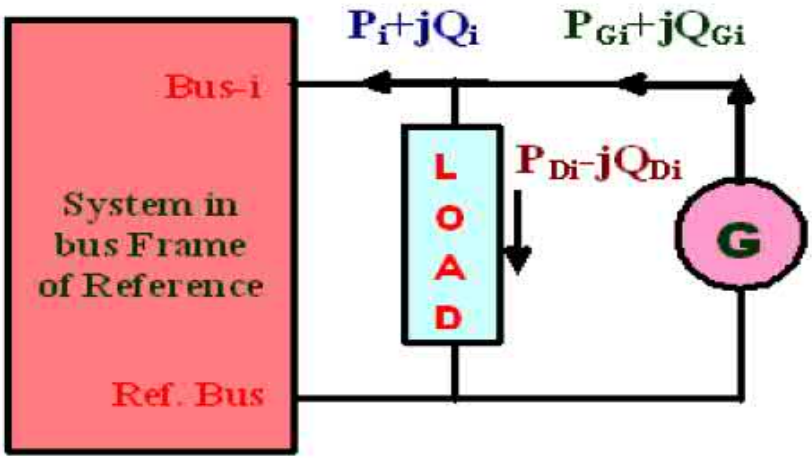



**Fig.1 power flows at a bus-i**

where Si = net complex power injected into bus *i*, SGi = complex power injected by the generator at bus *i*, and SDi = complex power drawn by the load at bus *i*. According to conservation of complex power, at any bus i, the complex power injected into the bus must be equal to the sum of complex power flows out of the bus via the transmission lines. Hence,

Si = _Sij " i = 1, 2, ……..n **(3)**

where Sij is the sum over all lines connected to the bus and *n* is the number of buses in the system (excluding the ground). The bus current injected at the bus-i is defined as

Ii = IGi – IDi " i = 1, 2, ……..n **(4)**

where IGi is the current injected by the generator at the bus and IDi is the current drawn by the load (demand) at that bus. In the bus frame of reference

IBUS = YBUS VBUS
**(5)**

where

$$I_{BUS} = \begin{bmatrix} I_1 \\ I_2 \\ . \\ . \\ I_n \end{bmatrix}$$ is the vector of currents injected at the buses,

$Y_{BUS}$ is the bus admittance matrix, and

$$V_{BUS} = \begin{bmatrix} V_1 \\ V_2 \\ . \\ . \\ V_n \end{bmatrix}$$ is the vector of complex bus voltages.

Equation (5) can be considered as

$$I_i = \sum_{j=1}^{n} Y_{ij} V_j \qquad \forall\ i = 1, 2, \ldots\ldots\ldots n \qquad \textbf{(6)}$$

The complex power $S_i$ is given by

$$S_i = V_i\ I_i^*$$

$$= V_i \left( \sum_{j=1}^{n} Y_{ij}\ V_j \right)^*$$

$$= V_i \left( \sum_{j=1}^{n} Y_{ij}^* V_j^* \right) \qquad \textbf{(7)}$$

Let $$V_i \triangleq |V_i| \angle \delta_i = |V_i| (\cos\ \delta_i + j \sin\ \delta_i)$$

$$\delta_{ij} = \delta_i - \delta_j$$

$$Y_{ij} = G_{ij} + jB_{ij}$$

Hence from (7), we get,

$$S_i = \sum_{j=1}^{n} |V_i| \, |V_j| \, (\cos \delta_{ij} + j \sin \delta_{ij}) \, (G_{ij} - j B_{ij}) \quad \textbf{(8)}$$

Separating real and imaginary parts in (8) we obtain,

$$P_i = \sum_{j=1}^{n} |V_i| \, |V_j| \, (G_{ij} \cos \delta_{ij} + B_{ij} \sin \delta_{ij}) \quad \textbf{(9)}$$

$$Q_i = \sum_{j=1}^{n} |V_i| \, |V_j| \, (G_{ij} \sin \delta_{ij} - B_{ij} \cos \delta_{ij}) \quad \textbf{(10)}$$

An alternate form of $P_i$ and $Q_i$ can be obtained by representing $Y_{ik}$ also in polar form as

$$Y_{ij} = |Y_{ij}| \angle \theta_{ij} \quad \textbf{(11)}$$

Again, we get from (7),

$$S_i = |V_i| \angle \delta_i \sum_{j=1}^{n} |Y_{ij}| \angle -\theta_{ij} \, |V_j| \angle -\delta_j \quad \textbf{(12)}$$

The real part of (12) gives $P_i$.

$$P_i = |V_i| \sum_{j=1}^{n} |Y_{ij}| \, |V_j| \cos(-\theta_{ij} + \delta_i - \delta_j)$$

$$= |V_i| \sum_{j=1}^{n} |Y_{ij}| \, |V_j| \cos -(\theta_{ij} - \delta_i + \delta_j) \quad \text{or}$$

$$P_i = \sum_{j=1}^{n} |V_i| \, |V_j| \, |Y_{ij}| \cos(\theta_{ij} - \delta_i + \delta_j) \qquad \forall \; i = 1, 2, \ldots\ldots\ldots n, \quad \textbf{(13)}$$

Similarly, $Q_i$ is imaginary part of (12) and is given by

$$Q_i = |V_i| \sum_{j=1}^{n} |Y_{ij}| \, |V_j| \sin -(\theta_{ij} - \delta_i + \delta_j) \quad \text{or}$$

$$Q_i = -\sum_{j=1}^{n} |V_i| \, |V_j| \, |Y_{ij}| \sin(\theta_{ij} - \delta_i + \delta_j) \qquad \forall \; i = 1, 2, \ldots\ldots\ldots n \quad \textbf{(14)}$$

Equations (9)-(10) and (13)-(14) are the 'power flow equations' or the 'load flow equations' in two alternative forms, corresponding to the n-bus system, where each bus-*i* is characterized by four variables, Pi, Qi, |Vi|, and di. Thus a total of 4n variables are

involved in these equations. The load flow equations can be solved for any 2n unknowns, if the other 2n variables are specified. This establishes the need for classification of buses of the system for load flow analysis into: PV bus, PQ bus, etc.

**DATA FOR LOAD FLOW**

Irrespective of the method used for the solution, the data required is common for any load flow. All data is normally in pu. The bus admittance matrix is formulated from these data. The various data required are as under:

**System data**: It includes: number of buses-*n*, number of PV buses, number of loads, number of transmission lines, number of transformers, number of shunt elements, the slack bus number, voltage magnitude of slack bus (angle is generally taken as 0o), tolerance limit, base MVA, and maximum permissible number of iterations.

**Generator bus data**: For every PV bus *i*, the data required includes the bus number, active power generation PGi, the specified voltage magnitude $i\ sp\ V$ , , minimum reactive power limit Qi,min, and maximum reactive power limit Qi,max.

**Load data**: For all loads the data required includes the the bus number, active power demand PDi, and the reactive power demand QDi.

**Transmission line data**: For every transmission line connected between buses *i* and *k* the data includes the starting bus number *i*, ending bus number *k*,.*r*esistance of the line, reactance of the line and the half line charging admittance.

**Transformer data**:
For every transformer connected between buses *i* and *k* the data to be given includes: the starting bus number *i*, ending bus number *k*, resistance of the transformer, reactance of the transformer, and the off nominal turns-ratio *a*.

**Shunt element data**: The data needed for the shunt element includes the bus number where element is connected, and the shunt admittance (Gsh + j Bsh).

**GAUSS – SEIDEL (GS) METHOD**
The GS method is an iterative algorithm for solving non linear algebraic equations. An initial solution vector is assumed, chosen from past experiences, statistical data or from practical considerations. At every subsequent iteration, the solution is updated till convergence is reached. The GS method applied to power flow problem is as discussed below.

**Case (a): Systems with PQ buses only:**
Initially assume all buses to be PQ type buses, except the slack bus. This means that (n–1) complex bus voltages have to be determined. For ease of programming, the slack bus is generally numbered as bus-1. PV buses are numbered in sequence and PQ buses are ordered next in sequence. This makes programming easier, compared to random ordering of buses. Consider the expression for the complex power at bus-i, given from (7), as:

$$S_i = V_i \left( \sum_{j=1}^{n} Y_{ij} \; V_j \right)^*$$

This can be written as

$$S_i^* = V_i^* \left( \sum_{j=1}^{n} Y_{ij} \, V_j \right) \qquad \textbf{(15)}$$

Since $S_i^* = P_i - jQ_i$, we get,

$$\frac{P_i - jQ_i}{V_i^*} = \sum_{j=1}^{n} Y_{ij} \, V_j$$

So that,

$$\frac{P_i - jQ_i}{V_i^*} = Y_{ii} \; V_i + \sum_{\substack{j=1 \\ j \neq i}}^{n} Y_{ij} \; V_j \qquad \textbf{(16)}$$

Rearranging the terms, we get,

$$V_i = \frac{1}{Y_{ii}} \left[ \frac{P_i - jQ_i}{V_i^*} - \sum_{\substack{j=1 \\ j \neq i}}^{n} Y_{ij} V_j \right] \qquad \forall \; i = 2, 3, \ldots\ldots\ldots n \qquad \textbf{(17)}$$

Equation (17) is an implicit equation since the unknown variable, appears on both sides of the equation. Hence, it needs to be solved by an iterative technique. Starting from an initial estimate of all bus voltages, in the RHS of (17) the most recent values of the bus voltages is substituted. One iteration of the method involves computation of all the bus voltages. In Gauss–Seidel method, the value of the updated voltages are used in the computation of subsequent voltages in the same iteration, thus speeding up convergence. Iterations are carried out till the magnitudes of all bus voltages do not change by more than the tolerance value. Thus the algorithm for GS method is as under:

**Algorithm for GS method**

1. Prepare data for the given system as required.
2. Formulate the bus admittance matrix YBUS. This is generally done by the rule of inspection.
3. Assume initial voltages for all buses, 2,3,…n. In practical power systems, the magnitude of the bus voltages is close to 1.0 p.u. Hence, the complex bus voltages at all (n-1) buses (except slack bus) are taken to be $1.0\angle 0^0$. This is normally refered as the ***flat start*** solution.
4. Update the voltages. In any ($k$ +1)*st* iteration, from (17) the voltages are given by

$$V_i^{(k+1)} = \frac{1}{Y_{ii}}\left[\frac{P_i - jQ_i}{(V_i^{(k)})^*} - \sum_{j=1}^{i-1} Y_{ij} V_j^{(k+1)} - \sum_{j=i+1}^{n} Y_{ij} V_j^{(k)}\right] \quad \forall \text{ i=2,3,...n} \qquad \textbf{(18)}$$

Here note that when computation is carried out for bus-i, updated values are already available for buses 2,3….(i-1) in the current *(k+1)st* iteration. Hence these values are used. For buses *(i+1)…..n,* values from previous, *kth* iteration are used.

$$\left|\Delta V_i^{(k+1)}\right| = \left|V_i^{(k+1)} - V_i^{(k)}\right| < \varepsilon \qquad \forall \text{ i = 2,3,...n} \qquad \textbf{(19)}$$

Where,e is the tolerance value. Generally it is customary to use a value of 0.0001 pu. Compute slack bus power after voltages have converged using (15) [assuming bus 1 is slack bus].

$$S_1^* = P_1 - jQ_1 = V_1^*\left(\sum_{j=1}^{n} Y_{1j} V_j\right) \qquad \textbf{(20)}$$

7. Compute all line flows.
8. The complex power loss in the line is given by Sik + Ski. The total loss in the system is calculated by summing the loss over all the lines.

**Case (b): Systems with PV buses also present:**
At PV buses, the magnitude of voltage and not the reactive power is specified. Hence it is needed to first make an estimate of Qi to be used in (18). From (15) we have

$$Q_i = -\text{Im}\left\{V_i^* \sum_{j=1}^{n} Y_{ij}\, V_j\right\}$$

Where *Im* stands for the imaginary part. At any $(k+1)^{st}$ iteration, at the PV bus-*i*,

$$Q_i^{(k+1)} = -\text{Im}\left\{(V_i^{(k)})^* \sum_{j=1}^{i-1} Y_{ij}\, V_j^{(k+1)} + (V_i^{(k)})^* \sum_{j=i}^{n} Y_{ij}\, V_j^{(k)}\right\} \quad \textbf{(21)}$$

The steps for $i^{th}$ PV bus are as follows:

1. Compute $Q_i^{(k+1)}$ using (21)
2. Calculate $V_i$ using (18) with $Q_i = Q_i^{(k+1)}$
3. Since $|V_i|$ is specified at the PV bus, the magnitude of $V_i$ obtained in step 2

has to be modified and set to the specified value $|V_{i,sp}|$. Therefore,

$$V_i^{(k+1)} = |V_{i,sp}|\, \angle\delta_i^{(k+1)} \quad \textbf{(22)}$$

The voltage computation for PQ buses does not change.

**Case (c): Systems with PV buses with reactive power generation limits specified:**
In the previous algorithm if the Q limit at the voltage controlled bus is violated during any iteration, i.e $(k+1)$ *i Q* computed using (21) is either less than Qi, min or greater than Qi,max, it means that the voltage cannot be maintained at the specified value due to lack of reactive power support. This bus is then treated as a PQ bus in the *(k+1)st* iteration and the voltage is calculated with the value of Qi set as follows:

If $Q_i < Q_{i,min}$ Then $Q_i = Q_{i,min}$.

If $Q_i > Q_{i,max}$ Then $Q_i = Q_{i,max}$.

**(23)**

If in the subsequent iteration, if Qi falls within the limits, then the bus can be switched back to PV status.

**Acceleration of convergence**
It is found that in GS method of load flow, the number of iterations increase with increase in the size of the system. The number of iterations required can be reduced if the correction in voltage at each bus is accelerated, by multiplying with a constant α, called the acceleration factor. In the (k+1)st iteration we can let

$$V_i^{(k+1)}(accelerate\ d) = V_i^{(k)} + \alpha\left(V_i^{(k+1)} - V_i^{(k)}\right) \quad \textbf{(24)}$$

where α is a real number. When α =1, the value of $(k+1)$ is the computed value. If $1<\alpha<2$ then the value computed is extrapolated. Generally _ is taken between 1.2 to 1.6, for GS load flow procedure. At PQ buses (pure load buses) if the voltage magnitude violates

the limit, it simply means that the specified reactive power demand cannot be supplied, with the voltage maintained within acceptable limits.

## Examples on GS load flow analysis:

**Example-1:** *Obtain the voltage at bus 2 for the simple system shown in Fig 2, using the Gauss–Seidel method, if* $V_1 = 1\angle 0^0$ *pu.*

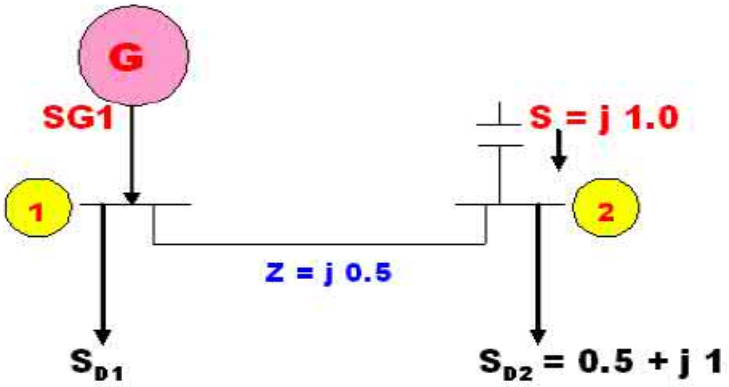



**Fig : System of Example 1**

**Solution**:

Here the capacitor at bus 2, injects a reactive power of 1.0 pu. The complex power injection at bus 2 is

$$S_2 = j1.0 - (0.5 + j\ 1.0) = -0.5 \text{ pu.}$$

$$V_1 = 1\angle 0^0$$

$$Y_{BUS} = \begin{bmatrix} -j2 & j2 \\ j2 & -j2 \end{bmatrix}$$

$$V_2^{(k+1)} = \frac{1}{Y_{22}}\left[\frac{P_2 - jQ_2}{\left(V_2^{(k)}\right)^*} - Y_{21}V_1\right]$$

Since $V_1$ is specified it is a constant through all the iterations. Let the initial voltage at bus 2, $V_2^0 = 1 + j\ 0.0 = 1\angle 0^0$ pu.

$$V_2^1 = \frac{1}{-j2}\left[\frac{-0.5}{1\angle 0^0} - \left(j2 \times 1\angle 0^0\right)\right]$$

$$= 1.0 - \text{j}0.25 = 1.030776 \angle -14.036^0$$

$$V_2^2 = \frac{1}{-j2}\left[\frac{-0.5}{1.030776\angle 14.036^0} - \left(j2 \times 1\angle 0^0\right)\right]$$

$$= 0.94118 - \text{j}\ 0.23529 = 0.970145 \angle -14.036^0$$

$$V_2^3 = \frac{1}{-j2}\left[\frac{-0.5}{0.970145\angle 14.036^0} - \left(j2 \times 1\angle 0^0\right)\right]$$

$$= 0.9375 - \text{j}\ 0.249999 = 0.970261 \angle -14.931^0$$

$$V_2^4 = \frac{1}{-j2}\left[\frac{-0.5}{0.970261\angle 14.931^0} - \left(j2 \times 1\angle 0^0\right)\right]$$

$$= 0.933612 - \text{j}\ 0.248963 = 0.966237 \angle -14.931^0$$

$$V_2^5 = \frac{1}{-j2}\left[\frac{-0.5}{0.966237\angle 14.931^0} - \left(j2 \times 1\angle 0^0\right)\right]$$

$$= 0.933335 - \text{j}\ 0.25 = 0.966237 \angle -14.995^0$$

Since the difference in the voltage magnitudes is less than 10-6 pu, the iterations can be stopped. To compute line flow

$$I_{12} = \frac{V_1 - V_2}{Z_{12}} = \frac{1\angle 0^0 - 0.966237\angle -14.995^0}{j0.5}$$

$$= 0.517472\ \angle -14.931^0$$

$$S_{12} = V_1 I_{12}^* = 1\angle 0^0 \times 0.517472\ \angle\ 14.931^0$$

$$= 0.5 + \text{j}\ 0.133329\ \text{pu}$$

$$I_{21} = \frac{V_2 - V_1}{Z_{12}} = \frac{0.966237\angle -14.995^0 - 1\angle 0^0}{j0.5}$$

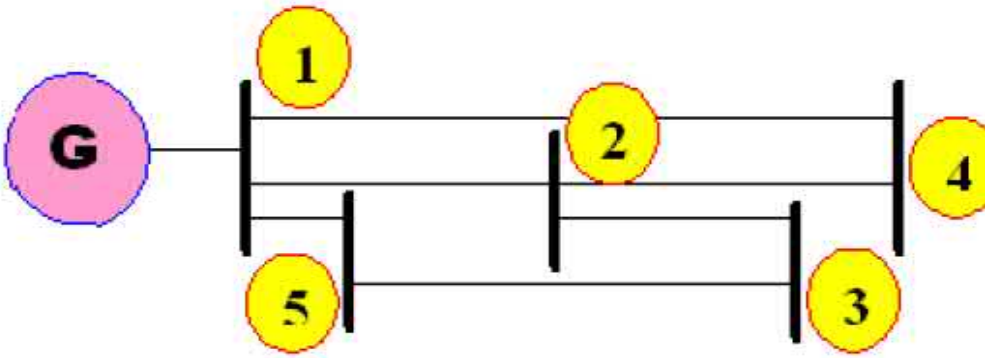
$$= 0.517472\ \angle -194.93^0$$

$$S_{21} = V_2 I_{21}^* = -0.5 + \text{j}\ 0.0\ \text{pu}$$

The total loss in the line is given by S12 + S21 = j 0.133329 pu Obviously, it is observed that there is no real power loss, since the line has no resistance.

## Example-2:

For the power system shown in fig. below, with the data as given in tables below, obtain the bus voltages at the end of first iteration, by applying GS method.




**Power System of Example 2**

**Line data of example 2**

| SB | EB | R (pu) | X (pu) | $\frac{B_C}{2}$ |
|---|---|---|---|---|
| 1 | 2 | 0.10 | 0.40 | - |
| 1 | 4 | 0.15 | 0.60 | - |
| 1 | 5 | 0.05 | 0.20 | - |
| 2 | 3 | 0.05 | 0.20 | - |
| 2 | 4 | 0.10 | 0.40 | - |
| 3 | 5 | 0.05 | 0.20 | - |

**Bus data of example 2**

| Bus No. | $P_G$ (pu) | $Q_G$ (pu) | $P_D$ (pu) | $Q_D$ (pu) | $\lvert V_{SP}\rvert$ (pu) | $\delta$ |
|---|---|---|---|---|---|---|
| 1 | - | - | - | - | 1.02 | $0^o$ |
| 2 | - | - | 0.60 | 0.30 | - | - |
| 3 | 1.0 | - | - | - | 1.04 | - |
| 4 | - | - | 0.40 | 0.10 | - | - |
| 5 | - | - | 0.60 | 0.20 | - | - |

**Solution**: In this example, we have,

- Bus 1 is slack bus, Bus 2, 4, 5 are PQ buses, and Bus 3 is PV bus
- The lines do not have half line charging admittances

$P_2 + jQ_2 = P_{G2} + jQ_{G2} - (P_{D2} + jQ_{D2}) = -0.6 - j0.3$

$$P_3 + jQ_3 = P_{G3} + jQ_{G3} - (P_{D3} + jQ_{D3}) = 1.0 + jQ_{G3}$$

Similarly $P_4 + jQ_4 = -0.4 - j0.1$, $P_5 + jQ_5 = -0.6 - j0.2$

The $Y_{bus}$ formed by the rule of inspection is given by:

$Y_{bus} =$

| | | | | |
|---|---|---|---|---|
| 2.15685 -j8.62744 | -0.58823 +j2.35294 | 0.0+j0.0 | -0.39215 +j1.56862 | -1.17647 +j4.70588 |
| -0.58823 +j2.35294 | 2.35293 -j9.41176 | -1.17647 +j4.70588 | -0.58823 +j2.35294 | 0.0+j0.0 |
| 0.0+j0.0 | -1.17647 +j4.70588 | 2.35294 -j9.41176 | 0.0+j0.0 | -1.17647 +j4.70588 |
| -0.39215 +j1.56862 | -0.58823 +j2.35294 | 0.0+j0.0 | 0.98038 -j3.92156 | 0.0+j0.0 |
| -1.17647 +j4.70588 | 0.0+j0.0 | -1.17647 +j4.70588 | 0.0+j0.0 | 2.35294 -j9.41176 |

The voltages at all PQ buses are assumed to be equal to 1+j0.0 pu. The slack bus voltage is taken to be $V_1^0 = 1.02+j0.0$ in all iterations.

$$V_2^1 = \frac{1}{Y_{22}}\left[\frac{P_2 - jQ_2}{V_2^{o*}} - Y_{21}V_1^o - Y_{23}V_3^0 - Y_{24}V_4^0 - Y_{25}V_5^0\right]$$

$$= \frac{1}{Y_{22}}\left[\frac{-0.6 + j0.3}{1.0 - j0.0} - \{(-0.58823 + j2.35294)\times 1.02\angle 0^o\}\right.$$

$$\left. - \{(-1.17647 + j4.70588)\times 1.04\angle 0^o\} - \{(-0.58823 + j2.35294)\times 1.0\angle 0^0\}\right]$$

$$= 0.98140\angle -3.0665^o = 0.97999 - j0.0525$$

Bus 3 is a PV bus. Hence, we must first calculate $Q_3$. This can be done as under:

$$Q_3 = |V_3||V_1|(G_{31}\sin\delta_{31} - B_{31}\cos\delta_{31}) + |V_3||V_2|(G_{32}\sin\delta_{32} - B_{32}\cos\delta_{32})$$

$$+ |V_3|^2(G_{33}\sin\delta_{33} - B_{33}\cos\delta_{33}) + |V_3||V_4|(G_{34}\sin\delta_{34} - B_{34}\cos\delta_{34})$$

$$+ |V_3||V_5|(G_{35}\sin\delta_{35} - B_{35}\cos\delta_{35})$$

We note that $\delta_1 = 0^o$; $\delta_2 = -3.0665^o$; $\delta_3 = 0^o$; $\delta_4 = 0^o$ and $\delta_5 = 0^o$

$\therefore \delta_{31} = \delta_{33} = \delta_{34} = \delta_{35} = 0^o$ ($\delta_{ik} = \delta_i - \delta_k$); $\delta_{32} = 3.0665^o$

$Q_3 = 1.04$ [1.02 (0.0+j0.0) + 0.9814 {−1.17647 × sin(3.0665°) − 4.70588

×cos(3.0665°)}+1.04{−9.41176 ×cos(0°)}+1.0 {0.0 + j0.0}+1.0{−4.70588×cos($0^0$)}]

= 1.04 [−4.6735 + 9.78823 − 4.70588] = 0.425204 pu.

$$V_3^1 = \frac{1}{Y_{33}}\left[\frac{P_3 - jQ_3}{V_3^{o*}} - Y_{31}V_1^o - Y_{32}V_2^1 - Y_{34}V_4^0 - Y_{35}V_5^0\right]$$

$$= \frac{1}{Y_{33}}\left[\frac{1.0 - j0.425204}{1.04 - j0.0} - \{(-1.7647 + j4.70588)\times(0.98140\angle -3.0665^o)\}\right.$$

$$\left. - \{(-1.17647 + j4.70588)\times(1\angle 0^o)\}\right]$$

$$= 1.05569\angle 3.077^o = 1.0541 + j0.05666 \text{ pu.}$$

Since it is a PV bus, the voltage magnitude is adjusted to specified value and $V_3^1$ is computed as: $V_3^1 = 1.04\angle 3.077^0$ pu

$$V_4^1 = \frac{1}{Y_{44}}\left[\frac{P_4 - jQ_4}{V_4^{o*}} - Y_{41}V_1^o - Y_{42}V_2^1 - Y_{43}V_3^1 - Y_{45}V_5^0\right]$$

$$= \frac{1}{Y_{44}}\left[\frac{-0.4 + j0.1}{1.0 - j0.0} - \{(-0.39215 + j1.56862)\times 1.02\angle 0^o\}\right.$$

$$\left. - \{(-0.58823 + j2.35294)\times(0.98140\angle -3.0665^o)\}\right]$$

$$= \frac{0.45293 - j3.8366}{0.98038 - j3.92156} = 0.955715\angle -7.303^o \text{ pu} = 0.94796 - j0.12149$$

$$V_5^1 = \frac{1}{Y_{55}}\left[\frac{P_5 - jQ_5}{V_5^{o*}} - Y_{51}V_1^o - Y_{52}V_2^1 - Y_{53}V_3^1 - Y_{54}V_4^1\right]$$

$$= \frac{1}{Y_{55}}\left[\frac{-0.6 + j0.2}{1.0 - j0.0} - \{(-1.17647 + j4.70588)\times 1.02\angle 0^o\}\right.$$

$$\left. - \{(-1.17647 + j4.70588)\times 1.04\angle 3.077^o\}\right]$$

$$= 0.994618\angle -1.56^o = 0.994249 - j0.027$$

Thus at end of 1st iteration, we have,

$V_1 = 1.02\angle 0^0$ pu $\quad V_2 = 0.98140\ \angle -3.066^0$ pu

$V_3 = 1.04\angle 3.077^0$ pu $\quad V_4 = 0.955715\angle -7.303^0$ pu

and $\quad V_5 = 0.994618\angle -1.56^0$ pu

## Example-3:

Obtain the load flow solution at the end of first iteration of the system with data as given below. The solution is to be obtained for the following cases

(i) All buses except bus 1 are PQ Buses

(ii) Bus 2 is a PV bus whose voltage magnitude is specified as 1.04 pu

(iii) Bus 2 is PV bus, with voltage magnitude specified as 1.04 and 0.25_Q2_1.0 pu.

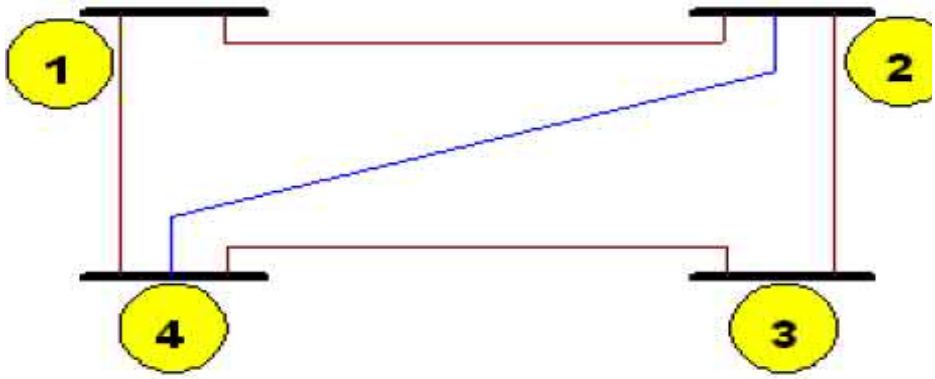



**Fig. System for Example 3**

**Table: Line data of example 3**

| SB | EB | R (pu) | X (pu) |
|---|---|---|---|
| 1 | 2 | 0.05 | 0.15 |
| 1 | 3 | 0.10 | 0.30 |
| 2 | 3 | 0.15 | 0.45 |
| 2 | 4 | 0.10 | 0.30 |
| 3 | 4 | 0.05 | 0.15 |

**Table: Bus data of example 3**

| Bus No. | $P_i$ (pu) | $Q_i$ (pu) | $V_i$ |
|---|---|---|---|
| 1 | – | – | $1.04 \angle 0^0$ |
| 2 | 0.5 | – 0.2 | – |
| 3 | – 1.0 | 0.5 | – |
| 4 | – 0.3 | – 0.1 | – |

**Solution**: Note that the data is directly in terms of injected powers at the buses. The bus admittance matrix is formed by inspection as under:

$Y_{BUS} =$

| | | | |
|---|---|---|---|
| 3.0 – j9.0 | –2.0 + j6.0 | – 1.0 + j3.0 | 0 |
| –2.0 + j6.0 | 3.666 – j11.0 | – 0.666 + j2.0 | – 1.0 + j3.0 |
| –1.0 + j3.0 | –0.666 + j2.0 | 3.666 – j11.0 | –2.0 + j6.0 |
| 0 | –1.0 + j3.0 | – 2.0 + j6.0 | 3.0 – j9.0 |

**Case(i): All buses except bus 1 are PQ Buses**

Assume all initial voltages to be $1.0 \angle 0^0$ pu.

$$V_2^1 = \frac{1}{Y_{22}} \left[ \frac{P_2 - jQ_2}{V_2^{o*}} - Y_{21} V_1^o - Y_{23} V_3^0 - Y_{24} V_4^0 \right]$$

$$= \frac{1}{Y_{22}}\left[\frac{0.5 + j0.2}{1.0 - j0.0} - \{(-2.0 + j6.0)\times(1.04\angle 0^{o})\}\right.$$

$$\left. - \{(-0.666 + j2.0)\times(1.0\angle 0^{o})\} - \{(-1.0 + j3.0)\times(1.0\angle 0^{0})\}\right]$$

$$= 1.02014\angle 2.605^{\circ}$$

$$V_3^1 = \frac{1}{Y_{33}}\left[\frac{P_3 - jQ_3}{V_3^{o*}} - Y_{31}V_1^{o} - Y_{32}V_2^{1} - Y_{34}V_4^{0}\right]$$

$$= \frac{1}{Y_{33}}\left[\frac{-1.0 - j0.5}{1.0 - j0.0} - \{(-1.0 + j3.0)\times(1.04\angle 0.0^{o})\}\right.$$

$$\left. - \{(-0.666 + j2.0)\times(1.02014\angle 2.605^{o})\} - \{(-2.0 + j6.0)\times(1.0\angle 0^{0})\}\right]$$

$$= 1.03108\angle -4.831^{\circ}$$

$$V_4^1 = \frac{1}{Y_{44}}\left[\frac{P_4 - jQ_4}{V_4^{o*}} - Y_{41}V_1^{o} - Y_{42}V_2^{1} - Y_{43}V_3^{1}\right]$$

$$= \frac{1}{Y_{44}}\left[\frac{0.3 + j0.1}{1.0 - j0.0} - \{(-1.0 + j3.0)\times(1.02014\angle 2.605^{o})\}\right.$$

$$\left. - \{(-2.0 + j6.0)\times(1.03108\angle -4.831^{o})\}\right]$$

$$= 1.02467\angle -0.51^{\circ}$$

Hence

$V_1^1 = 1.04\ \angle 0^0$ pu $\qquad V_2^1 = 1.02014\ \angle 2.605^0$ pu

$V_3^1 = 1.03108\ \angle -4.831^0$ pu $\qquad V_4^1 = 1.02467\angle -0.51^0$ pu

**Case(ii): Bus 2 is a PV bus whose voltage magnitude is specified as 1.04 pu**

We first compute $Q_2$.

$$Q_2 = |V_2|\left[|V_1|\left(G_{21}\sin\delta_{21} - B_{21}\cos\delta_{21}\right) + |V_2|\left(G_{22}\sin\delta_{22} - B_{22}\cos\delta_{22}\right)\right.$$
$$\left. + |V_3|\left(G_{23}\sin\delta_{23} - B_{23}\cos\delta_{23}\right) + |V_4|\left(G_{24}\sin\delta_{24} - B_{24}\cos\delta_{24}\right)\right]$$

$$= 1.04\,[1.04\,\{-6.0\} + 1.04\,\{11.0\} + 1.0\{-2.0\} + 1.0\,\{-3.0\} = 0.208 \text{ pu.}$$

$$V_2^1 = \frac{1}{Y_{22}}\left[\frac{0.5 - j0.208}{1.04\angle 0^0} - \left\{(-2.0 + j6.0)\times\left(1.04\angle 0^o\right)\right\}\right.$$
$$\left. - \left\{(-0.666 + j2.0)\times\left(1.0\angle 0^o\right)\right\} - \left\{(-1.0 + j3.0)\times\left(1.0\angle 0^0\right)\right\}\right]$$

$$= 1.051288 + \text{j}0.033883$$

The voltage magnitude is adjusted to 1.04. Hence $V_2^1 = 1.04\angle 1.846^0$

$$V_3^1 = \frac{1}{Y_{33}}\left[\frac{-1.0 - j0.5}{1.0\angle 0^0} - \left\{(-1.0 + j3.0)\times(1.04\angle 0.0^o)\right\}\right.$$
$$\left. - \left\{(-0.666 + j2.0)\times(1.04\angle 1.846^o)\right\} - \left\{(-2.0 + j6.0)\times\left(1.0\angle 0^0\right)\right\}\right]$$

$$= 1.035587\angle -4.951^{\text{o}} \text{ pu.}$$

$$V_4^1 = \frac{1}{Y_{44}}\left[\frac{0.3 + j0.1}{1.0 - j0.0} - \left\{(-1.0 + j3.0)\times\left(1.04\angle 1.846^o\right)\right\}\right.$$
$$\left. - \left\{(-2.0 + j6.0)\times(1.035587\angle -4.951^o)\right\}\right]$$

$$= 0.9985\angle -0.178^{\text{o}}$$

Hence at end of 1st iteration we have:

$V_1^1 = 1.04\ \angle 0^0$ pu  $V_2^1 = 1.04\ \angle 1.846^0$ pu

$V_3^1 = 1.035587\ \angle -4.951^0$ pu  $V_4^1 = 0.9985\angle -0.178^0$ pu

**Case (iii):** Bus 2 is PV bus, with voltage magnitude specified as 1.04 & $0.25 \leq Q_2 \leq 1$ pu. If $0.25 \leq Q_2 \leq 1.0$ pu then the computed value of $Q_2 = 0.208$ is less than the lower limit. Hence, $Q_2$ is set equal to 0.25 pu. Iterations are carried out with this value of $Q_2$. The voltage magnitude at bus 2 can no longer be maintained at 1.04. Hence, there is no necessity to adjust for the voltage magnitude. Proceeding as before we obtain at the end of first iteration,

$$V_1^1 = 1.04 \angle 0^0 \text{ pu} \qquad V_2^1 = 1.05645 \angle 1.849^0 \text{ pu}$$

$$V_3^1 = 1.038546 \angle -4.933^0 \text{ pu} \qquad V_4^1 = 1.081446 \angle 4.896^0 \text{ pu}$$

## Limitations of GS load flow analysis

GS method is very useful for very small systems. It is easily adoptable, it can be generalized and it is very efficient for systems having less number of buses. However, GS LFA fails to converge in systems with one or more of the features as under:

- Systems having large number of radial lines
- Systems with short and long lines terminating on the same bus
- Systems having negative values of transfer admittances
- Systems with heavily loaded lines, etc.

GS method successfully converges in the absence of the above problems. However, convergence also depends on various other set of factors such as: selection of slack bus, initial solution, acceleration factor, tolerance limit, level of accuracy of results needed, type and quality of computer/ software used, etc.

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## ATTENDANCE

Course Title with Code : Basic Electrical Engineering – BEE10

Semester & Section : 1st, E-Sa

| Sl. No. | USN | Student Name | Date | 01 | 02 | 06 | 07 | 08 | 13 | 15 | 16 | 20 | 20 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Month | 01 | 01 | 01 | 01 | 01 | 01 | 01 | 01 | 01 | 01 |
| | | | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| 01 | [illegible] | A.R. UJWAL GOWDA | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| 02 | [illegible] | ABUBAKER SIDDIQ | | 1 | 2 | 3 | 4 | 5 | 6 | A | 7 | 8 | 9 |
| 03 | [illegible] | AISHWARYA.N | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| 04 | [illegible] | AKASH.J | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| 05 | [illegible] | AMARN DAS | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | A | A | A |
| 06 | [illegible] | ANKUTHA ARUN | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| 07 | [illegible] | ARVIND.M.S | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| 08 | [illegible] | ASHISPRASAD.R | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| 09 | [illegible] | AYESHA SIDDIQUA | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| 10 | [illegible] | BAVITHA.N.K | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| 11 | [illegible] | CHETHANKUMAR.C.M | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | A | 8 | 9 |
| 12 | [illegible] | GANESH.K.M | | 1 | A | 2 | 3 | 4 | 5 | 6 | A | A | A |
| 13 | [illegible] | GARGEE.J | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | A | 8 | 9 |
| 14 | [illegible] | HANNA AFREEN | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | A | 8 | 9 |
| 15 | [illegible] | HARIPRASAD.C.S | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| 16 | [illegible] | JEEVAN.P | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | A | 9 | 10 |
| 17 | [illegible] | JEEVAN.P | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | A | 8 | 9 |
| 18 | [illegible] | KARTHIK.M | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| 19 | [illegible] | KASHIFA ZEHRA.V | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| 20 | [illegible] | KAVANA.J.C.R | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| 21 | [illegible] | LIKITH ABHISHEK.K | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| 22 | [illegible] | MAHADEV PRASAD.P.S | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | A | 8 | A |
| 23 | [illegible] | MANU.M | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| 24 | [illegible] | NASEERAH FATHIMA | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| 25 | [illegible] | MOHAMMED LABEEB | | 1 | K | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
| | No. of Abs. | | | | | | | | | | | | |
| | Initials | | | | | | | | | | | | |



| 21 | 22 | 23 | 27 | 28 | 03 | 03 | 04 | 05 | 10 | 11 |
|---|---|---|---|---|---|---|---|---|---|---|
| 01 | 01 | 01 | 01 | 01 | 01 | 01 | 02 | 02 | 02 | 02 |
| 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 |
| 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | A |
| 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 |
| 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 |
| 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 |
| A | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 |
| 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 |
| 11 | 12 | 13 | A | 14 | 15 | 16 | 17 | A | 18 | 19 |
| 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 |
| 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 |
| 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 |
| 10 | 11 | 12 | A | 13 | 14 | A | 15 | 16 | 17 | A |
| A | 7 | A | A | A | A | A | 8 | A | A | |
| 10 | 11 | 12 | 13 | A | A | A | 14 | 15 | 16 | A |
| 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 18 | A |
| 11 | 12 | 13 | A | A | 14 | 15 | 16 | 17 | 18 | 19 |
| 11 | 12 | 13 | A | A | A | A | A | 16 | 17 | 18 |
| 10 | 11 | 12 | A | 13 | A | 14 | A | 15 | 16 | A |
| 11 | 12 | 13 | 14 | 15 | 16 | 17 | A | 18 | 19 | 20 |
| 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 |
| 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 |
| 11 | 12 | 13 | A | 14 | 15 | 16 | 17 | 18 | 19 | 20 |
| 9 | 10 | 11 | A | 12 | 13 | 14 | 15 | 16 | 17 | 18 |
| 11 | A | 12 | 13 | 14 | 15 | 16 | 17 | 18 | A | 19 |
| 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 |
| 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 |
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## ASSESSMENT

| IA | Assignments / Internal Test Marks | | | | | | | | SEE Marks | Total Marks |
|---|---|---|---|---|---|---|---|---|---|---|
| | A1 | T1 | A2 | T2 | A3 | T3 | T4 | LM Marks | | |
| | | 37 | | 12 | | | | | | |
| | | 37 | | 23 | | | | | | |
| | | 41 | | 37 | | | | | | |
| | | 50 | | 42 | | | | | | |
| | | 28 | | 25 | | | | | | |
| | | 45 | | 37 | | | | | | |
| | | 44 | | 26 | | | | | | |
| | | 35 | | 21 | | | | | | |
| | | 33 | | 27 | | | | | | |
| | | 42 | | 33 | | | | | | |
| | | 22 | | 22 | | | | | | |
| | | 16 | | 15 | | | | | | |
| | | 18 | | 15 | | | | | | |
| | | 30 | | 23 | | | | | | |
| | | 36 | | 19 | | | | | | |
| | | 22 | | 08 | | | | | | |
| | | 15 | | 16 | | | | | | |
| | | 39 | | 35 | | | | | | |
| | | 46 | | 33 | | | | | | |
| | | 43 | | 49 | | | | | | |
| | | 25 | | 16 | | | | | | |
| | | 21 | | 07 | | | | | | |
| | | 40 | | 23 | | | | | | |
| | | 27 | | 38 | | | | | | |
| | | 46 | | 35 | | | | | | |
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ATME College of Engineering

## ATTENDANCE

Course Title with Code : E

Semester & Section : 1ST E-Sec

| Sl. No. | USN | Student Name | Date Month |
|---|---|---|---|
| 01 | 1CD19MCA061 | A.R. UJWAL GOWDA | |
| 02 | 1CD20MCA004 | ABUBAKER SIDDIQ | |
| 03 | 1CD20MCA041 | AISHWARYA.N | |
| 04 | 1CD20CI006 | AKASH.J | |
| 05 | 1CD20CI011 | AMAAN JAIN | |
| 06 | 1CD20MCA019 | ANURUPA ARUN | |
| 07 | 1CD20CI015 | ARVIND.MS | |
| 08 | 1CD20MCA006 | ASHISPRASAD.R | |
| 09 | 1CD20CI017 | AYESHA SIDDIQUA | |
| 10 | 1CD20CI018 | BAVITHA.N.K | |
| 11 | 1CD19CI192 | CHETHANKUMAR.C.M | |
| 12 | 1CD20CI019 | GANESH.K.M | |
| 13 | 1CD20MCA021 | GARGEE.J | |
| 14 | 1CD20MCA038 | HANIYA AFREEN | |
| 15 | 1CD20MCA026 | HARIPRASAD.C.S | |
| 16 | 1CD20MCA093 | JEEVAN.P | |
| 17 | 1CD20MCA023 | JEEVAN.P | |
| 18 | 1CD19MCA029 | KARTHIK.M | |
| 19 | 1CD19CI188 | KASHIFA ZEHRA.V | |
| 20 | 1CD20CI189 | KAVANA.K.R | |
| 21 | 1CD20MCA040 | LIKITH ABHISHEK.K | |
| 22 | 1CD20CI190 | MAHADEV PRASAD.P.S | |
| 23 | 1CD20MCA022 | MANU.M | |
| 24 | 1CD19CI195 | MASKEERAH FATHIMA | |
| 25 | 1CD19CI312 | MOHAMMED LABEEB | |
| | No. of Abs. | | |
| | Initials | | |







## ASSESSMENT

ATME College of Engineering

| ST | Assignments / Internal Test Marks | | | | | | | | SEE Marks | Total Marks |
|---|---|---|---|---|---|---|---|---|---|---|
| | A1 | T1 | A2 | T2 | A3 | T3 | T4 | DE marks | | |
| | | 37 | | 12 | | | | | | |
| | | 37 | | 27 | | | | | | |
| | | 42 | | 30 | | | | | | |
| | | 50 | | 42 | | | | | | |
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| | | 45 | | 37 | | | | | | |
| | | 44 | | 26 | | | | | | |
| | | 85 | | 21 | | | | | | |
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| | | 42 | | 33 | | | | | | |
| | | 22 | | 22 | | | | | | |
| | | 16 | | 15 | | | | | | |
| | | 12 | | 15 | | | | | | |
| | | 30 | | 23 | | | | | | |
| | | 36 | | 19 | | | | | | |
| | | 22 | | 08 | | | | | | |
| | | 15 | | 16 | | | | | | |
| | | 39 | | 35 | | | | | | |
| | | 46 | | 33 | | | | | | |
| | | 45 | | 49 | | | | | | |
| | | 25 | | AB | | | | | | |
| | | 21 | | 07 | | | | | | |
| | | 40 | | 23 | | | | | | |
| | | 37 | | 38 | | | | | | |
| | | 46 | | 35 | | | | | | |

ATME College of Engineering

## ATTENDANCE

Semester & Section: 1st E-Sec. Course Title with Code: Basic Electrical Engineering - 18ELE15

| Sl. No. | USN | Student Name | Date | 01 | 05 | 06 | 07 | 08 | 12 | 13 | 14 | 20 | 21 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Month | 01 | 01 | 01 | 01 | 01 | 01 | 01 | 01 | 01 | 01 |
| | | | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| 26 | 2020MVCS[illegible]021 | MOHAMMED SAFWAN | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | A | 8 | 9 |
| 27 | 2020CHCS[illegible]038 | MUZAMMIL HUSAIN NOOGRKAR SHANTINGERI | | 1 | 2 | 3 | 4 | A | A | 5 | 6 | 7 | 8 |
| 28 | 2020ECCS[illegible]045 | PANCHAMI C.H | | 1 | 2 | 3 | 4 | A | A | 5 | 6 | 7 | 8 |
| 29 | 2020MVCS[illegible]036 | PAVANKUMAR.D | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| 30 | 2020ECCS[illegible]052 | PAVAN. V | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| 31 | 2020CHCS[illegible]031 | POORVIK. R.M | | 1 | A | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
| 32 | 2020MVCS[illegible]112 | PRAJWAL | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| 33 | 2020CHCS[illegible]197 | RACHANA.S | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| 34 | 2020CHCS[illegible]203 | RANANTH.S.R | | 1 | 2 | A | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
| 35 | 2020MVCS[illegible]083 | SANJANA.V | | 1 | 2 | 3 | 4 | 5 | 6 | A | 7 | 8 | 9 |
| 36 | 2020CHCS[illegible]181 | SHAMANTH D ACHARYA | | 1 | A | 2 | 3 | 4 | 5 | 6 | A | 7 | 8 |
| 37 | 2020MVCS[illegible]067 | SHIVANI.K.K | | 1 | 2 | 3 | 4 | 5 | 6 | A | 7 | 8 | 9 |
| 38 | 2020ECCS[illegible]215 | VAISHNAVI.A | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| 39 | 2020CHCS[illegible]415 | WAZEERAHMED SANDENAWAR ATTAR | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | A | A |
| 40 | 2020MVCS[illegible]059 | VINEETH SHANOLLA N.J. | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| 41 | 2020MVCS[illegible]038 | YASHWANTH. M | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| 42 | 2020MECS[illegible]082 | YASHWANTH. N | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| 43 | 2020MVCS[illegible]015 | YASMEEN TBD | | 1 | A | A | A | 2 | 3 | 4 | 5 | 6 | 7 |
| 44 | 2020MVCS[illegible]054 | ZAYED KIRIYATULLAH MOHAMMED | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
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| | No. of Abs. | | | | | | | | | | | | |
| | Initials | | | | | | | | | | | | |



## ASSESSMENT

ATME College of Engineering

| 21 | 22 | 24 | 26 | 28 | 03 | 05 | 08 | 09 | 10 | 11 | | Assignments / Internal Test Marks | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 01 | 01 | 01 | 01 | 01 | 01 | 01 | 01 | 01 | 02 | 02 | | | | | | | | | | SEE Marks | Total Marks |
| 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | AT | A1 | T1 | A2 | T2 | A3 | T3 | T4 | CIE Marks | | |
| 10 | 11 | 12 | 13 | A | A | A | 14 | 15 | 16 | A | | | 16 | | 13 | | | | | | |
| 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | | | 11 | | 11 | | | | | | |
| 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | | | 17 | | 13 | | | | | | |
| 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | | | 20 | | 13 | | | | | | |
| 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | | | 23 | | 14 | | | | | | |
| 10 | 11 | 12 | A | 13 | 14 | A | 15 | 16 | 17 | 18 | | | 08 | | 25 | | | | | | |
| 10 | 11 | 12 | 13 | A | A | A | A | 14 | 15 | A | | | 11 | | 11 | | | | | | |
| 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | | | 36 | | 28 | | | | | | |
| 10 | 11 | 12 | 13 | 14 | 15 | A | 16 | A | A | A | | | 28 | | 18 | | | | | | |
| 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | | | 19 | | 06 | | | | | | |
| 9 | 10 | 11 | 12 | 13 | A | A | 14 | 15 | 16 | A | | | 34 | | 40 | | | | | | |
| 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | | | 43 | | 41 | | | | | | |
| 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | | | 40 | | 23 | | | | | | |
| A | 9 | 10 | 11 | 12 | 13 | 14 | 15 | A | A | 14 | | | 21 | | 09 | | | | | | |
| 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | | | 25 | | 18 | | | | | | |
| 11 | A | 12 | A | 13 | 14 | 15 | 16 | 17 | A | 18 | | | 32 | | 20 | | | | | | |
| 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | | | 43 | | 32 | | | | | | |
| 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | | | 45 | | 18 | | | | | | |
| 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | | | 29 | | 16 | | | | | | |
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ATME College of Engineering

## ATTENDANCE

Semester & Section: 4th E Sec

Course Title with Code: E

| Sl. No | USN | Student Name | Date / Mon |
|---|---|---|---|
| 26 | | MOHAMMED GOWSHIN | |
| 27 | | MOUZAMMIL HUSAIN PUDUGAKAR SHANTAGI | |
| 28 | | PANCHAMI C M | |
| 29 | | PRVANKUMAR. D | |
| 30 | | PRURI V | |
| 31 | | POORVIK. R.M | |
| 32 | | PRADHAL | |
| 33 | | RACHANA. B | |
| 34 | | ROHANTH S.R | |
| 35 | | SANDANA. V | |
| 36 | | SHAMANTH D ROHARA | |
| 37 | | SHIVANI. K.K | |
| 38 | | VRISHNAVI. A | |
| 39 | | UBEERAHMED DANDENAWAR ATD | |
| 40 | | VINEETH SHANDILYA M.J. | |
| 41 | | YASHWANTH. M | |
| 42 | | YASHWANTH. N | |
| 43 | | YASMEEN TAJ | |
| 44 | | ZAHEDKIFAYATULLAH PHRMM | |
| | | No. of Abs. | |
| | | Initials | |



## ASSESSMENT

ATME College of Engineering

| AT | Assignments / Internal Test Marks: A1 | T1 | A2 | T2 | A3 | T3 | T4 | IDC Marks | SEE Marks | Total Marks |
|---|---|---|---|---|---|---|---|---|---|---|
| | | 16 | | 13 | | | | | | |
| | | 41 | | 41 | | | | | | |
| | | 41 | | 43 | | | | | | |
| | | 39 | | 83 | | | | | | |
| | | 23 | | 14 | | | | | | |
| | | 08 | | 25 | | | | | | |
| | | 11 | | 11 | | | | | | |
| | | 36 | | 28 | | | | | | |
| | | 28 | | 45 | | | | | | |
| | | 19 | | 06 | | | | | | |
| | | 36 | | 40 | | | | | | |
| | | 45 | | 41 | | | | | | |
| | | 40 | | 23 | | | | | | |
| | | 24 | | 09 | | | | | | |
| | | 25 | | 16 | | | | | | |
| | | 09 | | 20 | | | | | | |
| | | 43 | | 28 | | | | | | |
| | | 42 | | 18 | | | | | | |
| | | 29 | | 16 | | | | | | |

## Department of Electrical and Electronics Engineering

Ref No: ATME/EEE/AY-2020-21/18

5th August 2021

To

The Principal
ATMECE

Subject: TLP for the month of August -2021

The Action Plan for this month is as given below. Both the evaluation activities of regular courses and remedial classes for the backlog courses are scheduled. Owing to the following activities, it may not be practically possible to continue with the online classes. The regular courses that demand classes will be conducted on 5th and 7th of August 2021 for IV semester and 4th and 6th of August 2021for VI semester.

| Semester | Date | Scheduled Activities | Other Activities |
|---|---|---|---|
| II | 4th August 2021 to 7th August 2021 | 18ELEL17- BEE Lab SEE conduction | Evaluation of IA-2, NBA documentation, NAAC documentation, Counselling-3, Tele calling for admission process |
| IV | | Lab Internal Test conduction | |
| VI | | | |
| IV | 9th August 2021 to 11th August 2021 | IA-3 conduction | NBA documentation, NAAC documentation, Counselling-3, Tele calling for admission process |
| VI | | | |
| VIII | 7th August 2021 & 9th August 2021 | Internship SEE | |
| | 10th August 2021 & 11th August 2021 | Project Phase- II SEE | |
| IV | 12th August 2021 to 19th August 2021 | Conduction of offline remedial classes for backlog students | IA3- Evaluation, NBA documentation, NAAC documentation, Tele calling for admission process |
| VI | | | |



ATME COLLEGE OF ENGINEERING
13th Kilometer, Mysore-Kanakapura-Bangalore Road, Mysore – 570 028 P : 0821-2593335 F: 0821-2593328
Email: info@atme.in, Web : www.atme.in

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## Department of Electrical and Electronics Engineering

**Offline remedial class time table:**

| Day | Semester | 10:00-11:00 | 11:15-12:15 | 12:15-1:15 | 2:00 to 3:00 | 3:00 to 4:00 |
|---|---|---|---|---|---|---|
| 12.8.21 Thursday | III | 18EE34-KRS | 18EE32-LK | 18EE32-LK | 18EE33-MS | 18EE33-MS |
| | V | 18EE52-SSR | 18EE52-SSR | 18EE54-SH | 18EE55-HoD | 18EE55-HoD |
| 13.8.21 Friday | III | 18EE32-LK | 18EE33-MS | 18EE33-MS | 18EE34-KRS | 18EE34-KRS |
| | V | 18EE54-SH | 18EE52-SSR | 18EE52-VK | 18EE55-HoD | 18EE55-HoD |
| 14.8.21 Saturday | III | 18EE32-VK | 18EE33-MS | 18EE33-MS | 18EE34-KRS | 18EE34-KRS |
| | V | 18EE52-SSR | 18EE54-SH | 18EE54-SH | 18EE55-HoD | 18EE55-HoD |
| 16.8.21 Monday | III | 18EE33-MS | 18EE32-VK | 18EE34-KRS | 18MAT31 | 18MAT31 |
| | V | 18EE54-SH | 18EE52-SSR | 18EE54-SH | 18EE55-HoD | |
| 17.8.21 Tuesday | III | 18EE32-LK | 18EE34-KRS | 18EE32-VK | 18MAT31 | 18MAT31 |
| | V | 18EE52-VK | 18EE54-SH | 18EE54-SH | 18EE55-HoD | |
| 18.8.21 Wednesday | III | 18EE32-LK | 18EE33-MS | 18EE34-KRS | 18MAT31 | 18MAT31 |
| | V | 18EE52-VK | 18EE52-VK | 18EE54-SH | 18EE55-HoD | |
| 19.8.21 Thursday | III | 18EE33-MS | 18EE34-KRS | 18EE32-VK | 18MAT31 | 18MAT31 |
| | V | 18EE52-VK | 18EE54-SH | | 18EE55-HoD | |

| III semester | | | |
|---|---|---|---|
| **Course Code** | **Course Title** | **Faculty** | **Hours** |
| 18EE32 | Electric Circuit Analysis | Mrs Lakshmi K | 5 |
| | | Mr Vinod Kumar P | 4 |
| 18EE33 | Transformers and Generators | Maria Sushma S | 9 |
| 18EE34 | Analog Electronic Circuits | Dr. Sathish K R | 9 |
| **V semester** | | | |
| 18EE52 | Microcontrollers | Mr Shreeshayana R | 5 |
| | | Mr Vinod Kumar P | 5 |
| 18EE54 | Signals And Systems | Ms. Swapna H | 10 |
| 18EE55 | Electrical Machine Design | Dr. Parthasarathy L | 10 |

Thanks and Regards

Approved
for ATME College of Engineering
05/8/21
Dean Academics

05.8.21
HoD

Dr. PARTHASARATHY L
Professor and HoD
Dept. of Electrical & Electronics Engineering
ATME College of Engineering, Mysuru



ATME COLLEGE OF ENGINEERING
13th Kilometer, Mysore-Kanakapura-Bangalore Road, Mysore – 570 028 P : 0821-2593335 F: 0821-2593328
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A T M E
College of Engineering

| | |
|---|---|
| **Semester** | **3** |
| **Department** | **EEE** |

**Regular Exam held during Feb/Mar 2021 (ARV)**

| SL | Course name with code | Name of the faculty handled | No. of students appeared | No. of students passed | No. of fails | Pass % |
|---|---|---|---|---|---|---|
| 1 | **Transform Calculus, Fourier Series and Numerical Techniques - 18MAT31** | Mrs. Divya K (A) & Dr. Madhusudhan V (B) | **54** | 30 | 24 | **56** |
| 2 | **Electric Circuit Analysis-18EE32** | Mrs. Lakshmi K (A & B) | **54** | 32 | 22 | **59** |
| 3 | **Transformers and Generators- 18EE33** | Maria Sushma S (A & B) | **54** | 22 | 32 | **41** |
| 4 | **Analog Electronic Circuits-18EE34** | Mr. Rajesh K S (A & B) | **54** | 40 | 14 | **74** |
| 5 | **Digital System Design - 18EE35** | Ms. Swapna H (A & B) | **54** | 42 | 12 | **78** |
| 6 | **Electrical and Electronics Measurements -18EE36** | Dr. Sathish K R (A) Mr. Rajesh K S(B) | **54** | 49 | 5 | **91** |
| 7 | **Additional Mathematics - I -18MATDIP31** | Mrs. Bhanupriya | **31** | 15 | 16 | **48** |

## Arrear Exam held during Aug/Sep 2021

| SL | Course name with code | Name of the faculty engaged special class | No of students appeared (Failed during regular exam) | No. of students passed | No. of fails | Pass % | Overall Pass % |
|---|---|---|---|---|---|---|---|
| 1 | **Electric Circuit Analysis- 18EE32** | Mrs. Lakshmi K & Mr. Vinod Kumar P | **20** | **10** | **10** | **50** | **78** |
| 2 | **Transformers and Generators- 18EE33** | Maria Sushma S | **27** | **20** | **7** | **75** | **78** |
| 3 | **Analog Electronic Circuits- 18EE34** | Dr. Sathish K R | **10** | **4** | **6** | **40** | **82** |

Dr. PARTHASARATHY L.
Professor and HOD

A T M E
College of Engineering

| | |
|---|---|
| **Semester** | **5** |
| **Department** | **EEE** |

**Regular Exam held during Feb/Mar 2021 (ARV)**

| SL | Course name with code | Name of the faculty handled | No. of students appeared | No. of students passed | No. of fails | Pass % |
|---|---|---|---|---|---|---|
| 1 | Management and Entrepreneurship- 18EE51 | Mr. Vinod Kumar P | 57 | 56 | **1** | **98** |
| 2 | Microcontroller - 18EE52 | Mr. Shreeshayana R | 57 | 40 | **17** | **70** |
| 3 | Power Electronics - 18EE53 | Mr. Sathish K R | 57 | 53 | **4** | **93** |
| 4 | Signals and Systems - 18EE54 | Ms. Swapna H | 56 | 23 | **33** | **41** |
| 5 | Electrical Machine Design-18EE55 | Dr. Parthasarathy L | 57 | 47 | **10** | **82** |
| 6 | High Voltage Engineering-18EE56 | Mr. Praveen Kumar M | 57 | 47 | **10** | **82** |

**Arrear Exam held during Aug/Sep 2021**

| SL | Course name with code | Name of the faculty engaged special class | No of students appeared (Failed during regular exam) | No. of students passed | No. of fails | Pass % | Overall Pass % |
|---|---|---|---|---|---|---|---|
| 1 | Microcontroller - 18EE52 | Mr. Vinod Kumar P Mr. Shreeshayana R | **14** | **4** | **10** | **29** | **77** |
| 2 | Signals and Systems - 18EE54 | Ms. Swapna H | **29** | **20** | **9** | **69** | **77** |
| 3 | Electrical Machine Design- 18EE55 | Dr. Parthasarathy L | **7** | **5** | **2** | **71** | **91** |

Dr. PARTHASARATHY L.
Professor and HOD
Dept. of Electrical & Electronics Engineering
Mysuru

# Model Question Paper-I with effect from 2018-19

USN | | | | | | | | | | |  **15EE71**

## Seventh Semester B.E.(CBCS) Examination
## Power System Analysis 2

(Core subject, E&EE)

Time: 3 Hrs  Max.Marks: 80

**Note: Answer any FIVE full questions, choosing at least ONE question from each module.**

**Module-1**

**1. (a)** Define following terms with an example oriented graph, tree & co-tree. **(06 Marks)**

**(b)** .Determine the bus admittance matrix using the singular transformations for the Sample power system with the line data shown in table below. 0 as reference **(05 Marks)**

| Line No. | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|
| Bus-code p-q | 0 -1 | 1 -2 | 2 -3 | 3 - 0 | 2 - 0 |
| Impedance pu) | 0.8 | 0.5 | 0.4 | 0.5 | 0.25 |

**(c)** Derive the algorithm for formation of Ybus by assuming mutually coupling between transmission lines **(5 Marks)**

**OR**

**2. (a)** What is load flow analysis? What are different types of buses considered during power system load flow? Discuss significance of slack bus in load flow studies. **(06 Marks)**

**(b)** In the power system shown in fig line 1-2 has the series impedance of 0.04+j0.12 pu with negligible line charging. The generation and load data is given in the table.

| Bus No. | Type | Generation (pu) | | Load (pu) | |
|---|---|---|---|---|---|
| | | Real | Reactive | Real | Reactive |
| 1 | Slack | - | - | - | - |
| 2 | PV | 0.3 | - | 0.6 | 0.2 |




**Fig (2b)**

The slack bus voltage is 1+j0.The voltage magnitude at bus is to be maintained at 1.05 pu and the generator at this bus has Q-Generation limits between 0 and 0.5pu.With 1+j0 pu initial voltages at bus 2.determine its voltage at the end of first iteration ,using the gauss seidel load flow model **(06 Marks)**

**c)** What is primitive Network ? Explain its significance **(04 Marks)**

## Module-2

**3.** **(a)** Compare Gauss Seidel and Newton -Raphson method of load flow analysis **(04Marks)**

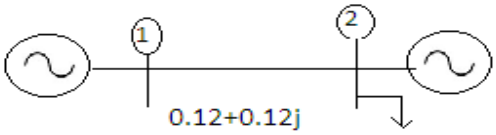
**(b)** Draw flow chart of load flow analysis using Newton –Raphson's method in polar co-ordinate. **(7marks)**

**(c)** Explain any two method of voltage control in power system **(05Marks)**

**OR**

**4.** **(a)**Deduce fast decoupled load flow model clearly stating all the assumptions made. **(08 Marks)**

(b) In a two bus system shown in fig Q4(b).The bus1 is slack bus with V=1 pu and bus 2is a load bus with P=100MW,Q=50MVAr.The line impedance is (0.12+0.12j)pu on a bus of 100MVA.Using Newton Raphson load flow method compute $|V_2|$ and $\delta_2$ upto one iteration




## Module-3

**5.** **(a)** Write down the transmission loss formula .Obtain the losses co-efficient formula for a system consisting of two Generating plants for Supplying several loads through a transmission line network **(08 Marks)**

**(b)**Briefly explain the two state generator model.With usual notatation derive the expression for availability and unavalibility in terms of failure and repair rate. **(08 Marks)**

**OR**

**6.** **(a)** State unit commitment problem .In brief explain dynamic programming method. **(06 Marks)**

**(b)** .Incremental fuel cost in rupees per MWh for the plant consisting of two units are

$$\frac{dC_1}{PG_1} = 0.20PG_1 + 40.0 \qquad \frac{dC_2}{PG_2} = 0.25PG_2 + 30.0$$

Assume both units are operating at all the times ,and total load varies room 40 MW to 250 MW and the maximum and minimum loads on each unit are to be 125 and 20 MW respectively .How will the load shared between two units as the system load varies the full range? What are the corresponding values of the plant incremental costs?Also find the saving of fuel of cost in r/hr for the optimal scheduling of a total load of 130MW as compared to equal distribution of the same load between the two points **(10 Marks)**

## Module-4

**7. (a)**Explain the problem formulation and solution procedure of optimal scheduling for hydrothermal plants **(09 Marks)**

**(b)**Define reliability.brifiely explain the modes of failure in power system reliability. **(07 Marks)**

**OR**

**8. (a)** Obtain an expression for i)steady state reliability R& Q ii)General reliability index R(t) **(06 Marks)**

**(b)**Define energy management system & Explain the three major function that are carried out in an energy control center of power system security **(06 Marks)**

**(c)**In brief explain indirect approach of contingency analysis **(04 Marks)**

## Module-5

**9. (a)** Explain the point by point method of solving the swing equation **(08 Marks)**

**(b)**Obtain the generalized algorithmic expression for bus impedance matrix elements when a link is added to the partial network. Also discuss the special cases **(08 Marks)**

**OR**

**10. (a)** For the network graph shown in fig (b) , determine $[Z_{BUS}]$, with node 1 as reference, using building algorithim.Neglect mutual coupling. Self impedance of elements are marked on the diagram .Add elements in the order specified.

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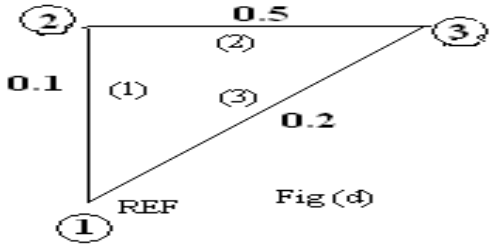


Fig (d)

**(08 Marks)**

(**b)**Illustrate clearly the steps involved solving swing equation using Runge -Kutta method for transient analysis **(08 Marks)**

Consider three bus system .each of three lines has series impedance of 0.02+0.08j pu and a total shunt impedance of 0.02jpu.The specified quantities at the buses are tabulated below

| Bus | Real Load Demand | Reactive Load demand | Real power generation $P_G$ | Reactive power generation $Q_G$ | Volatage specification |
|---|---|---|---|---|---|
| 1 | 2 | 1 | - | - | V1=1.04+j0 |
| 2 | 0 | 0 | 0.5 | 1 | 1+j0 |
| 3 | 1.5 | 0.6 | 0 | ? | V3=1.04 |

**Subject: Power System Analysis – 2** **Subject Code: 15EE71**

## Model Question Paper

<table>
<tr><th>Q. No.</th><th>Question</th><th>Marks</th></tr>
<tr><td>1. a</td><td>Define a primitive network. Formulate $Y_{Bus}$ by singular transformation method.</td><td>8</td></tr>
<tr><td>b.</td><td>In the power system shown in Fig. Q1(b), line 1-2 has the series impedance of (0.04+j0.12) pu with negligible line charging. The generation and load data is given in the table.
<table>
<tr><td>Bus No.</td><td>Type</td><td colspan="2">Generation (pu)</td><td colspan="2">Load (pu)</td></tr>
<tr><td>1</td><td>Slack</td><td>-</td><td>-</td><td>-</td><td>-</td></tr>
<tr><td>2</td><td>PV</td><td>0.3</td><td>-</td><td>0.6</td><td>0.2</td></tr>
</table>
The slack bus voltage is (1+j0). The voltage magnitude at bus 2 is to be maintained at 1.05 pu and the generator at this bus has Q-generation limits between 0 and 0.5 pu. With (1+ j0) pu initial voltage at bus 2, determine its voltage at the end of first iteration, using GS load flow model.

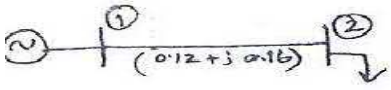
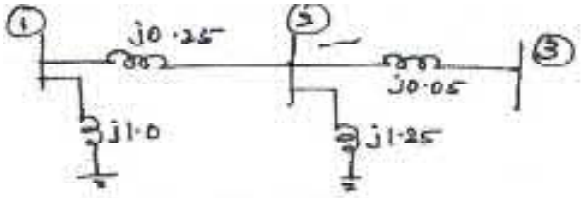

Fig. Q1(b)</td><td>8</td></tr>
<tr><td colspan="3">Or</td></tr>
<tr><td>2. a.</td><td>Develop the Gauss-Seidel load flow model for a power system with a slack bus and (n-1) number of PQ buses. Write the flow chart of the algorithm.</td><td>8</td></tr>
<tr><td>b.</td><td>Determine $Y_{Bus}$ by singular transformation for the system with data as below:
<table>
<tr><td>Element No.</td><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td></tr>
<tr><td>Bus Code p-q</td><td>0-1</td><td>0-2</td><td>2-3</td><td>3-0</td><td>2-0</td></tr>
<tr><td>Self-admittance in pu</td><td>1.4</td><td>1.6</td><td>2.4</td><td>2.0</td><td>1.8</td></tr>
</table></td><td>8</td></tr>
<tr><td>3.a</td><td>Derive expressions for diagonal elements of NR jacobian submatrices in polar form.</td><td>8</td></tr>
<tr><td>b.</td><td>In a two bus system shown in Fig. Q3(b), bus 1 is slack bus with $V_1=1.0\angle 0$ pu and bus 2 is a load bus with P = 100 MW, Q = 50 MVar. The line impedance is (0.12+j0.16) pu on a base of 100 MVA. Using NR load flow method compute $|V_2|$ and $\delta_2$ after one iteration.


Fig. Q3(b)</td><td>8</td></tr>
<tr><td colspan="3">Or</td></tr>
<tr><td>4.a</td><td>Explain the algorithm with fast decoupled load flow analysis, clearly stating all the assumptions mad.</td><td>8</td></tr>
<tr><td>b.</td><td>Explain how the voltage profile is controlled in an interconnected power system (i) by adjusting generator excitation, (ii) by VAR generators</td><td>8</td></tr>
<tr><td>5.a.</td><td>Draw and explain the following:<br>i) Input-Output curve<br>ii) Cost Curve</td><td>8</td></tr>
</table>

| | | |
|---|---|---|
| | iii) Incremental cost curve<br>iv) Heat rate curve | |
| b. | The incremental fuel costs in Rs/MWh for a plant consisting of two units are<br>$\frac{dF_1}{dP_{G1}} = 0.1P_{G1} + 20, \frac{dF_2}{dP_{G2}} = 0.12P_{G2} + 15.$<br>Assume that both units are operating at all times.<br>Determine<br>i) The most economical division of load between the generators for a constant load of 300 MW.<br>ii) The saving in Rs./ day obtained compared to equal load sharing between the | 8 |
| | Or | |
| 6.a. | Derive the coordination equations for economic load dispatch in a thermal power system with the consideration of transmission losses. | 8 |
| b. | Describe dynamic programming method for computation of optimal Unit Commitment. | 8 |
| 7.a | Write a flow chart for the optimal load flow solution. | 8 |
| b. | Explain the state space method used for power system reliability evaluation. Explain Loss Of Load Probability (LOLP) | 8 |
| | Or | |
| 8.a. | Discuss the optimal scheduling of hydrothermal system. | 8 |
| b. | Explain power system security assessment and modelling for contingency analysis | 8 |
| 9.a. | Derive the generalized algorithm for finding the elements of bus impedance matrix when a link is added. | 8 |
| b. | Discuss the steps for determining multimachine stability. | 8 |
| | Or | |
| 10.a. | Explain point by point method of solving swing equation. | 8 |
| b. | Form the $Z_{Bus}$ for the power system shown in Fig. Q10 (b) using $Z_{Bus}$ building algorithm. Select ground node as reference. The line reactances are in pu.<br>  | 8 |

Dr. R V Parimala
Prof. &HoD, Dept. of EEE
BNMIT, Bengaluru

## Department of Electrical and Electronics Engineering

# List of Year Long Activities planned under Decennial Banner

| SL. No. | Month Planned | Event | Target Audience | Coordinators | Remarks |
|---|---|---|---|---|---|
| ODD SEMESTER 2020-2021 | | | | | |
| 1 | 21.10.2020 & 23.10.2020 | Webinar Series under IEEE | III & V Semester students | Mr. Vinod Kumar P<br>Mr. Shreeshayana R<br>Mrs. Lakshmi K | **Completed** |
| 2 | 7th November | National Cancer Awareness day | Faculty and students | Mrs. Pooja M<br>Ms. Swapna H | **Completed** |
| 3 | December | "Virtual Technical Fest: Avagamah" Hackathon and Innovative Idea Submission Challenge | In House & outside student participants | Mr. Raghavendra L<br>Mr. Praveen Kumar M<br>Mr. Vinod Kumar P<br>Mr. Shreeshayana R<br>Mrs. Pooja M<br>Mr.Rajesh K S | **Completed** |
| 4 | December | Workshop on App development | V Semester | Mr. Vinod Kumar P<br>Mr. Shreeshayana R | **Completed** |
| 5 | December | Workshop on Tool usage | III Semester | Mrs. Lakshmi K<br>Mr. Sathish K R | **Completed** |
| 6 | December | World science day for peace and development | All Department students | Mrs. Pooja M<br>Ms. Swapna H | **Completed** |
| EVEN SEMESTER 2020-2021 | | | | | |
| 7 | April 2021 | Industry Visit | VIII semester | Mr. Praveen Kumar M<br>Mrs. Maria Sushma S | Due to Covid 19 pandemic, Students are not allowed to enter the industries. |
| 8 | May 2021 | Technical Talk | IV semester | Mrs. Lakshmi K<br>Mrs. Maria Sushma S<br>Mr. Mohan M | Postponed from March to May due to late commencement of Even semester |
| 9 | May 2021 | Entrepreneur Talk | VI and VIII semester | Mr. Praveen Kumar M<br>Mr. Sathish K R | Postponed from December/January to May due to VTU Examination |
| 10 | May 2021 | Armed force Flag Day | All Department students | Mr. Sathish K R<br>Mrs. Lakshmi K | Postponed from December to June due to offline class |
| 11 | June 2021 | National Level FDP | In-House and Outside Faculty Members | Mr. Raghavendra L<br>Mr. Sathish K R<br>Mr. Mohan M | Postponed from Feb to June due to late commencement of Even semester |
| 12 | June 2021 | Technical Talk | VI semester | Dr. Shakunthala C<br>Ms. Swapna H | Postponed from March to June due to late commencement of Even semester |

# Department of Electrical and Electronics Engineering

| SL. No. | Month Planned | Event | Target Audience | Coordinators | Remarks |
|---|---|---|---|---|---|
| 13 | June 2021 | State Level Quiz Competition | All students & outside Participants | Dr.Shakunthala C<br>Mrs. Maria Sushma S | Postponed from April to June due to late commencement of Even semester |
| 14 | **June 2021** | Workshop on C programming & puzzle | VIII Semester | Mr. Praveen Kumar M<br>Mr. Kiran B | Postponed from December to June due to offline class |
| 15 | June 2021 | Environment day | Faculty and Students | Mr. Mohan M<br>Mr. Yasin Shareif<br>Mr. Kushal R<br>Mr. Channabasava N<br>Mr. Sunil Kumar L<br>Mr. Somashekara M | Will be conducted |
| 16 | July 2021 | Project competition-Final year & Hobby projects | All students & outside participants | Dr. Shakunthala C<br>Mr.Raghavendra L<br>Mr.Praveen Kumar M<br>Mr.Vinod Kumar P<br>Mr. Shreeshayana R | Will be conducted |

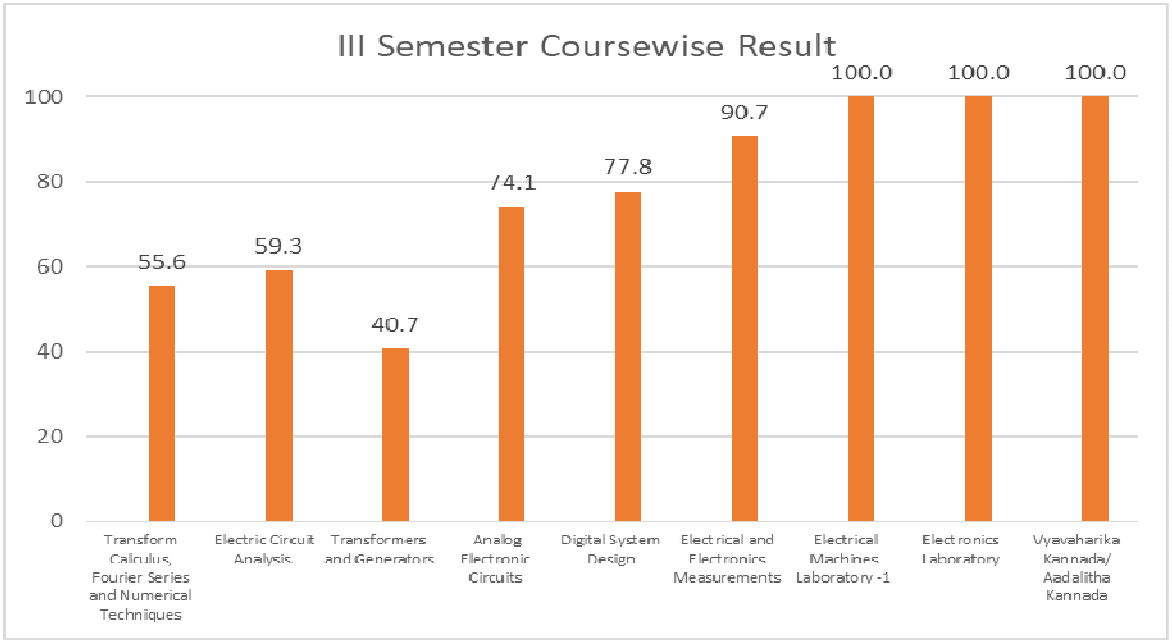
Dr. PARTHASARATHY L.
Professor and HOD

# Department of Electrical and Electronics Engineering

## Result Analysis of Odd Semester- Academic Year- 2020-21

| Class | No. of Students | No. of Pass | FCD | FC | SC | Pass % |
|---|---|---|---|---|---|---|
| **3rd semester** | | | | | | |
| **Regular** | **23** | **5** | **5** | **0** | **0** | **22** |
| **Lateral** | **31** | **7** | **1** | **5** | **1** | **23** |
| **Overall** | **54** | **12** | **6** | **5** | **1** | **22** |
| **5th semester** | **57** | **22** | **14** | **9** | **0** | **39** |
| **7th semester** | **48** | **45** | **37** | **8** | **0** | **94** |

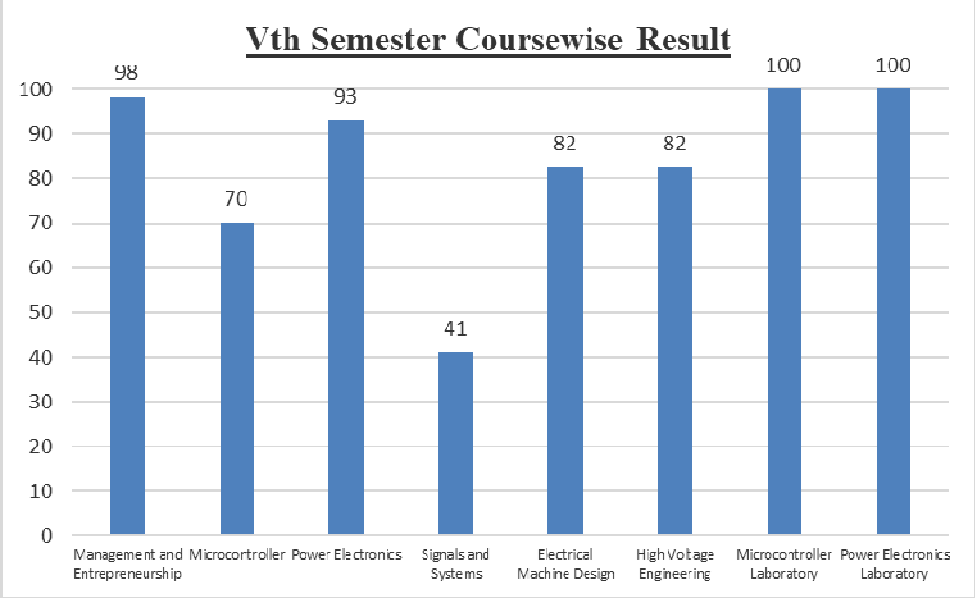
### 3rd Semester Course wise result



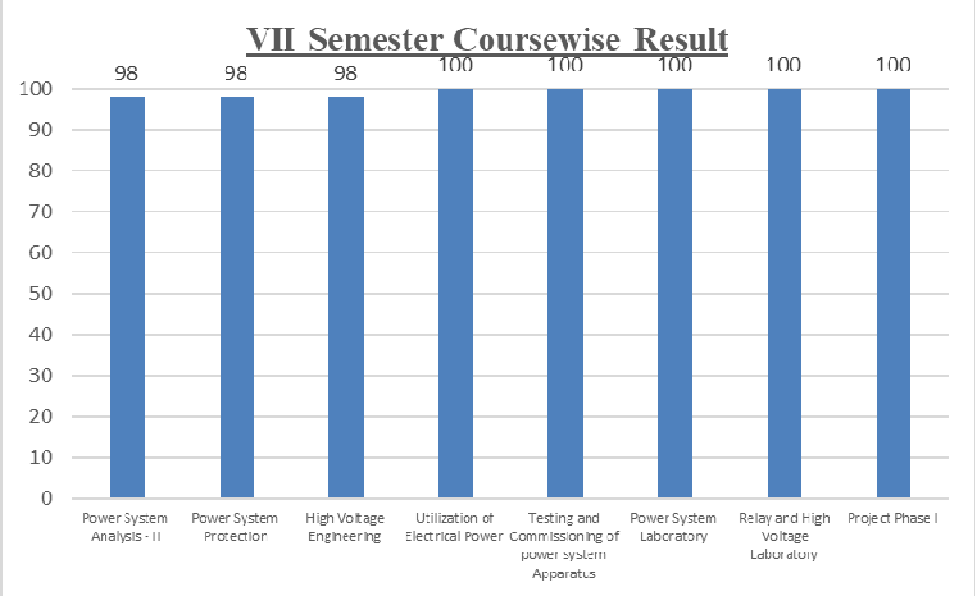

Result Analysis Coordinator HoD

## Department of Electrical and Electronics Engineering

**5th Semester Course-wise Result**




7th Semester Course-wise Result



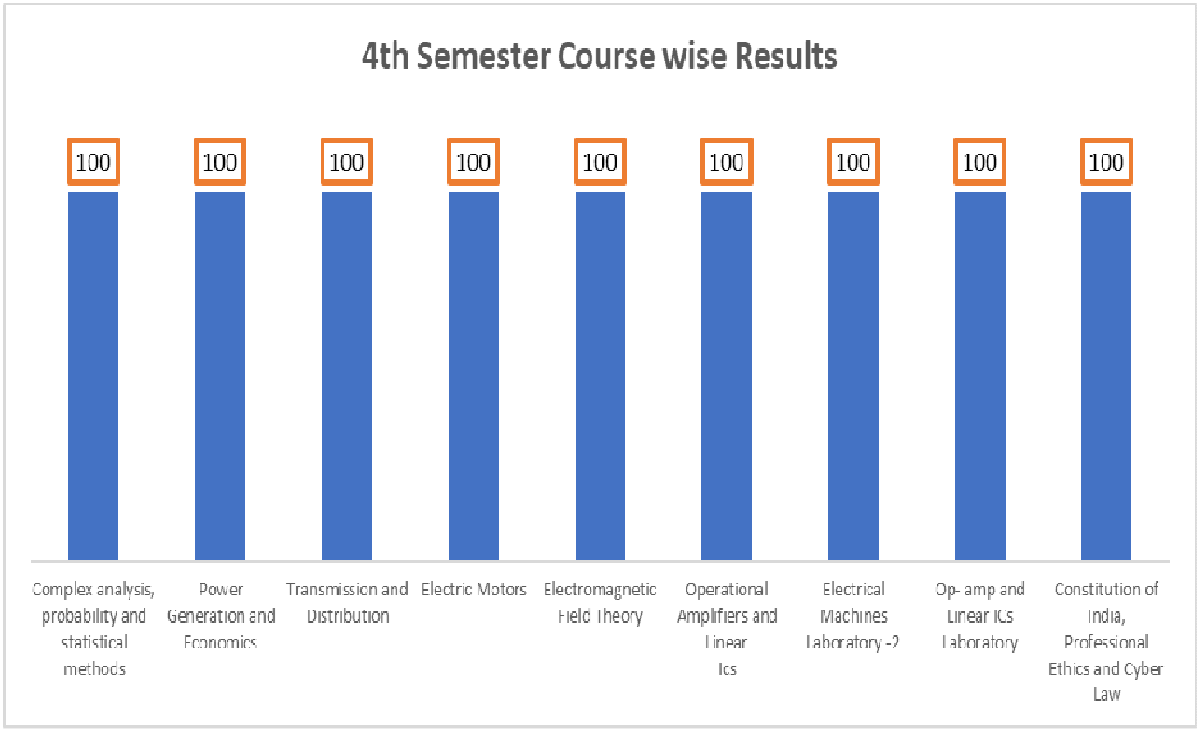

Result Analysis Coordinator HoD

# Department of Electrical and Electronics Engineering

## Result Analysis of Even Semester- Academic Year- 2020-21

| | No. of Students | No. of Pass | FCD | FC | SC | Pass % |
|---|---|---|---|---|---|---|
| **4th semester** | | | | | | |
| **Regular** | **23** | 23 | 9 | 10 | 4 | 100 |
| **Lateral** | **31** | 31 | 6 | 22 | 3 | 100 |
| **Overall** | **54** | 54 | 15 | 32 | 7 | 100 |
| **6th semester** | **57** | 57 | 30 | 23 | 4 | 100 |
| **8th semester** | **48** | 47 | 47 | 0 | 0 | 98 |

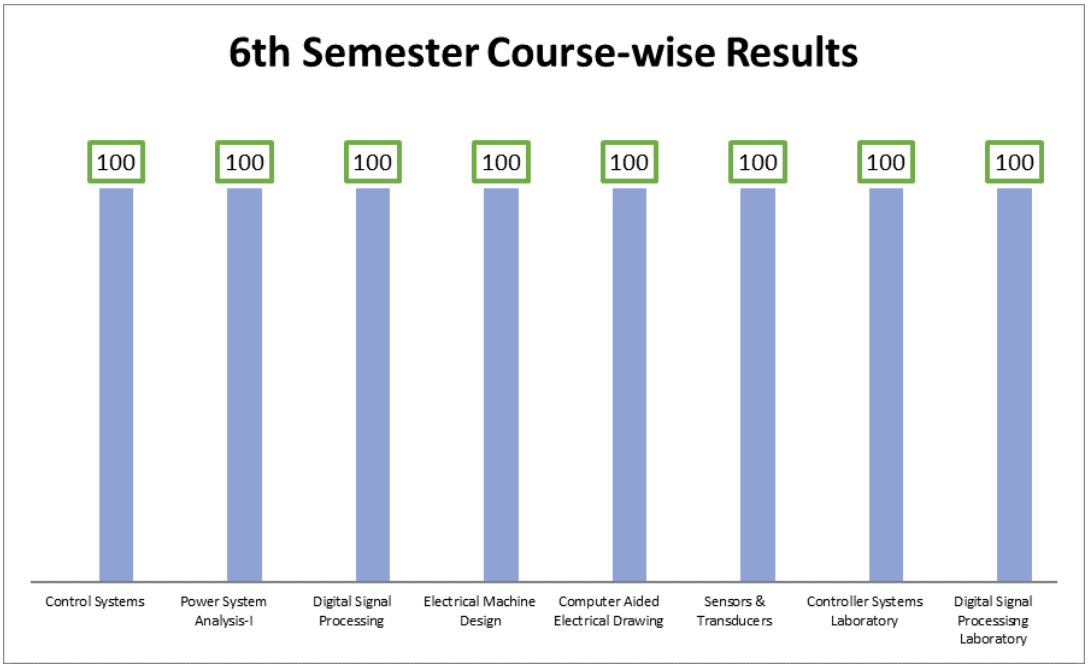
**4th Semester Course wise result**



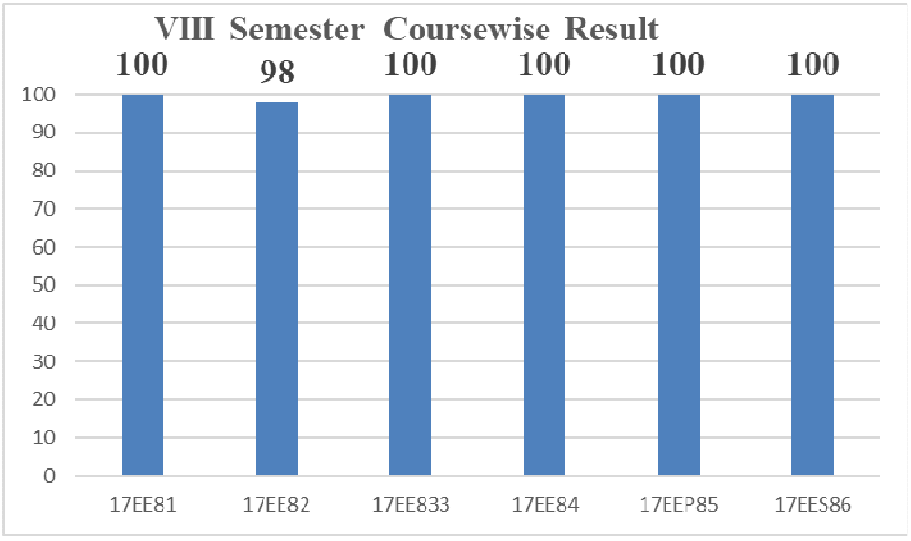

Result Analysis Coordinator HoD

## Department of Electrical and Electronics Engineering

### 6th Semester Course-wise Results




### 8th Semester Course-wise Results




Result Analysis Coordinator HoD

ATME College of Engineering

## WORK DONE DIARY

| | | WEEK 1 | MONDAY DATE 22/1 | TUESDAY DATE 23/1 | WEDNESDAY DATE 24/1 |
|---|---|---|---|---|---|
| ACTIVITY | Class Hours | | Availed CL | | |
| | Others | | | EMS - Online monitoring of the 3rd sem students (Morning & Afternoon batches) | EMS - Online monitoring of the 3rd sem students (Morning & Afternoon batches). |
| | | WEEK 2 | MONDAY DATE 29/1 | TUESDAY DATE 30/1 | WEDNESDAY DATE 31/1 |
| ACTIVITY | Class Hours | | | IEEE32 - B. Lecture (2 class) Scheme & Syllabus. Module 3a - Relevant charts. Resonance, Resonance in applications, Q factor of series circuit, Derivation of relevant expressions, Derivation of bandwidth of series circuit, Derivation of relationship between cut-off frequencies, Problems. IEEE-37 - EMI lab - Experiment | IEEE32 - ECA - Lecture Module 3a - Relevant charts Derivation of frequency at max voltage, Half power frequencies, Bandwidth, Derivation to obtain relationship, Q in terms of cut-off frequencies & half power frequencies. |
| | Others | | | 3rd sem lab batches & their batches formation. Formation of Whatsapp groups, mobile & class leaders list given to CET Cmte, Diploma & EMCC | Preparation of the time table, verification - updated the old time table & Lesson plan in the new format. |
| | | WEEK 3 | MONDAY DATE 5/2 | TUESDAY DATE 6/2 | WEDNESDAY DATE 7/2 |
| ACTIVITY | Class Hours | | | IEEE32 - ECA - B. lec (2 class) Module 3a - Relevant qst. Solved 3 numericals. IEEE-37 - EMI lab for 3rd sem EEE Conducted one experiment for all the 4 lab batches. | IEEE32 - ECA - B. Lecture Module 3a - Relevant qst. solved 3 numericals. |
| | Others | | EMS work. | EMS work. | EMS work. |



## WORK DONE DIARY

ATME College of Engineering

| | | WEEK 1 | THURSDAY DATE 25/1 | FRIDAY DATE 26/1 | SATURDAY DATE 27/1 |
|---|---|---|---|---|---|
| ACTIVITY | Class Hours | | IEEE37 - Online Class for B. Lec (Cancelled) Module - 02 - Network Theorems IEEE-37 - EMI lab (Online) Expt - 07 - Verification of the theorems by Pspice tool | IEEE 32 - Online class for B. Lec Module 2 - Network Theorems. | |
| | Others | | | Induction program for 3rd sem B. Lec, addressed about the basic guidelines which included syllabus of the course, Text books, Reference books, Syllabus, Time table | Attended the talk addressed by Dr Gopi Ramchiary how to write project proposal for the funding. |
| | | WEEK 2 | THURSDAY DATE 01/2 | FRIDAY DATE 02/2 | SATURDAY DATE 03/2 |
| ACTIVITY | Class Hours | | IEEE37 - EMI lab (Online) 1st cycle of lab experiments conducted. | IEEE37 - EMI lab batches B. Lecture OC EEE test conducted IEEE32 - ECA - B. lec (2 class) Module 3a - Relevant charts Derivation of relevant steps of a parallel resonance ckt for a ckt you will get the effects of R-L ckt & C ckt separately. | |
| | Others | | EMS Coordinator making regulating reference tool exams from getting in DA office. MBA MOOC's Introduction & Preparation | | |
| | | WEEK 3 | THURSDAY DATE 08/2 | FRIDAY DATE 09/2 | SATURDAY DATE 10/2 |
| ACTIVITY | Class Hours | | Holiday on account of Makha Sankranthi | IEEE32 - ECA Module 1 - Basic Concepts Introduction, basic definitions Ideal & Practical sources. IEEE37 - EMI lab IA conducted for 3rd batch - 01 | IEEE32 - ECA - Mock test IEEE37 - EMI lab IA conducted for the batch - 02 |
| | Others | | | EMS work | EMS work. |

| WEEK 4 | MONDAY DATE 16/01 | TUESDAY DATE 19/01 | WEDNESDAY DATE 20/01 |
|---|---|---|---|
| ACTIVITY – Class Hours | 18EE32 - ECA (A section)<br>Module 1 :- Source shifting & Source transformation - 2 VTU QP Discussion.<br>18EE32 - ECA (A section)<br>Module 1 - Concept of Source transformation Solved 2 numericals. | 18EE32 - ECA (B section)<br>Module 1 :- Numericals on Source transformation.<br>18EEL37 - EMI Lab offline<br>3rd Sem A & B Section conducted one experiment each for all the 4 lab batches. | 18EE32 - ECA (B section)<br>Module 1 - Numericals on Source transformation<br>18ELE13 - BEE (E section)<br>Module 1b - AC fundamentals Concept AC generation diff's b/w avg quantities definitions, Phasor Concept & Representation<br>18EE32 - ECA (A section)<br>Module 1 :- Source shifting & transformation - 5 VTU QP. |
| ACTIVITY – Others | | | |

| WEEK 5 | MONDAY DATE 23/01 | TUESDAY DATE 24/01 | WEDNESDAY DATE 25/01 |
|---|---|---|---|
| ACTIVITY – Class Hours | 18EE32 - ECA (B lec).<br>Module 1 :- Basic Concepts Solved 3 problems on Mesh - Delta Transformation<br>18EE32 - ECA (A lec)<br>Module 1 :- Basic Concepts Concepts of node & Independent Solved 2 problems. | Republic Day. | 18EE32 - ECA (B lec)<br>Module 1 - Basic Concepts Concept of Mesh & Independent analysis<br>18ELE13 - BEE (E section) 2 classes<br>Module 2a - Single phase Transformer, Working principle, Construction, Losses in a transformer, Efficiency & condition for $\eta_{max}$. |
| ACTIVITY – Others | | | |

| WEEK 6 | MONDAY DATE 01/02 | TUESDAY DATE 02/02 | WEDNESDAY DATE 03/02 |
|---|---|---|---|
| ACTIVITY – Class Hours | 18EE32 - ECA - A lec (2 classes)<br>Module 1 - Basic Concepts Nodal Analysis, Concept of Independent node - Solved 7 problems.<br>18EE32 - ECA - B lec<br>Module 1 - Basic Concepts - Nodal analysis, Concept of Independent node - Solved 2 problems. | 18EE32 - ECA A lec (2 classes)<br>Module 1 - Basic Concepts Nodal Analysis, Concept of Independent node - Solved 7 problems.<br>18EEL37 - EMI Lab. | 18ELE13 - BEE - E lec<br>Module 2a - Single phase Transformer - Solved 4 numericals Discussed VTU QP. |
| ACTIVITY – Others | | | IA-1 Invigilation duty of the Course 18EE32 |





| WEEK 4 | THURSDAY DATE 21/01 | FRIDAY DATE 22/01 | SATURDAY DATE 23/01 |
|---|---|---|---|
| ACTIVITY – Class Hours | 18EE32 - ECA A section<br>Module 1 - Star - Delta Transformation - 5 VTU QP Discussion<br>18ELE13 - BEE (E section)<br>Module 1b - AC fundamentals & Module 3a - Single phase Transformer: AC generation, animation video play, Equation, transmission & distribution of the electrical from animation video play. | 18ELE13 - BEE (E section)<br>Module 2a - Single phase Transformer - Introduction<br>18EE32 - ECA (A section)<br>Module 1 - Mesh analysis - 5 VTU QP Discussion.<br>18EE32 - ECA (A section)<br>Module 1 - Concept of Source transformation & Solved 2 numericals | Holiday. |
| ACTIVITY – Others | | | |

| WEEK 5 | THURSDAY DATE 28/01 | FRIDAY DATE 29/01 | SATURDAY DATE 30/01 |
|---|---|---|---|
| ACTIVITY – Class Hours | 3rd Sem offline - IA1<br>18ELE 13 - BEE (E)<br>Module 3a - Single Phase Transformer - 2 numericals Solved | 1st Sem offline - IA1 | 18EE32 - ECA (B-lec)<br>Module 1 - Basic Concepts mesh analysis - Solved 3 numericals |
| ACTIVITY – Others | 3rd Sem Internal entry 31 Students Resume filling in VTU portal. | Attended the NEP Workshop. | 1st year IA1 invigilation duty.<br>1st year Resume filling. |

| WEEK 6 | THURSDAY DATE 04/02 | FRIDAY DATE 05/02 | SATURDAY DATE 06/02 |
|---|---|---|---|
| ACTIVITY – Class Hours | 18ELE 13 - BEE - Module 3b Domestic Wiring - Introduction, types of wiring with animation videos. | 18ELE 13 - BEE - E lec<br>module 3b :- Domestic wiring Earthing, Necessity of earthing, methods of earthing - plate earthing.<br>18EE32 - ECA - A lec<br>Module 2 - Network Theorems Millman's theorem.<br>18EE32 - ECA - B lec<br>Module 2 - Network Theorems Millman's theorem. | Offline Special class to 3rd Sem B section - 18EE32 - Module 2 - Network Theorems - Theorems, Norton's Theorem & MPT |
| ACTIVITY – Others | Attended the talk on Hindu Women Property Rights. | | |

| | | MONDAY DATE 05/2 | TUESDAY DATE 06/2 | WEDNESDAY DATE 07/2 |
|---|---|---|---|---|
| WEEK 7 | ACTIVITY – Class Hours | 18EE32 - ECA - B lec (2 class) module 2 - Network Reduction Theorems, Norton Theorem. 18EE32 - ECA - B lec Revision class. (mid sem) | 18EE32 - ECA - B lec (2 class) module 2 - Network Reduction Theorems, Superposition theorem. 18EEL37 - EM1 Lab for 3rd Sem A & B Section Conducted one experiment each for all the 4 batches. | 18EE32 - ECA - B lec module 2 - Network Reduction Maximum Power Transfer Theorem 18ELE13 - BEE - E lec module 5b - D |
| | Others | | | VTU Theory Exam invigilation duty. |
| WEEK 8 | MONDAY DATE 13/2 | TUESDAY DATE 14/2 | WEDNESDAY DATE 15/2 |
| | ACTIVITY – Class Hours | Half day CL. 18EE32 - ECA - B lec module 4 - Laplace Transform standard waveforms | 18EE32 - ECA - B lec (2 class) module 4 :- Laplace transform - Generation of waveforms & its LT Numericals 18EEL37 - EM1 Lab (A&B) | 18EE32 - ECA - B lec module 4 - LT - Periodic waveforms & its LT 18ELE13 - BEE - E lec (3 class) module 2a - Single phase AC ckt - Analysis of RL, RC, & RLC ckts Definition of Real power, Reactive power, apparent power, power factor Solved 8 problems. |
| | Others | | | |
| WEEK 9 | MONDAY DATE 20/2 | TUESDAY DATE 21/2 | WEDNESDAY DATE 22/2 |
| | ACTIVITY – Class Hours | 18EE32 ECA B lec module 5b - Two port Network - Solved 4 problems. | 18EE32 - ECA - B lec (2 class) module 3b - Transient analysis - Initial & final conditions of R L & C. Solved 3 problems. 18EEL37 - EM1 Lab 3rd A&B Section | 18EE32 - ECA - B lec module 3b - Transient Analysis Solved 3 problems |
| | Others | VTU theory Exam Duty. 1st year IA2 invigilation duty. | | |





| | | THURSDAY DATE 09/2 | FRIDAY DATE 10/2 | SATURDAY DATE 11/2 |
|---|---|---|---|---|
| WEEK 7 | ACTIVITY – Class Hours | 18EE32 - ECA - A lec (2 class) module 2 - Network Theorems MPT, Superposition theorem 18ELE13 - BEE - E lec module 2 - Single Phase AC ckt :- Analysis of RLC ckt & Impedance ckt | 18ELE13 - BEE - E lec module 2 :- 1φ AC ckts Analysis of Capacitive ckt 18EE32 - ECA - B lec Module 3 - Network Theorems Reciprocity Theorem 18EE32 - ECA - B lec Module 4 - Laplace Transform Definition & properties & proofs. | 18EE32 - ECA - B lec (2 class) module 4 - LT - Properties defined & proved - Numericals 18EEL37 - EM1 Lab for 3rd sem A & B Section Conducted one experiment each for all the 4 lab batches. |
| | Others | | Offered counselling for 10 students | |
| WEEK 8 | THURSDAY DATE 16/2 | FRIDAY DATE 17/2 | SATURDAY DATE 18/2 |
| | ACTIVITY – Class Hours | 18ELE13 - BEE - E lec module 4a - DC generator Introduction, Construction, EMF eqn | 18ELE13 - BEE - E lec module 4a - DC generator Types of DC generator, Numericals - Module 5b - Type writing 18EE32 - ECA (B lec) Module 5b :- Two Port Network - Introduction & Definition of Z, Y & T parameters | 18EE32 - B lec module 5b - Two Port Network - Solved 4 problems. Concept of Symmetry & Reciprocity. |
| | Others | | VTU Theory exam duty | VTU theory exam duty |
| WEEK 9 | THURSDAY DATE 23/2 | FRIDAY DATE 24/2 | SATURDAY DATE 25/2 |
| | ACTIVITY – Class Hours | 18ELE13 - BEE - E lec module 4a - DC generator Types of DC generator, Solved 8 numericals. | 18ELE13 - BEE - E lec module 4a - DC generator Numericals, module 4b - DC motor Working principle. 18EEL37 - Lab IA Conduction | 18EE32 - ECA - B lec module 3b - Transient Analysis Solved 1 problem. module 5b - & Two port network. |
| | Others | | | VTU theory exam duty |

ATME College of Engineering

## WORK DONE DIARY

| WEEK 10 | MONDAY DATE 6/10 | TUESDAY DATE 7/10 | WEDNESDAY DATE 8/10 |
|---|---|---|---|
| ACTIVITY – Class Hours | 18EEL37 - EMI lab IA - Conduction of batch 05 & 04<br>18EE32 - ECA - B/Lec<br>Module 3b - Transient Analysis - Solved 2 problems | 18EE32 - ECA A/B Lec Postponed.<br>Module 5a - Unbalanced 3φ ckt - Con. unbalanced 3φ balanced & unbalanced 4 wire & 3 wire system. Delta connected 3φ balanced & unbalanced systems.<br>18EEL37 - EMI lab (A Lec) | 18EE32 - ECA - B<br>Module 5b - Two fold way Solve 2 problems.<br>18ELE13 - BEE - E Lec<br>Module 4b - DC motor Torque, 3φ & efficiency of DC motor. |
| ACTIVITY – Others | | | |

| WEEK 11 | MONDAY DATE 13/10 | TUESDAY DATE 14/10 | WEDNESDAY DATE 15/10 |
|---|---|---|---|
| ACTIVITY – Class Hours | | | 18ELE13 BEE - E Lec<br>Module 4b - DC motor. Numericals<br>Module 2b - 3φ ckt - Necessity of 3φ power, Advantages of 3φ power. |
| ACTIVITY – Others | Counselling of the students.<br>EMS Work - CIE finalization | 3rd sem B section IMS Valuation<br>3rd sem B section of all 3 assignment | |

| WEEK 12 | MONDAY DATE 20/10 | TUESDAY DATE 21/10 | WEDNESDAY DATE 22/10 |
|---|---|---|---|
| ACTIVITY – Class Hours | | | 18ELE13 - BEE - E Lec (Lecture)<br>Module 2b - 3φ AC ckt - Mathematical of 3φ power. Numericals |
| ACTIVITY – Others | 18EE32 - ECA - A/B Lec finalization of CIE marks | 3rd sem EMI lab IA finalization.<br>CIE marks entry in ATME (3rd sem) | |



ATME College of Engineering

WORK DONE DIARY

| WEEK 10 | THURSDAY DATE 9/10 | FRIDAY DATE 10/10 | SATURDAY DATE 11/10 |
|---|---|---|---|
| ACTIVITY – Class Hours | 18ELE13 - BEE - E Lec<br>Module 4b - DC motor - Characteristics of DC motor. | 18ELE13 - BEE - E Lec<br>Module 4a - DC motor Numericals.<br>18EE32 - ECA - A Lec<br>Module 4 - Laplace Transform Solved 2 problems. | |
| ACTIVITY – Others | | EMS Work. | |

| WEEK 11 | THURSDAY DATE 16/10 | FRIDAY DATE 17/10 | SATURDAY DATE 18/10 |
|---|---|---|---|
| ACTIVITY – Class Hours | Holiday on account of Maha Shivarathri | 18ELE13 - BEE - E Lec<br>Module 2b - 3φ AC ckt - Relationship b/w line & phase voltage of a star & delta balanced system. | Holiday. |
| ACTIVITY – Others | | 18EE32 - ECA - B/Lec Finalization of the marks. | |

| WEEK 12 | THURSDAY DATE 23/10 | FRIDAY DATE 24/10 | SATURDAY DATE 25/10 |
|---|---|---|---|
| ACTIVITY – Class Hours | 18ELE13 - BEE - E Lec<br>Mock test on module 5 & 4. | 18ELE13 - BEE - E Lec<br>Module 2b - 3φ AC ckt - Numericals. | 18ELE13 - BEE - E Lec.<br>Module 2b - 3φ AC ckt<br>VTU QP discussion |
| ACTIVITY – Others | EMS Work | EMS Work. | |

ATME College of Engineering

# WORK DONE DIARY

| WEEK 13 | MONDAY DATE 24/03 | TUESDAY DATE 25/03 | WEDNESDAY DATE 26/03 |
|---|---|---|---|
| ACTIVITY – Class Hours | | | 18ELE13- BFE-E4L<br>Module 5a – 3¢ hours<br>Introduction- Introduction, working principle, Methods & Types of altimeter, Frequency of an altimeter, EMP eq$^{n}$ derivation |
| ACTIVITY – Others | Internship evaluation. Attended Dept meeting | Meeting with project batches for seminar topic selection for the project batches | |

| WEEK 14 | MONDAY DATE 31/03 | TUESDAY DATE 01/04 | WEDNESDAY DATE 02/04 |
|---|---|---|---|
| ACTIVITY – Class Hours | Attended CL | 18ELE13 - EMI lab.<br>LCE updation. | |
| ACTIVITY – Others | | | LCE completed for the batch of - 18ELE13, CISCO training will be taken by the project guide |

| WEEK 15 | MONDAY DATE 07/04 | TUESDAY DATE 08/04 | WEDNESDAY DATE 09/04 |
|---|---|---|---|
| ACTIVITY – Class Hours | | | |
| ACTIVITY – Others | 1st sem IAS invigilation<br>1st sem Merit list-calculation. | 1st sem IAS evaluation<br>Seminar evaluation. | VTU theory exam duty<br>1st sem IAS verification. |



ATME College of Engineering

WORK DONE DIARY

| WEEK 13 | THURSDAY DATE 27/03 | FRIDAY DATE 28/03 | SATURDAY DATE 29/03 |
|---|---|---|---|
| ACTIVITY – Class Hours | 18ELE13- BEE-E4L<br>Module 5a- 3¢ 5¢ hours<br>Numericals | 18ELE13- BFE- E4L<br>Module 5a- 3¢ I.M.<br>Introduction, Construction with typical working principle, Uses & its significance. | 18ELE-13- BEE-E4L<br>Module 5a- 3¢ I.M. |
| ACTIVITY – Others | | VTU theory exam duty | VTU theory exam duty |

| WEEK 14 | THURSDAY DATE 03/04 | FRIDAY DATE 04/04 | SATURDAY DATE 05/04 |
|---|---|---|---|
| ACTIVITY – Class Hours | | Holiday on account of good Friday. | |
| ACTIVITY – Others | Department meeting.<br>Criteria sheet for the course 18ELE-13 collection. | | 1st year IA invigilation duty<br>Project batches- seminar topics finalization. |

| WEEK 15 | THURSDAY DATE 10/04 | FRIDAY DATE 11/04 | SATURDAY DATE 12/04 |
|---|---|---|---|
| ACTIVITY – Class Hours | | | Holiday. |
| ACTIVITY – Others | 1st sem CIE finalization | 18ELE13- VTU lab exam duty | |

# ATME College of Engineering

## C1.1.1 - The Institution ensures effective curriculum delivery through a well-planned and documented process

## Supporting Documents

### Index

| Sl. No. | Academic Year | Particulars |
|---|---|---|
| 1 | 2020-21 | Academic Calendar- College & Department |
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| 4 | | Learning Outcome- Course Module |
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| 6 | | Teaching – Learning resources |
| 7 | | Attendance Record |
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| 10 | | Academic Activity and its Planning |
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# Department of Electronics & Communication Engineering

**ATME COLLEGE OF ENGINEERING**
13th Kilometer, Mysore-Kanakapura-Bangalore Road, Mysore – 570 028 P : 0821-2593335 F: 0821-2593328
Email: info@atme.in, Web : www.atme.in

# ATME COLLEGE OF ENGINEERING, MYSURU

## Revised Academic Calendar (ODD SEMESTER, 2020-21)

| WEEK | MONTH | SUN | MON | TUE | WED | THU | FRI | SAT | HOLIDAY (H) | COLLEGE EVENTS |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | SEPTEMBER | | | 1 | 2 | 3 | 4 | 5 | | 3rd , 5th & 7th Semster : commencement of Online Classes |
| 2 | | 6 | 7 | 8 | 9 | 10 | 11 | 12 | | |
| 3 | | 13 | 14 | 15 | 16 | 17 | 18 | 19 | Mahalaya Amavasya | |
| 4 | | 20 | 21 | 22 | 23 | 24 | 25 | 26 | | |
| 5 | | 27 | 28 | 29 | 30 | | | | | |
| 5 | OCTOBER | | | | | 1 | 2 | 3 | Gandhi Jayanthi | |
| 6 | | 4 | 5 | 6 | 7 | 8 | 9 | 10 | | First I A for 3rd , 5th and 7th Semester |
| 7 | | 11 | 12 | 13 | 14 | 15 | 16 | 17 | | |
| 8 | | 18 | 19 | 20 | 21 | 22 | 23 | 24 | | |
| 9 | | 25 | 26 | 27 | 28 | 29 | 30 | 31 | Ayudha Pooja, Vijaya Dashami, Eid-Milad , Valmiki Jayanthi | |
| 10 | NOVEMBER | 1 | 2 | 3 | 4 | 5 | 6 | 7 | Kannada Rajyotsava | |
| 11 | | 8 | 9 | 10 | 11 | 12 | 13 | 14 | Naraka Chaturdashi | Second IA for 3rd , 5th and 7th Semester |
| 12 | | 15 | 16 | 17 | 18 | 19 | 20 | 21 | Balipadyami | Commencement of On-Campus Classes for Semseter 7. |
| 13 | | 22 | 23 | 24 | 25 | 26 | 27 | 28 | | |
| 14 | | 29 | 30 | | | | | | | |

Non Working Saturdays

# ATME COLLEGE OF ENGINEERING, MYSURU

**Revised Academic Calendar (ODD SEMESTER, 2020-21)**

| WEEK | MONTH | SUN | MON | TUE | WED | THU | FRI | SAT | HOLIDAY (H) | COLLEGE EVENTS |
|---|---|---|---|---|---|---|---|---|---|---|
| 14 | DECEMBER | | | 1 | 2 | 3 | 4 | 5 | Kanakadasa Jayanthi | |
| 15 | | 6 | 7 | 8 | 9 | 10 | 11 | 12 | | |
| 16 | | 13 | 14 | 15 | 16 | 17 | 18 | 19 | | |
| 17 | | 20 | 21 | 22 | 23 | 24 | 25 | 26 | Christmas | |
| 18 | | 27 | 28 | 29 | 30 | 31 | | | | Third IA for Semesters 3, 5 and 7 |
| 18 | JANUARY | | | | | | 1 | 2 | | |
| 19 | | 3 | 4 | 5 | 6 | 7 | 8 | 9 | | LAB Interenals for Semesters 3,5 and 7 |
| 20 | | 10 | 11 | 12 | 13 | 14 | 15 | 16 | Makra Sankranthi | Improvement IA for Semesters 3,5 and 7, LAST working day for ODD Sem 2020-21 |
| 21 | | 17 | 18 | 19 | 20 | 21 | 22 | 23 | | Comencement of Odd Semester Practical Exams |
| 22 | | 24 | 25 | 26 | 27 | 28 | 29 | 30 | Republic Day | |
| 23 | | 31 | | | | | | | | |
| 23 | FEBRUARY | | 1 | 2 | 3 | 4 | 5 | 6 | | End of Odd Semester Practical Exams |
| 24 | | 7 | 8 | 9 | 10 | 11 | 12 | 13 | | Commencement of Odd Semester Theory Exams |
| 25 | | 14 | 15 | 16 | 17 | 18 | 19 | 20 | | |
| 26 | | 21 | 22 | 23 | 24 | 25 | 26 | 27 | | |
| 27 | | 28 | | | | | | | | |

Non Working Saturdays

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| No. Of Working Days | 17 | 20 | 20 | 17 | 17 | 9 | Total No. Of Working Days | 100 |

# ATME COLLEGE OF ENGINEERING, MYSURU

## Revised Academic Calendar (ODD SEMESTER, 2020-21)

| WEEK | MONTH | SUN | MON | TUE | WED | THU | FRI | SAT | HOLIDAY (H) | COLLEGE EVENTS |
|---|---|---|---|---|---|---|---|---|---|---|
| 14 | MARCH | | 1 | 2 | 3 | 4 | 5 | 6 | | |
| 15 | | 7 | 8 | 9 | 10 | 11 | 12 | 13 | Mahashivaratri | |
| 16 | | 14 | 15 | 16 | 17 | 18 | 19 | 20 | | |
| 17 | | 21 | 22 | 23 | 24 | 25 | 26 | 27 | | 25th End of odd semester Theory exams, 26th Mar 2021 Commencement of Even Semester |
| 18 | | 28 | 29 | 30 | 31 | | | | | |
| 18 | APRIL | | | | | 1 | 2 | 3 | Good Friday | |
| 19 | | 4 | 5 | 6 | 7 | 8 | 9 | 10 | | |
| 20 | | 11 | 12 | 13 | 14 | 15 | 16 | 17 | Chadramana Yugadi, Ambedkar Jayanthi | |
| 21 | | 18 | 19 | 20 | 21 | 22 | 23 | 24 | | |
| 22 | | 25 | 26 | 27 | 28 | 29 | 30 | | Mahavir Jayanthi | |
| 23 | MAY | | | | | | | 1 | May Day (Labour Day) | |
| 23 | | 2 | 3 | 4 | 5 | 6 | 7 | 8 | | |
| 24 | | 9 | 10 | 11 | 12 | 13 | 14 | 15 | Idul-Fitr, Basava Jayathi | |
| 25 | | 16 | 17 | 18 | 19 | 20 | 21 | 22 | | |
| 26 | | 23 | 24 | 25 | 26 | 27 | 28 | 29 | | |
| 27 | | 30 | 31 | | | | | | | |

Non Working Saturdays

Sd-
Dr. L Basavaraj
Principal

# ATME COLLEGE OF ENGINEERING, MYSURU

**Revised Academic Calendar (EVEN SEMESTER, 2020-21)**

| WEEK | MONTH | SUN | MON | TUE | WED | THU | FRI | SAT | HOLIDAY (H) | COLLEGE EVENTS |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | APRIL | | | | | 1 | 2 | 3 | | |
| 2 | | 4 | 5 | 6 | 7 | 8 | 9 | 10 | | |
| 3 | | 11 | 12 | 13 | 14 | 15 | 16 | 17 | | |
| 4 | | 18 | 19 | 20 | 21 | 22 | 23 | 24 | | Commencement of 4th, 6th and 8th Semester Classes |
| 5 | | 25 | 26 | 27 | 28 | 29 | 30 | | | |
| 5 | MAY | | | | | | | 1 | May Day | |
| 6 | | 2 | 3 | 4 | 5 | 6 | 7 | 8 | | |
| 7 | | 9 | 10 | 11 | 12 | 13 | 14 | 15 | Basava Jayanthi, Ramzan | |
| 8 | | 16 | 17 | 18 | 19 | 20 | 21 | 22 | | |
| 9 | | 23 | 24 | 25 | 26 | 27 | 28 | 29 | | FIRST IA 4TH AND 6TH SEM |
| | | 30 | 31 | | | | | | | |
| 10 | JUNE | | | 1 | 2 | 3 | 4 | 5 | | |
| 11 | | 6 | 7 | 8 | 9 | 10 | 11 | 12 | | |
| 12 | | 13 | 14 | 15 | 16 | 17 | 18 | 19 | | |
| 13 | | 20 | 21 | 22 | 23 | 24 | 25 | 26 | | |
| 14 | | 27 | 28 | 29 | 30 | | | | | |

**Non Working Saturdays**

# ATME COLLEGE OF ENGINEERING, MYSURU

## Revised Academic Calendar (EVEN SEMESTER, 2020-21)

| WEEK | MONTH | SUN | MON | TUE | WED | THU | FRI | SAT | HOLIDAY (H) | COLLEGE EVENTS |
|---|---|---|---|---|---|---|---|---|---|---|
| 14 | JULY | | | | | 1 | 2 | 3 | | SECOND IA 4TH AND 6TH SEM |
| 15 | | 4 | 5 | 6 | 7 | 8 | 9 | 10 | | |
| 16 | | 11 | 12 | 13 | 14 | 15 | 16 | 17 | | |
| 17 | | 18 | 19 | 20 | 21 | 22 | 23 | 24 | Bakrid | 8th Sem Last Working Day, 8th Sem Theory Exam Begins |
| 18 | | 25 | 26 | 27 | 28 | 29 | 30 | 31 | | 8th Sem Theory Exam Ends, THIRD IA 4th AND 6th SEM |
| 18 | AUGUST | 1 | 2 | 3 | 4 | 5 | 6 | 7 | | 4th and 6th Sem Last Working Day, 8th Sem Internship Viva Voce. LAB IA 4th and 6th Sem. |
| 19 | | 8 | 9 | 10 | 11 | 12 | 13 | 14 | | Practical Exams Starts for 4th and 6th Sem |
| 20 | | 15 | 16 | 17 | 18 | 19 | 20 | 21 | Muharram | Practical Exams Ends for 4th and 6th Sem |
| 21 | | 22 | 23 | 24 | 25 | 26 | 27 | 28 | | Theory Exams Starts for 4th and 8th Sem |
| 22 | | 29 | 30 | 31 | | | | | | |
| 23 | SEPTEMBER | | | | 1 | 2 | 3 | 4 | | |
| 24 | | 5 | 6 | 7 | 8 | 9 | 10 | 11 | Ganesha Chathurthi | Theory Exams Starts for 4th and 8th Sem |
| 25 | | 12 | 13 | 14 | 15 | 16 | 17 | 18 | | |
| 26 | | 19 | 20 | 21 | 22 | 23 | 24 | 25 | Non Working Saturdays | |
| 27 | | 26 | 27 | 28 | 29 | 30 | 31 | 32 | | |
| WORKING DAYS (8th Sem) | | | 14 | 14 | 13 | 13 | 13 | 6 | 73 | |
| WORKING DAYS(4th & 6th) | | | 16 | 16 | 15 | 16 | 16 | 7 | 86 | Inclusive of IA tests and other activities |

DEAN ACADEMICS
DR. M S GOVINDE GOWDA

PRINCIPAL
DR. L BASAVARAJ

# ATME COLLEGE OF ENGINEERING, MYSURU

## Electronics and Communication Engineering

### Academic Calendar 2020-21 Odd Semester

| WEEK | MONTH | SUN | MON | TUE | WED | THU | FRI | SAT | No. of days/week | Department Activities |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | SEPTEMBER | 30 | 31 | 1<br>IP | 2 | 3 | 4 | 5 | 4 | 3rd, 5th & 7th Sem: commencement of Online Classes<br>IP-Induction Program |
| 2 | | 6 | 7 | 8 | 9 | 10<br>DM | 11 | 12 | 6 | DM- Department Meeting |
| 3 | | 13 | 14 | 15 | 16<br>P | 17 | 18<br>WM | 19 | 4 | Mahalaya Amavasya<br>WM- Website material updation<br>Project Batch creation |
| 4 | | 20 | 21 | 22 | 23 | 24<br>DM | 25<br>A & S | 26<br>P | 6 | DM- Department Meeting<br>A & S- Attendance and Syllabus coverage<br>P- Project guide Allotment |
| 5 | | 27 | 28<br>SI | 29 | 30<br>CR | | | | 3 | CR- Counseling Report submission<br>SI- Students interaction with HOD |
| 5 | OCTOBER | | | | | 1 | 2 | 3 | 1 | 2nd-Gandhi Jayanthi |
| 6 | | 4 | 5<br>IA-QS | 6<br>IA-QS | 7 | 8 | 9 | 10 | 6 | IA-QS- IA QP Question Paper Scruitinization<br>First I A for 3rd , 5th and 7th Semester |
| 7 | | 11 | 12 | 13 | 14 | 15<br>DM | 16 | 17 | 5 | DM- Department Meeting |
| 8 | | 18 | 19 | 20 | 21 | 22<br>PTM | 23<br>PTM | 24<br>PTM | 6 | PTM- Parents Teacher Meeting |
| 9 | | 25 | 26 | 27<br>A & S | 28<br>SI | 29<br>CR | 30 | 31 | 3 | Ayudha Pooja, Vijaya Dashami, Eid-Milad , Valmiki Jayanthi<br>A & S- Attendance and Syllabus coverage<br>SI- Students interaction with HOD<br>CR- Counseling Report submission |
| 10 | NOVEMBER | 1 | 2 | 3 | 4 | 5<br>DM | 6<br>IA-QS | 7 | 5 | Kannada Rajyotsava<br>DM- Department Meeting<br>IA-QS- IA QP Question Paper Scruitinization |
| 11 | | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 5 | Second IA for 3rd , 5th and 7th Semester, 14th-Naraka Chaturdashi |
| 12 | | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 4 | Commencement of offline classes to 7th semester<br>Balipadyami |
| 13 | | 22 | 23 | 24 | 25<br>A & S | 26<br>DM | 27<br>WD | 28<br>SI | 6 | A & S- Attendance and Syllabus coverage<br>WD- Workdone Dairy verification<br>SI- Students interaction with HOD<br>DM- Department Meeting |
| 14 | | 29 | 30<br>CR | | | | | | 1 | CR- Counseling Report submission |

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 15 | DECEMBER | | | 1 | 2 | 3 | 4 | 5 | 3 | Kanakadasa Jayanthi |
| 16 | | 6 | 7 | 8<br>PCM | 9 | 10<br>DM, PTM | 11<br>PTM | 12<br>PTM | 6 | PTM- Parents Teacher Meeting<br>PCM-PAC Committee Meeting<br>DM- Department Meeting |
| 17 | | 13 | 14<br>DCM | 15 | 16<br>PR | 17<br>PR | 18<br>PR | 19 | 4 | DCM-DAB Committee Meeting<br>PR- Project Review-1 |
| 18 | | 20 | 21 | 22 | 23<br>IA-QS | 24<br>DM, IA-QS | 25 | 26<br>WD | 5 | IA-QS- IA QP Question Paper Scruitinization<br>WD- Workdone Dairy verification |
| 19 | | 27 | 28 | 29 | 30 | 31<br>SI | | | 4 | Third I A for 3rd ,5th and 7th Semesters<br>SI- Students interaction with HOD |
| 20 | JANUARY | | | | | | 1 | 2 | 1 | |
| 21 | | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 6 | Practical IA |
| 22 | | 10 | 11<br>IT | 12<br>IT | 13<br>IT | 14 | 15<br>IT | 16<br>LD | 4 | Makara Sankranthi<br>LD-Last working Day<br>IT- Improvement Test |
| 23 | | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 6 | Semster Practical Exmainations, Webinar on Big DATA analysis- Hadoop |
| 24 | | 24 | 25 | 26 | 27 | 28 | 29 | 30 | 5 | Semster Practical Exmainations, Republic Day |
| 25 | | 31 | | | | | | | | |
| 26 | FEBRUARY | | 1 | 2 | 3 | 4 | 5 | 6 | 4 | |
| 27 | | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 6 | Commencement of Theory Exan for Sem 3, 5 and 7 |
| 28 | | 14 | 15 | 16 | 17<br>SA | 18<br>SA | 19<br>SA | 20 | 5 | SA- Subject Allotment Process for even semester |
| 29 | | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 6 | FDP on Research Writing |
| 30 | | 28 | | | | | | | | |
| 26 | MARCH | | 1 | 2 | 3 | 4 | 5 | 6 | 5 | Webinar on Competitive Exam Preparation |
| 27 | | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 5 | Mahashivarathri Festival |
| 28 | | 14 | 15 | 16 | 17<br>WM | 18<br>WM | 19<br>WM | 20 | 5 | WM- Website materails submission for 2 modules |
| 29 | | 21 | 22 | 23 | 24 | 25 | 26<br>CM | 27 | 6 | End of Theory exams for Semesters 3, 5 and 7<br>Commensement<br>CM-Commencement of EVEN semester |
| 30 | | 28 | 29 | 30 | 31 | | | | | |

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 18 | APRIL | | | | | 1 | 2 | 3 | 3 | Good Friday |
| 19 | | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 6 | Industrial Visit- TVS Mysuru |
| 20 | | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 3 | Chadramana Yugadi, Ambedkar Jayanthi |
| 21 | | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 6 | |
| 22 | | 25 | 26 | 27 | 28 | 29 | 30 | | 5 | Mahavir Jayanthi,Webinar on Entrepreneurship and Communication Skills |
| 23 | MAY | | | | | | | 1 | | May Day (Labour Day) |
| 23 | | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 5 | |
| 24 | | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 3 | Idul-Fitr, Basava Jayathi |
| 25 | | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 6 | |
| 26 | | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 6 | Project Exhibition |
| 27 | | 30 | 31 | | | | | | 1 | |

Non Working Saturdays

Sd-
Dr. L Basavaraj
Principal

Sd\-
Dr. Mahesh P K
HOD

## Lesson Plan & Work-done Diary for AY: 2020-21, ODD Semester

| **Course with Code:** Electronic Devices -18EC33 | | | | **Faculty:** Dr. Prathibha M K | | | **Semester & Section**: III & A | |
|---|---|---|---|---|---|---|---|---|
| **Class No.** | **Date planned (DD/MM)** | **Topics to be covered** | **TLP Planned** | **Class No.** | **Date of Conduction (DD/MM)** | **Topics Covered** | **TLP Executed** | **Remarks if any deviation** |
| **MODULE-1** | | | | | | | | |
| 1 | 4/9/2020 | Semiconductors Bonding forces in solids, | Chalk & Talk | 1 | 5/9/20 | Semiconductors Bonding forces in solids, | PPT on line Mode | Since PPT has been prepared the solution to the problem is explained one day ahead of the planned date. |
| 2 | 5/9/2020 | Energy bands, Metals, Semiconductors and Insulators, | Chalk & Talk | 2 | 4/9/20 | Energy bands, Metals, Semiconductors and Insulators, | PPT on line Mode | |
| 3 | 8/9/2020 | Direct and Indirect semiconductors, | Chalk & Talk | 3 | 10/9/20 | Direct and Indirect semiconductors, | PPT on line Mode | |
| 4 | 11/9/2020 | Electrons and Holes, Intrinsic and Extrinsic materials, | Chalk & Talk | 4 | 11/9/20 | Electrons and Holes, Intrinsic and Extrinsic materials, | PPT on line Mode | |
| 5 | 12/9/2020 | Conductivity and Mobility, Drift and Resistance | Chalk & Talk | 5 | 12/9/20 &15/9/20 | Conductivity and Mobility, Drift and Resistance | PPT on line Mode | |
| 6 | 15/9/2020 | Effects of temperature and doping on mobility | Chalk & Talk | 6 | 15/9/20 | Effects of temperature and doping on mobility | PPT on line Mode | |
| 7 | 18/9/2020 | Hall Effect | Chalk & Talk | 7 | 18/9/20 | Hall Effect | PPT on line Mode | |
| 8 | 19/9/2020 | Problems | Chalk & Talk | 8 | 18/9/20 | Problems | PPT on line Mode | |

| **Course with Code:** Electronic Devices -18EC33 | | | | **Faculty:** Dr. Prathibha M K | | | **Semester & Section**: III & A | |
|---|---|---|---|---|---|---|---|---|
| **Class No.** | **Date planned (DD/MM)** | **Topics to be covered** | **TLP Planned** | **Class No.** | **Date of Conduction (DD/MM)** | **Topics Covered** | **TLP Executed** | **Remarks if any deviation** |
| **MODULE-2** | | | | | | | | |
| 9 | 22/9/2020 | Module-2: P-N Junctions Forward and Reverse biased junctions- | Chalk & Talk | 9 | 24/9/2020 | Module-2: P-N Junctions Forward and Reverse biased junctions- | PPT | Some classes has been made internal Swapping due to External DCS Work |
| 10 | 25/9/2020 | Qualitative description of Current flow at a junction, | Chalk & Talk | 10 | 25/9/2020 | Qualitative description of Current flow at a junction, | PPT | |
| 11 | 26/9/2020 | reverse bias, Reverse bias breakdown- Zener breakdown | Chalk & Talk | 11 | 29/9/2020 | reverse bias, Reverse bias breakdown- Zener breakdown | PPT | |
| 12 | 29/9/2020 | avalanche breakdown, Rectifiers | Chalk & Talk | 12 | 3/10/2020 | avalanche breakdown, Rectifiers | PPT | |
| 13 | 3/10/2020 | Optoelectronic Devices Photodiodes: Current and Voltage in an Illuminated Junction, | Chalk & Talk | 13 | 6/10/2020 | Optoelectronic Devices Photodiodes: Current and Voltage in an Illuminated Junction, | PPT | |
| 14 | 6/10/2020 | Solar Cells, Photodetectors. | Chalk & Talk | 14 | 13/10/2020 | Solar Cells, Photodetectors. | PPT | |
| 15 | 13/10/2020 | Light Emitting Diode: Light Emitting materials | Chalk & Talk | 15 | 16/10/2020 | Light Emitting Diode: Light Emitting materials | PPT | |
| 16 | 16/10/2020 | Summary/Problems | Chalk & Talk | 16 | 19/10/2020 | Summary/Problems | PPT | |

| **Course with Code:** Electronic Devices -18EC33 | | | | **Faculty:** Dr. Prathibha M K | | | **Semester & Section**: III & A | |
|---|---|---|---|---|---|---|---|---|
| **Class No.** | **Date planned (DD/MM)** | **Topics to be covered** | **TLP Planned** | **Class No.** | **Date of Conduction (DD/MM)** | **Topics Covered** | **TLP Executed** | **Remarks if any deviation** |
| **MODULE-3** | | | | | | | | |
| 17 | 2010/2020 | Module-3: Bipolar Junction Transistor Fundamentals of BJT operation, | Chalk & Talk | 16 | 2010/2020 | Module-3: Bipolar Junction Transistor Fundamentals of BJT operation, | PPT | |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 18 | 23/10/2020 | Amplification with BJTS, BJT Fabrication, | Chalk & Talk | | 23/10/2020 | Amplification with BJTS, BJT Fabrication, | PPT | |
| 19 | 24/10/2020 | The coupled Diode model (Ebers-Moll Model), | Chalk & Talk | 17 | 24/10/2020 | The coupled Diode model (Ebers-Moll Model), | PPT | |
| 20 | 27/11/2020 | Switching operation of a transistor, Cutoff, saturation, | Chalk & Talk | | 27/11/2020 | Switching operation of a transistor, Cutoff, saturation, | PPT | |
| 21 | 31/11/2020 | switching cycle, specifications, | Chalk & Talk | 18 | 31/11/2020 | switching cycle, specifications, | PPT | |
| 22 | 3/11/2020 | Drift in the base region, | Chalk & Talk | | 3/11/2020 | Drift in the base region, | PPT | |
| 23 | 6/11/2020 | Base narrowing, Avalanche breakdown | Chalk & Talk | 19 | 6/11/2020 | Base narrowing, Avalanche breakdown | PPT | |
| 24 | 7/11/2020 | Summary/Problems | Chalk & Talk | | 7/11/2020 | Summary/Problems | PPT | |

| **Course with Code:** Electronic Devices -18EC33 | | | | **Faculty:** Dr. Prathibha M K | | | **Semester & Section**: III & A | |
|---|---|---|---|---|---|---|---|---|
| **Class No.** | **Date planned (DD/MM)** | **Topics to be covered** | **TLP Planned** | **Class No.** | **Date of Conduction (DD/MM)** | **Topics Covered** | **TLP Executed** | **Remarks if any deviation** |
| **MODULE-4** | | | | | | | | |
| 25 | 10/11/2020 | Module-4: Field Effect Transistors Basic pn JFET Operation, | Chalk & Talk | 25 | 10/11/2020 | Module-4: Field Effect Transistors Basic pn JFET Operation, | PPT | Since the concepts are basic to complete this module with the PPT 5 hours is sufficient and there is a deviation in Dates since CL has been applied during this period. |
| 26 | 20/11/2020 | Equivalent Circuit and Frequency Limitations, | Chalk & Talk | 26 | 20/11/2020 | Equivalent Circuit and Frequency Limitations, | PPT | |
| 27 | 21/11/2020 | MOSFETTwo terminal MOS structure- Energy band diagram, | Chalk & Talk | 27 | 21/11/2020 | MOSFETTwo terminal MOS structure- Energy band diagram, | PPT | |
| 28 | 24/11/2020 | Ideal Capacitance – Voltage Characteristics and Frequency Effects, | Chalk & Talk | 28 | 24/11/2020 | Ideal Capacitance – Voltage Characteristics and Frequency Effects, | PPT | |
| 29 | 27/11/2020 | Basic MOSFET Operation | Chalk & Talk | 28 | 24/11/2020 | Basic MOSFET Operation | PPT | |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 30 | 28/11/2020 | MOSFET structure, | Chalk & Talk | 29 | 2/12/2020 | MOSFET structure, | PPT | |
| 31 | 1/12/2020 | Current-Voltage Characteristics. | Chalk & Talk | 29 | 2/12/2020 | Current-Voltage Characteristics. | PPT | |
| 32 | 4/12/2020 | Problems | Chalk & Talk | 29 | 2/12/2020 | Problems | PPT | |

| **Course with Code:** Electronic Devices -18EC33 | | | | **Faculty:** Dr. Prathibha M K | | | **Semester & Section**: III & A | |
|---|---|---|---|---|---|---|---|---|
| **Class No.** | **Date planned (DD/MM)** | **Topics to be covered** | **TLP Planned** | **Class No.** | **Date of Conduction (DD/MM)** | **Topics Covered** | **TLP Executed** | **Remarks if any deviation** |
| **MODULE-5** | | | | | | | | |
| 33 | 5/12/2020 | Module-5: Fabrication of p-n junctions Thermal Oxidation, Diffusion | Chalk & Talk | 30 | 4/12/2020 | Module-5: Fabrication of p-n junctions Thermal Oxidation, Diffusion | PPT | Since the concepts are simple to complete this module with the PPT 7 hours is sufficient. |
| 34 | 8/12/2020 | , Rapid Thermal Processing, Ion implantation, | Chalk & Talk | 31 | 5/12/2020 | , Rapid Thermal Processing, Ion implantation, | PPT | |
| 35 | 11/12/2020 | chemical vapour deposition, photolithography, | Chalk & Talk | 32 | 1212/2020 | chemical vapour deposition, photolithography, | PPT | |
| 36 | 12/12/2020 | Etching, metallization. Integrated Circuits Background, | Chalk & Talk | 33 | 15/12/2020 | Etching, metallization. Integrated Circuits Background, | PPT | |
| 37 | 15/12/2020 | Evolution of ICs, | Chalk & Talk | 34 | 18/12/2020 | Evolution of ICs, | PPT | |
| 38 | 18/12/2020 | CMOS Process Integration, | Chalk & Talk | 35 | 19/12/2020 | CMOS Process Integration, | PPT | |
| 39 | 19/12/2020 | Integration of Other Circuit Elements. | Chalk & Talk | 36 | 22/12/2020 | Integration of Other Circuit Elements. | PPT | |
| 40 | 22/12/2020 | Problems | Chalk & Talk | 36 | 22/12/2020 | Problems | PPT | |

| | Activity | Planned | Actual | Remarks |
|---|---|---|---|---|
| **1** | Theory Classes | 40 | 36 | Some of the concepts are Simple and due to covid 19 PPT has been used to explain the concepts of all the modules, which in turn reduces the time required to draw the figures on the board. |
| **2** | Assignments/ Quizzes/ Self-study | 2 | 2 | |
| **3** | Tutorials/ Extra classes | - | - | |
| **4** | Internal Assessments | 3 | 3 | |
| **5** | ICT based Teaching (% of usage in Curriculum) | - | 100 | |

| **Planning** | **Execution** |
|---|---|
| **Faculty Signature:** Prathibha M.K | **Faculty Signature:** Prathibha M.K |
| **HoD Signature:** | **HoD Signature:** |

ATME College of Engineering

Period From SEP 2020 To JAN 2021

Semester : Odd / Even ✓

Faculty Member : GURUPRASAD K.N.

Designation : ASSISTANT PROFESSOR

Department : ELECTRONICS AND COMMUNICATION

Faculty Member ID : ECO1020

| Sl. No. | Sem. / Sec. / Branch | Course Title | Course Code |
|---|---|---|---|
| 1 | 7th / B / ECE | MICROWAVES AND ANTENNA | 17EC71 |
| 2 | 3rd / A / ECE | ELECTRONIC DEVICES AND INSTRUMENTATION LAB | 18ECL37 |
| 3 | 3rd / C / ECE | ELECTRONIC DEVICES | 18EC33 |
| 4 | | | |

| | Review at the end of the | | | | End of Semester |
|---|---|---|---|---|---|
| | 1st Month | 2nd Month | 3rd Month | 4th Month | |
| Staff | | | | | |
| HOD / Reviewer | | | | | |

| Course Outcomes | Course Title | MICROWAVES AND ANTENNAS | Course Code | 17EC71 |
|---|---|---|---|---|
| CO-1 | Describe the use and advantages of microwave transmission and analyze various parameters related to microwave transmission lines and waveguides. | | | |
| CO-2 | Identify microwave devices and understand strip lines for several applications | | | |
| CO-3 | Analyze various antenna parameters and necessary point source and array configurations for building an RF system. | | | |
| CO-4 | Recommend various antenna configurations according to the applications. | | | |
| CO-5 | | | | |
| CO-6 | | | | |

| Course Title with Code : | MICROWAVES AND ANTENNAS - 17EC71 | | | | | | | | | | | | Semester : 7th | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Course Outcomes | Program Outcomes | | | | | | | | | | | | Program Specific Outcomes | | | |
| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 | PSO4 |
| CO-1 | 2 | 2 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 2 | 0 | – | – |
| CO-2 | 2 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 2 | 0 | – | – |
| CO-3 | 3 | 2 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 2 | – | – |
| CO-4 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 2 | 1 | – | – |
| CO-5 | | | | | | | | | | | | | | | | |
| CO-6 | | | | | | | | | | | | | | | | |

ATME College of Engineering

# Lesson Plan

MICROWAVES AND ANTENNA - 17EC71 **Semester & Section : 7th B**

| Class No | Date Planned | Topics proposed to be covered | Topic Covered Date | Remarks |
|---|---|---|---|---|
| 1 | 02-09-20 | Microwave Tubes : Introduction, Reflex Klystron | 02-09-20 | |
| 2 | 03-09-20 | Mechanism of Oscillation, Modes | 03-09-20 | |
| 3 | 04-09-20 | Modes of Oscillations, mode curve | 04-09-20 | |
| 4 | 05-09-20 | Microwave frequencies, devices, systems. | 05-09-20 | |
| 5 | 09-9-20 | Transmission lines and equations | 09-09-20<br>10-09-20 | |
| 6 | 10-09-20 | TL equations continued, Reflection coefficient | 11-09-20 | |
| 7 | 11-09-20 | Transmission coeffficient | 12-09-20 | |
| 8 | 12-09-20 | Standing wave and standing wave Ratio | 16-09-20 | |
| 9 | 16-09-20 | Smith Chart | 18, 19, 23 -09-20 | Additional Smith chart problems |
| 10 | 18-09-20 | Single stub matching | 24-09-20 | |
| 11 | 19-09-20 | Microwave network theory : introduction | 25-09-20 | |
| 12 | 23-09-20 | Symmetrical Z and Y parameters | 26-09-20 | |
| 13 | 24-09-20 | Symmetrical parameters - continued | 26-09-20 | |
| 14 | 25-09-20 | S-matrix representation of multi-port N/w | 30-09-20 | |
| 15 | 26-09-20 | Microwave passive devices : coaxial connectors | 01-10-20 | |
| 16 | 30-09-20 | Adapters | 03-10-20<br>~~05-10-20~~ | |
| 17 | 01-10-20 | Attenuators | 28-10-20 | 9.30 to 11.00<br>1 ½ class |
| 18 | 03-10-20 | Phase shifters | 28-10-20 | |
| 19 | 07-10-20 | Waveguide tees | 29-10-20 | 42-Gears drive |
| 20 | 14-10-20 | Magic tees - problem solving | 29-10-20 | TCS training |
| 21 | 15-10-20 | Strip lines : introduction, microstrip lines | 4-10-20 | TCS training |
| 22 | 16-10-20 | Parallel strip lines | 4-10-20 | TCS training |
| 23 | 17-10-20 | Coplanar strip lines | 5-10-20 | TCS training |
| 24 | 21-10-20 | Shielded strip lines | 5-10-20 | TCS training |
| 25 | 22-10-20 | Antenna basics : introduction, Parameters | 6-11-20 | TCS training |

| | | | | |
|---|---|---|---|---|
| 26 | 23-10-20 | Beam area, Radiation Intensity, Efficiency | 07-11-20 | CL |
| 27 | 24-10-20 | Directivity and Gain, Antenna apertures | 07-11-20 | TCS Drive |
| 28 | 28-10-20 | Effective Height, Bandwidth | 11-11-20 | |
| 29 | 29-10-20 | Radio communication link | 11-11-20 | |
| 30 | 04-11-20 | Antenna field zones, polarization | 11-11-20 | |
| 31 | 05-11-20 | Point sources and Arrays : Introduction | 18-11-20 | |
| 32 | 06-11-20 | Patterns, power theorem, radiation intensity | 19-11-20 | |
| 33 | 07-11-20 | Field patterns, phase patterns | 20-11-20<br>21-11-20 | |
| 34 | 11-11-20 | Arrays of two isotropic point sources | 25-11-20<br>26-11-20 | |
| 35 | 18-11-20 | Linear arrays of equal amplitude & spacing | 27-11-20<br>28-11-20 | |
| 36 | 19-11-20 | Electric dipoles : Introduction, short dipole | 02-12-20 | |
| 37 | 20-11-20 | Fields of a short dipole | 04-12-20 | |
| 38 | 21-11-20 | Radiation resistance of a short dipole | 05-12-20 | |
| 39 | 25-11-20 | Thin linear Antenna | 09-12-20 | |
| 40 | 26-11-20 | Radiation resistance of $\lambda/2$ antenna | 09-12-20 | |
| 41 | 27-11-20 | Loop and Horn antenna : Introduction | 10-12-20 | |
| 42 | 28-11-20 | The loop antenna-General case | 11-12-20 | |
| 43 | 02-12-20 | Far field patterns of circular loop antenna | 11-12-20 | |
| 44 | 04-12-20 | Radiation resistance of loops | 12-12-20 | |
| 45 | 05-12-20 | Directivity of circular loop antenna | 12-12-20<br>16-12-20 | |
| 46 | 09-12-20 | Horn antennas, Rectangular horn antenna | 17-12-20 | |
| 47 | 10-12-20 | Antenna types : Helical antenna | 23-12-20 | |
| 48 | 11-12-20 | Helical geometry, practical design | 23-12-20 | |
| 49 | 12-12-20 | Yagi-Uda array, parabolic General properties | 24-12-20 | |
| 50 | 16-12-20 | Log-periodic antenna | 26-12-20 | |

Faculty Member Signature

HOD Signature

# MINUTES OF MEETING

**Date: 15-04-2021**

**Meeting held from** 3:30 PM to 4: 15PM

**Agenda:**

- Dissemination of Academic council meeting held on 07th April 2021.
- Preparation for next semester AY 2020-21 EVEN.
- Dissemination of HoDs meeting held on 12st April 2021.

- HoD introduced newly joined faculty Mrs. Nida Maheen & Mrs. Meghana S to the staff members.
- Review of previous minutes of meeting.
- HoD informed lesson plan and course models to be submitted to the website coordinator at the earliest
- HoD informed all the faculty members to submit their research paper in the International Conference ICRTST-2021 conducted by the college. Also mentioned that, Minimum of 8 papers from faculty and 10 papers from students are insisted to submit.
- HoD informed, New PEO and PSO statements has to be included in GC meeting for approval.
- HoD discussed on the changes to be incorporated in the Administrative Calendar of Events as per the suggestions given by Dr. MSG.
- HoD strictly informed faculty members not to share any confidential data to other colleges.
- Informed about the commencement of even semester from 19th April 2021.
- HoD informed all the class teachers to collect the consent of students regarding Online/Offline Mode from students.
- HoD informed the time table coordinators to prepare
- Offline Time Table from 9:00 A.M to 4:45 P.M
- Online Time Table from 10:00 A.M to 1 P.M and 2 P.M. to 3 P.M
- HOD inform all the faculties to provide the website material as for the previous meeting discussion.

- HOD reminded regarding the PO attainment and counselor's allotment for the newly joined faculty.
- HOD enquired the Project Seminar Evaluation committee regarding the seminar topic finalization and Collection of Project status report

The following Faculty members were present in the meeting.

| Sl. No | Faculty Name | Sl. No. | Faculty Name |
|---|---|---|---|
| 1 | Dr. Prakash Kuruvatti | 8 | Mr. Girish M |
| 2 | Dr. Yathisha L | 9 | Mrs. Harshitha N |
| 3 | Dr. Prathibha M K | 10 | Ms. Anupama Shetter |
| 4 | Mrs. A C Pavithra | 11 | Mrs Keerthi A Kumbar |
| 5 | Mr. Guruprasad K N | 12 | Mrs. Shalini V S |
| 6 | Mr. Pradeep Kumar Y | 13 | Mrs. Nida Maheen |
| 7 | Mr. Abhilash G | 14 | Mrs. Meghana S |
| 8 | Mr. Manjunath K | | |

Sd/-
**HOD**

**COURSE MODULES OF THE SUBJECT TAUGHT FOR THE SESSION AUG-DEC 2020-21 (ODD SEM)**

## COURSE SYLLABI WITH COS

| **Faculty Name**: Dr. Prathibha M K | | | **Academic Year:** 2020 – 21 (Odd Semester) | | | | |
|---|---|---|---|---|---|---|---|
| **Department:** Electronics and Communication Engineering | | | | | | | |
| **Course Code** | **Course Title** | **Core/ Elective** | **Prerequisite** | **Contact Hours** | | | **Total Hrs/ Sessions** |
| | | | | **L** | **T** | **P** | |
| 18EC33 | ELECTRONIC DEVICES | Core | Basic electronics | 3 | - | - | 40 |
| **Objectives** | This course will enable students to:<br>1. Understand the basics of semiconductor physics and electronic devices.<br>2. Describe the mathematical models BJTs and FETs along with the constructional details.<br>3. Understand the construction and working principles of optoelectronic devices<br>4. Understand the fabrication process of semiconductor devices and CMOS process integration. | | | | | | |

**Topics Covered as per Syllabus**

Module-1: Semiconductors Bonding forces in solids, Energy bands, Metals, Semiconductors and Insulators, Direct and Indirect semiconductors, Electrons and Holes, Intrinsic and Extrinsic materials, Conductivity and Mobility, Drift and Resistance, Effects of temperature and doping on mobility, Hall Effect. (Text 1: 3.1.1, 3.1.2, 3.1.3, 3.1.4, 3.2.1, 3.2.3, 3.2.4, 3.4.1, 3.4.2, 3.4.3, 3.4.5).

Module-2: P-N Junctions Forward and Reverse biased junctions- Qualitative description of Current flow at a junction, reverse bias, Reverse bias breakdown- Zener breakdown, avalanche breakdown, Rectifiers. (Text 1: 5.3.1, 5.3.3, 5.4, 5.4.1, 5.4.2, 5.4.3) Optoelectronic Devices Photodiodes: Current and Voltage in an Illuminated Junction, Solar Cells, Photodetectors. Light Emitting Diode: Light Emitting materials.(Text 1: 8.1.1, 8.1.2, 8.1.3, 8.2, 8.2.1)

Module-3: Bipolar Junction Transistor Fundamentals of BJT operation, Amplification with BJTS, BJT Fabrication, The coupled Diode model (Ebers-Moll Model), Switching operation of a transistor, Cutoff, saturation, switching cycle, specifications, Drift in the base region, Base narrowing, Avalanche breakdown. (Text 1: 7.1, 7.2, 7.3, 7.5.1, 7.6, 7.7.1, 7.7.2, 7.7.3).

Module-4: Field Effect Transistors Basic pn JFET Operation, Equivalent Circuit and Frequency Limitations, MOSFETTwo terminal MOS structure- Energy band diagram, Ideal Capacitance – Voltage Characteristics and Frequency Effects, Basic MOSFET Operation- MOSFET structure, Current-Voltage Characteristics. (Text 2: 9.1.1, 9.4, 9.6.1, 9.6.2, 9.7.1, 9.7.2, 9.8.1, 9.8.2).

Module-5: Fabrication of p-n junctions Thermal Oxidation, Diffusion, Rapid Thermal Processing, Ion implantation, chemical vapour deposition, photolithography, Etching, metallization. (Text 1: 5.1) Integrated Circuits Background, Evolution of ICs, CMOS Process Integration, Integration of Other Circuit Elements. (Text 1: 9.1, 9.2, 9.3.1, 9.3.3).

**List of Text Books**

1. Ben. G. Streetman, Sanjay Kumar Banergee, “Solid State Electronic Devices”, 7thEdition, Pearson Education, 2016, ISBN 978-93-325-5508-2.
2. Donald A Neamen, Dhrubes Biswas, “Semiconductor Physics and Devices”, 4th Edition, MCGraw Hill Education, 2012, ISBN 978-0-07-107010-2.

**List of Reference Books**

| | |
|---|---|
| 1. S. M. Sze, Kwok K. Ng, "Physics of Semiconductor Devices", 3rd Edition, Wiley, 2018.<br>2. A. Bar-Lev, "Semiconductor and Electronic Devices", 3rd Edition, PHI, 1993. | |
| **List of URLs, Text Books, Notes, Multimedia Content, etc** | |
| 1. | |
| **Course Outcomes** | After studying this course, students will be able to:<br>1. Define the principles of semiconductor Physics<br>2. Outline the principles and characteristics of different types of semiconductor devices<br>3. Explain the fabrication process of semiconductor devices<br>4. Utilize the mathematical models of semiconductor junctions and MOS transistors for circuits and systems. |
| **Internal Assessment Marks:** 40 (3 Session Tests are conducted during the semester and marks allotted based on average of best performances). | |

## The Correlation of Course Outcomes (CO's) and Program Outcomes (PO's)

| **Subject Code:** | 18EC33 | **Faculty** : Dr.Prathibha M K | | | | **Title:** ELECTRONIC DEVICES | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **List of Course Outcomes** | **Program Outcomes** | | | | | | | | | | | |
| | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** | **PO11** | **PO12** | Total |
| **CO-1** | 2 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 5 |
| **CO-2** | 2 | 2 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 6 |
| **CO-3** | 2 | 2 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 7 |
| **CO-4** | 3 | 2 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 7 |
| **Total** | 9 | 7 | 4 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 4 | 25 |

**Note:** 3 = Strong Contribution 2 = Average Contribution 1 = Weak Contribution 0= No Contribution

## The Correlation of Course Outcomes (CO's) and Program Specific Outcomes (PSO's)

| **Subject Code:** | 18EC33 | **Faculty** : Dr.Prathibha M K | | **Title:** ELECTRONIC DEVICES | |
|---|---|---|---|---|---|
| **List of Course Outcomes** | **Program Specific Outcomes** | | | | |
| | **PSO-1** | **PSO-2** | **PSO-3** | **PSO-4** | **Total** |
| **CO-1** | 2 | 1 | 0 | 0 | 3 |
| **CO-2** | 2 | 1 | 0 | 0 | 3 |
| **CO-3** | 2 | 1 | 0 | 0 | 3 |
| **CO-4** | 2 | 2 | 0 | 0 | 4 |
| **Total** | 8 | 5 | 0 | 0 | 13 |

**Note:** 3 = Strong Contribution 2 = Average Contribution 1 = Weak Contribution 0= No Contribution

Sd/-
**HOD**

# ATME COLLEGE OF ENGINEERING

## DEPARTMENT OF ELECTRONICS AND COMMUNICATION

## TIME TABLE FOR EVEN SEMESTER - 2020-21

**SEM/SECTION : 4/B**

| DAY \ TIME | | 10.00 - 11.00 | 11.00 - 11.15 | 11.15 - 12.15 | 12.15 - 01.15 | 01.15 - 02.00 | 02.00 - 03.00 | |
|---|---|---|---|---|---|---|---|---|
| Mon | | 18EC42 | BREAK | 18CPC49 | 18EC46 | LUNCH BREAK | 18MATDIP41 | |
| Tue | | 18EC44 | | 18EC45 | 18EC43 | | 18MAT41 | |
| Wed | | 18EC44 | | 18EC46 | 18EC43 | | 18ECL48 | |
| Thu | | 18EC45 | | 18EC43 | 18MAT41 | | 18EC42 | |
| Fri | | 18MAT41 | | 18EC45 | 18EC42 | | 18ECL47 | |
| Sat | | 18EC44 | | 18EC46 | Counselling | | 18MATDIP41 | |

| Subject Code | Subject Title | Staff In – Charge | Initials |
|---|---|---|---|
| 18MAT41 | Complex Analysis, Probability and Statistical Methods | Mrs. Divya K | DK |
| 18EC42 | Analog Circuits | Mr. Guruprasad K N | GP |
| 18EC43 | Control Systems | Ms. Navya N | NN |
| 18EC44 | Engineering Statistics & Linear Algebra | Ms. Anupama Shetter | AS |
| 18EC45 | Signals & Systems | Mr. Manjunath K | MK |
| 18EC46 | Microcontroller | Mrs. Meghana S | MS |
| 18ECL47 | Microcontroller Laboratory | Mrs. Shalini V S | SVS |
| 18ECL48 | Analog Circuits Laboratory | MR. GURUPRASAD K N | G.P. |
| 18CPC49 | Constitution of India, Professional Ethics and Cyber Law | Mr. Chandrashekar C | CSC |
| 18MATDIP41 | Additional Mathematics – II (Only for Lateral Entry Students) | Mrs. Sowmya K | SK |

TT Coordinators

HOD

Dean Academics 19/4/21.

19/4/21

Prinicipal

# ATME COLLEGE OF ENGINEERING

## DEPARTMENT OF ELECTRONICS AND COMMUNICATION

## TIME TABLE FOR EVEN SEMESTER - 2020-21

**SEM/SECTION : 6/A**

| DAY \ TIME | | 10.00 - 11.00 | 11.00 - 11.15 | 11.15 - 12.15 | 12.15 - 01.15 | 01.15 - 02.00 | 02.00 - 03.00 | |
|---|---|---|---|---|---|---|---|---|
| Mon | | 18EC63 | BREAK | 18EC61 | 18EC62 | LUNCH BREAK | 18XX65X | |
| Tue | | 18EC62 | | 18XX65X | APTI | | 18ECL66 | |
| Wed | | 18EC63 | | 18XX65X | 18EC644 | | 18ECL67 | |
| Thu | | 18EC644 | | 18EC62 | 18EC63 | | 18EC61 | |
| Fri | | 18EC62 | | 18EC61 | 18EC644 | | TECH | |
| Sat | | 18EC61 | | 18EC63 | Counselling | | 18ECMP68 | |

| Subject Code | Subject Title | Staff In – Charge | Initials |
|---|---|---|---|
| 18EC61 | Digital Communication | Dr. Prathibha M K | Dr. MKP |
| 18EC62 | Embedded Systems | Mr. Pradeep Kumar Y | PKY |
| 18EC63 | Microwave & Antennas | Mrs. Nida Maheen | NM |
| 18EC644 | Digital System Design using Verilog | Dr. Mahesh P K | Dr. MPK |
| 18XX65X | Open Elective –A | | |
| 18ECL66 | Embedded Systems Laboratory | Mr. Manjunath K | MK |
| 18ECL67 | Communication Laboratory | Mrs. Pavithra A C | ACP |
| 18ECMP68 | Mini-project | Dr. Yathisha L/Mrs. Meghana S | Dr. YL/MS |
| TECH | Technical | Mr. Abhilash G | ABI |
| APTI | Aptitude | Mrs. Shalini V S | SVS |

TT Coordinators

HOD

19/4/21

Dean Academics

19/4/21

Prinicipal

# ATME COLLEGE OF ENGINEERING

## DEPARTMENT OF ELECTRONICS AND COMMUNICATION

## TIME TABLE FOR EVEN SEMESTER - 2020-21

**SEM/SECTION : 6/B**

| DAY / TIME | | 10.00 - 11.00 | 11.00 - 11.15 | 11.15 - 12.15 | 12.15 - 01.15 | 01.15 - 02.00 | 02.00 - 03.00 | |
|---|---|---|---|---|---|---|---|---|
| Mon | | 18EC62 | BREAK | 18EC644 | 18EC63 | LUNCH BREAK | 18XX65X | |
| Tue | | 18EC63 | | 18XX65X | 18EC61 | | 18EC62 | |
| Wed | | 18EC61 | | 18XX65X | 18EC63 | | 18EC644 | |
| Thu | | 18EC644 | | 18EC61 | APTI | | 18ECL66 | |
| Fri | | 18EC63 | | TECH | 18EC62 | | 18ECL67 | |
| Sat | | 18EC62 | | 18EC61 | Counselling | | 18ECMP68 | |

| Subject Code | Subject Title | Staff In – Charge | Initials |
|---|---|---|---|
| 18EC61 | Digital Communication | Mrs. Keerthi A kumbar | KAK |
| 18EC62 | Embedded Systems | Mr. Pradeep Kumar Y | PKY |
| 18EC63 | Microwave & Antennas | Mrs. Nida Maheen | NM |
| 18EC644 | Digital System Design using Verilog | Mr. Abhilash G | ABI |
| 18XX65X | Open Elective –A | | |
| 18ECL66 | Embedded Systems Laboratory | Mr. Manjunath K | MK |
| 18ECL67 | Communication Laboratory | Mrs. Pavithra A C | ACP |
| 18ECMP68 | Mini-project | Dr. Prathibha M K/ Ms. Navya N | Dr. MKP/NN |
| TECH | Technical | Mr. Abhilash G | ABI |
| APTI | Aptitude | Mrs. Shalini V S | SVS |

TT Coordinators

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# ATME COLLEGE OF ENGINEERING

## DEPARTMENT OF ELECTRONICS AND COMMUNICATION

## TIME TABLE FOR EVEN SEMESTER - 2020-21

**SEM/SECTION : 8/A**

| DAY \ TIME | | 10.00 - 11.00 | 11.00 - 11.15 | 11.15 - 12.15 | 12.15 - 01.15 | 01.15 - 02.00 | 02.00 - 03.00 | |
|---|---|---|---|---|---|---|---|---|
| **Mon** | | 17EC81 | BREAK | 17EC82 | 17EC835 | LUNCH BREAK | 17EC81 | |
| **Tue** | | 17EC82 | | 17EC835 | 17EC81 | | 17EC82 | |
| **Wed** | | 17EC835 | | 17EC82 | 17EC81 | | 17EC835 | |
| **Thu** | | 17ECP85 | | | | | 17ECS86 | |
| **Fri** | | 17ECP85 | | | | | 17ECS86 | |
| **Sat** | | | | | | | | |

| Subject Code | Subject Title | Staff In – Charge | Initials |
|---|---|---|---|
| 17EC81 | Wireless Cellular and LTE 4G Broadband | Mrs. Harshitha N | HN |
| 17EC82 | Fiber Optics & Networks | Dr. Prakash Kuravatti | Dr. PK |
| 17EC835 | Network and Cyber Security | Mr. Girish M | GM |
| 17EC84 | Internship/Professional Practice | PSE Committee | |
| 17ECP85 | Project Work | PSE Committee | |
| 17ECS86 | Seminar | PSE Committee | |

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# ATME COLLEGE OF ENGINEERING

## DEPARTMENT OF ELECTRONICS AND COMMUNICATION

## TIME TABLE FOR EVEN SEMESTER - 2020-21

**SEM/SECTION : 8/B**

| DAY / TIME | | 10.00 - 11.00 | 11.00 - 11.15 | 11.15 - 12.15 | 12.15 - 01.15 | 01.15 - 02.00 | 02.00 - 03.00 | |
|---|---|---|---|---|---|---|---|---|
| Mon | | 17EC835 | BREAK | 17EC82 | 17EC81 | LUNCH BREAK | 17EC835 | |
| Tue | | 17EC82 | | 17EC81 | 17EC835 | | 17EC82 | |
| Wed | | 17EC82 | | 17EC81 | 17EC835 | | 17EC81 | |
| Thu | | 17ECP85 | | | | | 17ECS86 | |
| Fri | | 17ECP85 | | | | | 17ECS86 | |
| Sat | | | | | | | | |

| Subject Code | Subject Title | Staff In – Charge | Initials |
|---|---|---|---|
| 17EC81 | Wireless Cellular and LTE 4G Broadband | Mrs. Harshitha N | HN |
| 17EC82 | Fiber Optics & Networks | Mrs. Pavithra A C | ACP |
| 17EC835 | Network and Cyber Security | Mr. Girish M | GM |
| 17EC84 | Internship/Professional Practice | PSE Committee | |
| 17ECP85 | Project Work | PSE Committee | |
| 17ECS86 | Seminar | PSE Committee | |

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# ATME COLLEGE OF ENGINEERING

## DEPARTMENT OF ELECTRONICS AND COMMUNICATION

## TIME TABLE FOR EVEN SEMESTER - 2020-21

**SEM/SECTION : 4/A**

| DAY \ TIME | | 10.00 - 11.00 | 11.00 - 11.15 | 11.15 - 12.15 | 12.15 - 01.15 | 01.15 - 02.00 | 02.00 - 03.00 | |
|---|---|---|---|---|---|---|---|---|
| **Mon** | | 18MAT41 | | 18EC44 | 18EC42 | | 18MATDIP41 | |
| **Tue** | | 18EC43 | | 18CPC49 | 18MAT41 | | 18ECL47 | |
| **Wed** | | 18EC46 | **BREAK** | 18MAT41 | 18EC44 | **LUNCH BREAK** | 18EC45 | |
| **Thu** | | 18EC44 | | 18EC42 | 18EC45 | | 18EC46 | |
| **Fri** | | 18EC45 | | 18EC46 | 18EC43 | | 18ECL48 | |
| **Sat** | | 18EC42 | | 18EC43 | Counselling | | 18MATDIP41 | |

| Subject Code | Subject Title | Staff In – Charge | Initials |
|---|---|---|---|
| 18MAT41 | Complex Analysis, Probability and Statistical Methods | Mrs. Priyanka N B | PNB |
| 18EC42 | Analog Circuits | Mr. Guruprasad K N | GP |
| 18EC43 | Control Systems | Ms. Navya N | NN |
| 18EC44 | Engineering Statistics & Linear Algebra | Mrs. Keerthi A Kumbar | KAK |
| 18EC45 | Signals & Systems | Dr. Yathisha L | Dr. YL |
| 18EC46 | Microcontroller | Dr. Bhagyashree S R | Dr. SRB |
| 18ECL47 | Microcontroller Laboratory | Mrs. Shalini V S | SVS |
| 18ECL48 | Analog Circuits Laboratory | Ms. Anupama Shetter | AS |
| 18CPC49 | Constitution of India, Professional Ethics and Cyber Law | Mr. Chandrashekar C | CSC |
| 18MATDIP41 | Additional Mathematics – II (Only for Lateral Entry Students) | Mrs. Sowmya K | SK |

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# Department of Electronics and Communication Engineering

## ONLINE CLASS TIME TABLE FOR ODD SEMESTER 2020-21

**Semester : 3 B**

| DAY | SEM | 9:00 - 10:00 | 10:00-11:00 | 11:15 - 12:15 | 12:15 - 1:15 | 1:15-2:00 | 2:00-3.00 | 3:00-4.00 | |
|---|---|---|---|---|---|---|---|---|---|
| Monday | III 'B' | | 18EC34 | 18EC35 | 18MAT31 | | 18EC32 | | |
| Tuesday | III 'B' | | 18MAT31 | 18EC36 | 18EC34 | | 18ECL37 | | |
| Wednesday | III 'B' | | 18EC33 | 18KAK39 | 18MAT31 | **Lunch Break** | APTITUDE | | |
| Thursday | III 'B' | | 18EC32 | 18EC33 | 18EC36 | | 18EC35 | | |
| Friday | III 'B' | | 18EC33 | 18EC36 | 18MAT31 | | 18ECL38 | | |
| Saturday | III 'B' | | 18EC32 | 18EC34 | 18EC35 | | MENTORING | | |

| Subject Code | Subject Title | Total Hours Alloted | Faculty In-Charge |
|---|---|---|---|
| 18MAT31 | TRANSFORM CALCULUS, FOURIER SERIES | 4 | DIVYA K |
| 18EC32 | NETWORK THEORY | 3 | DARSHINI M B |
| 18EC33 | ELECTRONIC DEVICES | 3 | Dr. PRATHIBA M K |
| 18EC34 | DIGITAL SYSTEM DESIGN | 3 | HARSHITHA N |
| 18EC35 | COMPUTER ORGANIZATION & ARCHITECTURE | 3 | KEERTHI A KUMBAR |
| 18EC36 | POWER ELECTRONICS AND INSTRUMENTATION | 3 | Dr. YATHISHA L |
| 18ECL37 | ELCTRONIC DEVICES AND INSTRUMENTATION | 1 | PRAJWALASIMHA S N |
| 18ECL38 | DIGITAL SYSTEM DESIGN LABORATORY | 1 | PRADEEPKUMAR Y |
| 18KAK39 | ADALITHA KANNADA | 1 | NANDEESHA K G |
| | APTITUDE | 1 | SHALINI V S |

Coordinator

HOD

# Department of Electronics and Communication Engineering

## ONLINE CLASS TIME TABLE FOR ODD SEMESTER 2020-21

**Semester : 3 A**

| DAY | SEM | 9:00 - 10:00 | 10:00-11:00 | 11:15 - 12:15 | 12:15 - 1:15 | 1:15-2:00 | 2:00-3.00 | 3.00-4.00 | |
|---|---|---|---|---|---|---|---|---|---|
| Monday | III 'A' | | 18MAT31 | 18EC36 | 18EC34 | | 18ECL37 | | |
| Tuesday | III 'A' | | 18EC33 | 18MAT31 | 18EC35 | | MENTORING | | |
| Wednesday | III 'A' | | 18EC32 | 18EC35 | 18MAT31 | Lunch | 18EC34 | | |
| Thursday | III 'A' | | 18EC36 | 18EC35 | 18EC32 | Break | 18ECL38 | | |
| Friday | III 'A' | | 18EC34 | 18MAT31 | APTITUDE | | 18EC33 | | |
| Saturday | III 'A' | | 18EC36 | 18KAK39 | 18EC33 | | 18EC32 | | |

| Subject Code | Subject Title | Total Hours Alloted | Faculty In-Charge |
|---|---|---|---|
| 18MAT31 | TRANSFORM CALCULUS, FOURIER SERIES AND NUMERICAL TECHNIQUES | 4 | PRIYANKA N B |
| 18EC32 | NETWORK THEORY | 3 | ABHILASH G |
| 18EC33 | ELECTRONIC DEVICES | 3 | Dr. PRATHIBA M K |
| 18EC34 | DIGITAL SYSTEM DESIGN | 3 | PAVITHRA A C |
| 18EC35 | COMPUTER ORGANIZATION & ARCHITECTURE | 3 | Dr.BHAGYASHREE S R |
| 18EC36 | POWER ELECTRONICS AND INSTRUMENTATION | 3 | Dr. YATHISHA L |
| 18ECL37 | ELECTRONIC DEVICES AND INSTRUMENTATION LABORATORY | 1 | GURUPRASAD K N |
| 18ECL38 | DIGITAL SYSTEM DESIGN LABORATORY | 1 | PRADEEPKUMAR Y |
| 18KAK39 | ADALITHA KANNADA | 1 | NANDEESHA K G |
| | APTITUDE | 1 | PRAJWALASIMHA S N |

Coordinator

HOD

# Department of Electronics and Communication Engineering

## ONLINE CLASS TIME TABLE FOR ODD SEMESTER 2020-21

**Semester : 5 A**

| DAY | SEM | 9:00 - 10:00 | 10:00-11:00 | 11:15 - 12:15 | 12:15 - 1:15 | 1:15-2:00 | 2:00-3:00 | 3:00-4:00 | |
|---|---|---|---|---|---|---|---|---|---|
| Monday | V 'A' | | 18EC54 | 18EC53 | 18EC52 | | 18ECL57 | | |
| Tuesday | V 'A' | | 18EC52 | TECHNICAL | 18EC56 | | 18ES51 | | |
| Wednesday | V 'A' | | 18ES51 | 18EC54 | APTITUDE | **Lunch Break** | 18EC55 | | |
| Thursday | V 'A' | | 18EC52 | 18EC54 | 18EC56 | | 18EC55 | | |
| Friday | V 'A' | | 18EC53 | 18EC56 | 18ES51 | | 18ECL58 | | |
| Saturday | V 'A' | | 18CIV59 | 18EC55 | 18EC53 | | MENTORING | | |

| Subject Code | Subject Title | Total Hours Alloted | Faculty In-Charge |
|---|---|---|---|
| 18ES51 | TECHNOLOGICAL INNOVATION MANAGEMENT & ENTREPRENEURSHIP | 3 | HARSHITHA N |
| 18EC52 | DIGITAL SIGNAL PROCESSING | 3 | ANUPAMA SHETTER |
| 18EC53 | PRINCIPLES OF COMMUNICATION SYSTEM | 3 | GIRISH M |
| 18EC54 | INFORMATION THEORY AND CODING | 3 | CHANDRA SHEKAR P |
| 18EC55 | ELCTROMAGENTIC WAVES | 3 | Dr. PRAKASH KURAVATTI |
| 18EC56 | VERILOG HDL | 3 | Dr. MAHESH P K |
| 18ECL57 | DSP LABORATORY | 1 | ANUPAMA SHETTER |
| 18ECL58 | HDL LABORATORY | 1 | GIRISH M |
| 18CIV59 | ENVIRONMENT | 1 | NAMITHA |
| | APTITUDE | 1 | PRADEEPKUMAR Y |
| | TECHNICAL TRAINING | 1 | KEERTHI A KUMBAR |

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# Department of Electronics and Communication Engineering

## ONLINE CLASS TIME TABLE FOR ODD SEMESTER 2020-21

**Semester : 5 B**

| DAY | SEM | 9:00 - 10:00 | 10:00-11:00 | 11:15 - 12:15 | 12:15 - 1:15 | 1:15-2:00 | 2:00-3.00 | 3.00-4.00 | |
|---|---|---|---|---|---|---|---|---|---|
| Monday | V 'B' | | 18EC52 | 18EC56 | 18ES51 | | 18EC54 | | |
| Tuesday | V 'B' | | 18EC56 | 18EC53 | 18EC55 | | 18ECL57 | | |
| Wednesday | V 'B' | | 18EC55 | 18EC53 | 18EC52 | **Lunch Break** | 18ES51 | | |
| Thursday | V 'B' | | 18EC54 | 18EC55 | 18EC53 | | 18ECL58 | | |
| Friday | V 'B' | | 18ES51 | APTITUDE | 18EC52 | | MENTORING | | |
| Saturday | V 'B' | | 18EC56 | 18EC54 | 18CIV59 | | TECHNICAL | | |

| Subject Code | Subject Title | Total Hours Alloted | Faculty In-Charge |
|---|---|---|---|
| 18ES51 | TECHNOLOGICAL INNOVATION MANAGEMENT & | 3 | HARSHITHA N |
| 18EC52 | DIGITAL SIGNAL PROCESSING | 3 | ANUPAMA SHETTER |
| 18EC53 | PRINCIPLES OF COMMUNICATION SYSTEM | 3 | GIRISH M |
| 18EC54 | INFORMATION THEORY AND CODING | 3 | MANJUNATH K |
| 18EC55 | ELCTROMAGENTIC WAVES | 3 | Dr. PRAKASH KURAVATTI |
| 18EC56 | VERILOG HDL | 3 | PRADEEPKUMAR Y |
| 18ECL57 | DSP LABORATORY | 1 | ANUPAMA SHETTER |
| 18ECL58 | HDL LABORATORY | 1 | MANJUNATH K |
| 18CIV59 | ENVIRONMENT | 1 | NAMITHA |
| | APTITUDE | 1 | DARSHINI M B |
| | TECHNICAL TRAINING | 1 | KEERTHI A KUMBAR |

Coordinator

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# Department of Electronics and Communication Engineering

## ONLINE CLASS TIME TABLE FOR ODD SEMESTER 2020-21

**Semester : 7 A**

| DAY | SEM | 9:00 - 10:00 | 10:00-11:00 | 11:15 - 12:15 | 12:15 - 1:15 | 1:15-2:00 | 2:00-3.00 | 3.00-4.00 | |
|---|---|---|---|---|---|---|---|---|---|
| Monday | VII 'A' | | 17EC71 | 17EC72 | 17EC73 | Lunch Break | MENTORING | | |
| Tuesday | VII 'A' | | 17EC72 | 17EC71 | 17EC755 | | 17ECL76 | | |
| Wednesday | VII 'A' | | 17EC741 | 17EC71 | 17EC755 | | 17EC72 | | |
| Thursday | VII 'A' | | 17EC741 | APTITUDE | 17EC73 | | PROJECT | | |
| Friday | VII 'A' | | 17EC73 | 17EC741 | TECHNICAL | | 17ECL77 | | |
| Saturday | VII 'A' | | 17EC73 | 17EC72 | 17EC755 | | 17EC71 | | |

| Subject Code | Subject Title | Total Hours Alloted | Faculty In-Charge |
|---|---|---|---|
| 17EC71 | MICROWAVES AND ANTENNAS | 4 | MANJUNATH K |
| 17EC72 | DIGITAL IMAGE PROCESSING | 4 | PRAJWALASIMHA S N |
| 17EC73 | POWER ELECTRONICS | 4 | SHALINI V S |
| 17EC741 | MULTEMEDIA COMMUNICATION | 3 | PRADEEPKUMAR Y |
| 17EC755 | SATELLITE COMMUNICATION | 3 | DARSHINI M B |
| 17ECL76 | ADVANCED COMMUNICATION LAB | 1 | KEERTHI A KUMBAR |
| 17ECL77 | VLSI LAB | 1 | CHANDRA SHEKAR P |
| 17ECP78 | PROJECT WORK PHASE 1 + PROJECT WORK | 2 | GIRISH M |
| | APTITUDE | 1 | KEERTHI A KUMBAR |
| | TECHNICAL TRAINING | 1 | ABHILASH G |

Coordinator

HOD

# Department of Electronics and Communication Engineering

## ONLINE CLASS TIME TABLE FOR ODD SEMESTER 2020-21

**Semester : 7 B**

| DAY | SEM | 9:00 - 10:00 | 10:00-11:00 | 11:15 - 12:15 | 12:15 - 1:15 | 1:15-2:00 | 2:00-3.00 | 3.00-4.00 | |
|---|---|---|---|---|---|---|---|---|---|
| Monday | VII 'B' | | 17EC741 | 17EC73 | 17EC755 | | 17ECL76 | | |
| Tuesday | VII 'B' | | 17EC73 | 17EC741 | 17EC72 | | MENTORING | | |
| Wednesday | VII 'B' | | 17EC71 | 17EC72 | APTITUDE | Lunch Break | 17EC755 | | |
| Thursday | VII 'B' | | 17EC71 | 17EC741 | 17EC755 | | 17ECL77 | | |
| Friday | VII 'B' | | 17EC72 | 17EC71 | 17EC73 | | PROJECT | | |
| Saturday | VII 'B' | | 17EC71 | TECHNICAL | 17EC73 | | 17EC72 | | |

| Subject Code | Subject Title | Total Hours Alloted | Faculty In-Charge |
|---|---|---|---|
| 17EC71 | MICROWAVES AND ANTENNAS | 4 | GURUPRASAD K N |
| 17EC72 | DIGITAL IMAGE PROCESSING | 4 | PRAJWALASIMHA S N |
| 17EC73 | POWER ELECTRONICS | 4 | SHALINI V S |
| 17EC741 | MULTEMEDIA COMMUNICATION | 3 | PAVITHRA A C |
| 17EC755 | SATELLITE COMMUNICATION | 3 | DARSHINI M B |
| 17ECL76 | ADVANCED COMMUNICATION LAB | 1 | PAVITHRA A C |
| 17ECL77 | VLSI LAB | 1 | SHALINI V S |
| 17ECP78 | PROJECT WORK PHASE I + PROJECT WORK SEMINAR | 2 | KEERTHI A KUMBAR |
| | APTITUDE | 1 | GURUPRASAD K N |
| | TECHNICAL TRAINING | 1 | ABHILASH G |

Coordinator

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# ATME COLLEGE OF ENGINEERING

## DEPARTMENT OF ELECTRONICS AND COMMUNICATION

## OFFLINE TIME TABLE FOR ODD SEMESTER - 2020-21

**SEM/SECTION : 3/C** **HALL NO. 202**

| DAY \ TIME | | 10.00 - 11.00 | 11.00 - 12.00 | 12.00 - 01.00 | 01.00 -01.45 | 01.45 - 02.45 | 02.45 - 03.45 | |
|---|---|---|---|---|---|---|---|---|
| Mon | | 18EC32 | 18EC35 | DIP MATHS | LUNCH BREAK | 18EC36 | 18EC33 | |
| Tue | | 18MAT31 | 18EC34 | 18EC34 | | EDL(C1)/DSD(C2) | | |
| Wed | | 18MAT31 | 18EC32 | 18EC36 | | 18EC33 | 18EC32 | |
| Thu | | 18EC35 | 18MAT31 | DIP MATHS | | EDL(C2)/DSD(C1) | | |
| Fri | | 18EC33 | 18EC34 | 18EC34 | | 18MAT31 | DIP MATHS | |
| Sat | | 18EC32 | 18EC35 | 18KAK39 | | 18EC36 | 18EC33 | |

| Subject Code | Subject Title | Staff In – Charge | Initials |
|---|---|---|---|
| 18MAT31 | Transform Calculus, Fourier Series & Numerical Techniques | Mrs. Priyanka N B | PNB |
| 18EC32 | Network theory | Mr. Abhilash G | ABI |
| 18EC33 | Electronic Devices | Mr. Guruprasad K N | GP |
| 18EC34 | Digital System Design | Dr. Basavaraj L | Dr. BL |
| 18EC35 | Computer Organization & Architectures | Mrs. Keerthi A Kumbar | KAK |
| 18EC36 | Power Electronics and Instrumentation | Mrs. Shalini V S | SVS |
| 18EC37 | Electronic Devices and Instrumentation Laboratory | Mr. Guruprasad K N, Mr. Prajwala Simha S N | GP/SNP |
| 18EC38 | Digital System Design Laboratory | Mr. Pradeep Kumar Y, Mrs. Harshitha N | PKY/HN |
| 18KAK39 | Aadalitha Kannada | Mr. Nandish K G | NKG |
| 18MATDIP31 | Additional Mathematics - 1 | Mrs. Banupriya | BP |

HOD

30/12/20

Dean Academics

30/12/20

Prinicipal

# Module 1: SEMICONDUCTORS

## Introduction

Today's electronic devices are made up of a wide variety of components. Some, like resistors and capacitors, are simple and passive, while others, such as advanced central processing unit (CPU) chips, are extremely complex and can contain over 20 billion transistors

More than 95% of the electronic devices are based on silicon (Si) technology. Therefore, silicon is the most important material in semiconductor industry. Most of the electronic products like microprocessors or memory products are based on silicon technology. Alternative materials like gallium arsenide or germanium are used for specific applications, like light emitting diodes or ultra-high speed electronics.

Nowadays the most important electronic device is the Metal oxide semiconductor field effect transistor (MOSFET). The MOSFET is closely related to Digital Electronics. If it comes to the realization of digital electronics the MOS transistor is the electronic device of choice. Bipolar transistors are mainly used in the area of analog electronics. Throughout the last 20 years we have seen a trend from analog to digital electronics. However, there is still (and will be) a need for analog electronics.

## Semiconductors bonding forces in solids

All **solids** are composed of atoms that are **bonded** together. The **bonding** may be of different nature depending upon the constituent atoms and the prevalent energy states, but all the **bonds** are meant to provide a certain level of attractive force to keep the atoms.

**TYPES OF BONDING IN SOLIDS** Ionic bonding Covalent bonding Metallic bonding.

**IONIC BOND** An ionic bonding is the attractive force existing between a positive ion and a negative ion when they are brought into close proximity. These ions are formed when the atoms of different elements involved loss or gain electrons in order to stabilize their outer shell electron configuration.

**COVALENT BOND** In covalent bonding the stable arrangement of electrons in an outer shell is achieved by a process of valence electron sharing rather than electron transfer. A covalent bond may also be formed when two or more atoms of different non-metals share one or more pairs of valence electrons.

**METALLIC BOND** the valence electrons from all the atoms belonging to the crystal are free to move throughout the crystal. The crystal may be considered as an array of positive metal ions embedded in a "cloud" or "sea" of free electrons. This type of bonding is called metallic bonding.

## Energy bands, Metals, Semiconductors and Insulators

**Energy bands** consisting of a large number of closely spaced **energy** levels exist in crystalline materials. The **bands** can be thought of as the collection of the individual **energy** levels of electrons surrounding each atom.

There Important energy bands are

1. Valence band,
2. Conduction Band
3. Forbidden Band.

**Valence Band**

- Band of energy level which are far away from the nucleus.
- An e- in valence band, expenses strong force of attraction from nucleolus.
- And it can't move freely when external electric field is applied.
- It is called bounded electron.

**Conduction Band**

- Band of energy level which are closer to nucleus.
- An e- in valence band, expenses strong force of attraction from nucleus.
- And it can't move freely when external electric field is applied.
- It is called bounded electron.

**Forbidden Band / Energy Gap**

- In solid-state physics, an **energy gap** or **band gap**, is an energy range in a solid where no electron states can exist.
- It generally refers to the energy difference (in electron volts) between the top of the valence band and the bottom of the conduction band in insulators and semiconductors

**Types of Materials**

Materials can be divided into 3 types based on the values of energy gap, The Fig. 1.1 shows the Energy Bands of different Materials.

1. Insulator
2. Conductor
3. Semi-Conductor

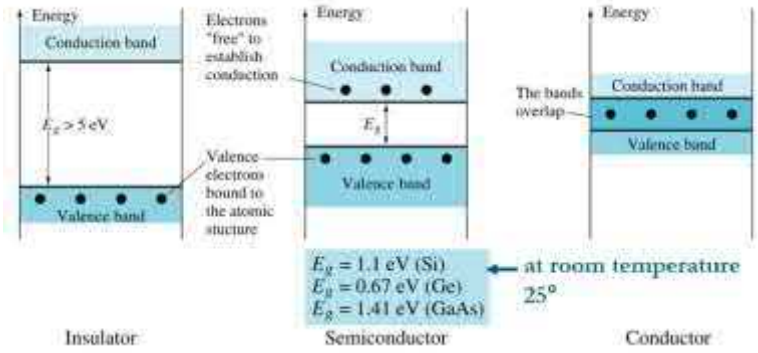



**Fig. 1.1:** Energy Bands of different Materials

## INSULATORS

- It is a material with large energy gap.

  Eg= several ev ,wher ev= 1.6*10-19 joules
- Due to large energy gap an e- from valence band can't move into conduction band remains complete fill.
- Conduction band completely empty.
- Ex: glass, Diamond, Silicon di oxide.

## CONDUCTORS

- It is a material with large energy gap.

  $E_g$= several eV, where eV = 1.6*10-19 joules
- Due to large energy gap an e- from valence band can't move into conduction band remains complete fill.
- Conduction band completely empty.
- Ex: glass, Diamond, Silicon di oxide.

## SEMICONDUCTORS

- The materials, in which the conduction and valence bands are separated by a small energy gap (1eV) are called semiconductors.
- Silicon and germanium are the commonly used semiconductors.

- A small energy gap means that a small amount of energy is required to free the electrons by moving them from the valence band in to the conduction band.
- If the temperature is further increased, more valence electrons will acquire energy to jump into the conduction band.
- If a valence receives sufficient thermal energy, it can move into conduction band leaving a vacancy in valence band, which is called hole and therefore, if one e- is sufficiently thermally energized it creates a pair of free e- and hole, this process is called carrier generation.
- Carrier generation can happen due to thermal excitation, Photo excitation, Electrical excitation, Impact ionization.Ex: Si, Ge, GaAS, Gap.GaAsP,

## Direct and Indirect semiconductors

The process of free e- returning from conduction band to valence band which causes disappearance of a free e- , hole pair is called carrier recombination. Semiconductors are divided into 2 types based upon the method of recombination.

1. Direct band gap SC
2. Indirect band gap SC

**Direct band gap SC**

- For these semiconductors, Conduction band minima and valence band maxima occurs at same value of momentum.
- Silicon An e- from CB directly return to VB without changing its momentum. And releases energy in the form of light (photon hV). Ex: GaAS, Gap.GaAsP.

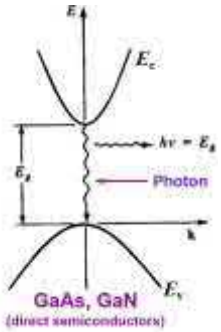



**Fig. 1.2:** Direct band gap semiconductors

**Indirect band gap SC**

- CB minima and VB maxima occurs at different value of momentum.
- Silicon When e- from CB returns VB after changing its momentum is called indirect band gap semiconductor.
- E- Changes its momentum by releasing phonon which is a heat particle.
- Ex: Si, Ge.

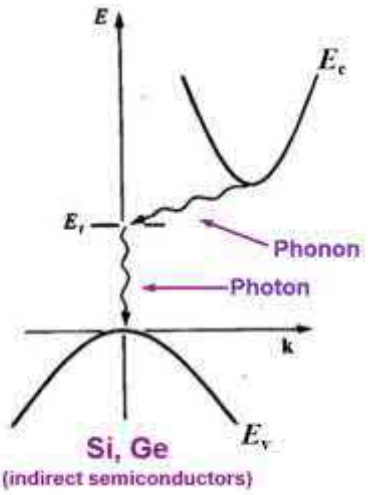



**Fig. 1.3:** Indirect band gap semiconductors

# Electrons and Holes, Intrinsic and Extrinsic materials

There is an energy gap between the conduction and valence bands for semiconductors. However, valence electrons can ""absorb" heat or light energy, to enable them to "jump up" into the conduction band. Even at typical room temperatures, many electrons will have acquired sufficient energy to jump up into the conduction band and if the temperature increases, so will the number of electrons in the conduction band. Each electron that moves to the conduction band, leaves behind a vacant position or **hole** in the valence band, (i.e. an unoccupied electron position in the covalent bond that it "escaped" from).This process is called **electron hole pair generation**.

The free electrons from electron hole pairs, enable current to flow in the semiconductor when an external voltage is applied. The holes in the valence band also allow electron movement within the valence band itself and this also contributes to current flow. The net effect is that heat increases the conduction properties of a pure semiconductor, due to electron hole pair generation. The conductance, however, will still be very low, compared to a typical metal conductor. This is due

to the relatively low number of electron hole pairs generated, compared to the vast number of free electrons in a conductor. For this reason, the currents produced in pure semiconductor will typically only be in the region of micro-Amps.

If the conduction band electron and the valence band hole are created by thermal excitation of a valence band electron to the conduction band, then they are called **Electron-Hole Pair (EHP).**

**Intrinsic and Extrinsic materials**

A Semiconductor which does not have any kind of impurities, behaves as an **Insulator at 0k** and behaves as **a Conductor at higher temperature** is known as Intrinsic Semiconductor or Pure Semiconductors.

Germanium and Silicon (4th group elements) are the best examples of intrinsic semiconductors and they possess diamond cubic crystalline structure.

- The conductivity of a pure (intrinsic) s/c is low due to the low number of free carriers.
- The number of carriers are generated by thermally or electromagnetic radiation for a pure semiconductor.
- For an intrinsic semiconductor

$$\mathbf{n = p = n_i} \qquad \mathbf{(1)}$$

n = concentration of electrons per unit volume

p = concentration of holes per unit volume

$n_i$ = the intrinsic carrier concentration of the semiconductor under consideration

$$\mathbf{n = p} \qquad \mathbf{(2)}$$

- Number of $e^-$'s in CB = number of holes in VB.
- This is due to the fact that when an $e^-$ makes a transition to the CB, it leaves a hole behind in VB. We have a bipolar (two carrier) conduction and **the number of holes and $e^-$ 's are equal.**

$$\mathbf{n.p = n_i^2} \qquad \mathbf{(3)}$$

This equation is called as mass-action law.

- The intrinsic carrier concentration $n_i$ depends on;
    - The semiconductor material, and
    - The temperature.

**Extrinsic Semiconductors**

The Extrinsic Semiconductors are those in which **impurities** of large quantity are present. Usually, the impurities can be either **3rd** group elements or **5th** group elements.

Based on the impurities present in the Extrinsic Semiconductors, they are classified into **two** categories.

1. N-**type** semiconductors
2. **P-type** semiconductors

N-**type** semiconductors

- When any pentavalent element such as Phosphorous, Arsenic or Antimony is added to the intrinsic
- Semiconductor, four electrons are involved in covalent bonding with four neighboring pure Semiconductor atoms.
- The fifth electron is weakly bound to the parent atom. And even for lesser thermal energy it is released leaving the parent atom positively ionized.
- The Intrinsic Semiconductors doped with pentavalent impurities are called N-type Semiconductors.
- The energy level of fifth electron is called donor level.
- The donor level is close to the bottom of the conduction band most of the donor level electrons are excited in to the conduction band at room temperature and become the Majority charge carriers.
- Hence in N-type Semiconductors electrons are Majority carriers and holes are Minority carriers.

**P-type semiconductors**

- When a trivalent elements such as **Al, Ga or Indium** have three electrons in their outer most orbits, added to the intrinsic semiconductor all the three electrons of Indium are engaged in covalent bonding with the three neighboring Si atoms.
- Indium needs one more electron to complete its bond. This electron maybe supplied by Silicon, thereby creating a vacant electron site or hole on the semiconductor atom.
- Indium accepts one extra electron, the energy level of this impurity atom is called **acceptor level** and this acceptor level lies just above the valence band.

- These type of trivalent impurities are called **acceptor impurities** and the semiconductors doped the acceptor impurities are called **P-type semiconductors**.
- Even at relatively low temperatures, these acceptor atoms get ionized taking electrons from valence band and thus giving rise to holes in valence band for conduction**.**
- Due to ionization of acceptor atoms only holes and **no electrons** are created.
- Thus holes are more in number than electrons and hence **holes are majority** carriers and **electrons are minority** carriers in P-type semiconductors**.**

## Conductivity and Mobility, Drift and Resistance

Carrier **mobility** in a **semiconductor** is one of the most important parameters for the operation of electronic devices. Actually, the **mobility** measures the ability of free carriers (electrons or holes) to move in the material as it is subjected to an external electric field. **Mobility** is the speed with which a particle moves. It depends upon the applied electric field. **Conductivity** is the ability to transport the charge carriers that is physical and chemical characteristics of the material. **Conductivity** is inverse of resistivity.

When one electron-hole pair is created, there are two charge carriers produced. One is negative charge carrier associated with the electron and other is positive charge carrier associated to the hole.

Say the mobility of the hole in the crystal is $\mu_h$ and the mobility of electron in the same crystal is $\mu_e$. These holes and electrons move in opposite direction. The electrons always tend to move in opposite to the applied electric field, the current density due to drift of holes is given by,

$$\mathbf{J_h = epv_h = ep\mu_h E} \qquad (4)$$

The current density due to drift of electrons is given by,

$$\mathbf{J_e = env_e = en\mu_e E} \qquad (5)$$

As the drifting of holes contributes current in the same direction and drifting of electrons provides current in opposite direction, in both cases, currents are in the same direction that is in the direction of drifting of holes. Hence, resultant current due to these both charge carriers will be arithmetic sum of two currents and hence resultant current density would be,

$$\mathbf{J = J_h + J_e = epv_h + env_e = ep\mu_h E + en\mu_e E = (p\mu_h + n\mu_e)eE = \sigma E} \qquad (6)$$

Where

n is the magnitude of free electron concentration,

'p' is the magnitude of hole concentration and

$\sigma = (p\mu_h + n\mu_e)e$ is the Conductivity of semiconductor.

## Effects of temperature and doping on mobility

The mobility of intrinsic **semiconductor** decreases with increase in **temperature** because at higher **temperature**, the numbers of carriers are more and they are energetic also. This causes an increased number of collisions of charge carriers with the atoms and thus the mobility decreases.

The two main scattering events that influence electron and hole motion (and, thus, mobility) are the lattice scattering and the *impurity scattering*.

All lattice atoms vibrate due to temperature and can scatter carriers due to collisions. These collective vibrations are called phonons, thus *lattice scattering* is also known as *phonon scattering*. With increasing temperature, lattice vibrations increase, and the mean free time between Collisions decreases => mobility decreases (typical dependence $\sim T^{-3/2}$ )

Scattering from crystal defects and ionized impurities dominate at low temperatures. Since carriers moving with low velocity (at low temperature) can get scattered more easily by ionized impurities, this kind of scattering causes a decrease in carrier mobility with decreasing temperature (typical dependence $\sim T^{3/2}$).

Note: the scattering probability is inversely proportional to the mean free time (and to mobility), hence, the mobility's due to two or more scattering events add inversely:

$$\frac{\mathbf{1}}{\mu} = \frac{\mathbf{1}}{\mu_1} + \frac{\mathbf{1}}{\mu_2} + \cdots \qquad (\mathbf{7})$$

Thus, the mechanism causing the lowest mobility value dominates.

Mobility also decreases with increasing doping, since the ionized impurities scatter carriers more (e.g., $\mu_n$ for intrinsic Si is 1350 $cm^2/V-sec$ at 300 K, whereas with a donor doping of $10^{17}/cm^3$ , n drops to $700 cm^2/V-sec$ ).

## Hall Effect

If a current (I) carrying semiconductor is placed in a transverse magnetic field (B), then electric field (force) is induced in the perpendicular direction of I and B processing.

Consider a semiconductor (P-Type or N-types) in which current I and Magnetic field B is applied, a force is act on the charge carriers. This force pushing the charge carriers towards the back of the semiconductor.

When the mobile carriers (i.e. electrons or holes) are pushed towards the back, the front becomes depleted and the semiconductor loss it neutrality.

Now there is an excess of mobile charge carriers at the back and an excess of opposite charge due to impurity atom at the front.

**If the semiconductor is N-type:** The electron will be in excess at the back surface and the surface becomes negatively charged with respect to front. This gives rise to a potential difference called Hall voltage between front and back

**If the semiconductor is P-type:** The hole will be in excess at the back surface and the surface becomes positively charged with respect to front. The polarity of Hall voltage is in reverse direction.

At equilibrium, the force exerted on electrons due to electric field and magnetic field must balance each other.

$$\mathbf{F\ (electric) + F\ (magnetic) = 0} \qquad \mathbf{(8)}$$

The conductivity and Hall coefficient for N-type semiconductor is given

$$\boldsymbol{\mu_n = \frac{\sigma}{n.q} = \sigma R_H} \qquad \mathbf{(9)}$$

$R_H$ Is the Hall coefficient.

# ELECTRONIC DEVICES

## Module-1

## Semiconductors

# Bonding forces in solids

- There are three types of solid:
  1. **Covalent network** - very hard with very high melting points and poor conductivity.
  2. **Ionic** (formed form ions) - hard, brittle, high melting points and poor conductivity.
  3. **Metallic** (formed from metal atoms) - soft or hard, high melting points, good conductivity, malleable and ductile.

NB: A solid with only one type of atom is also called '**atomic**'

# Energy bands

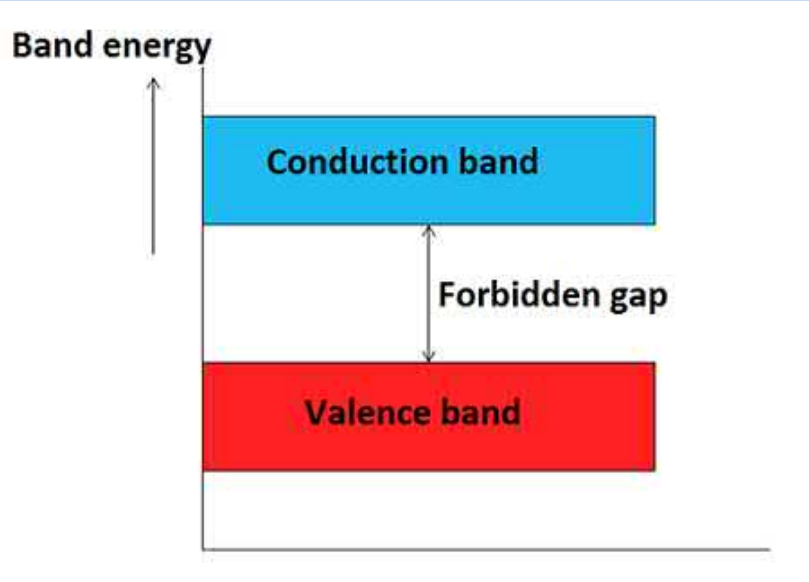
There are number of energy bands in solids but three of them are very important. These three energy bands are important to understand the behavior of solids. These energy bands are

- Valence band
- Conduction band
- Forbidden band or forbidden gap

# Energy bands

## Valence band

- The energy band which is formed by grouping the range of energy levels of the valence electrons or outermost orbit electrons is called as valence band.
- Electrons in the valence band have lower energy than the electrons in conduction band.
- The electrons present in the valence band are loosely bound to the nucleus of atom.

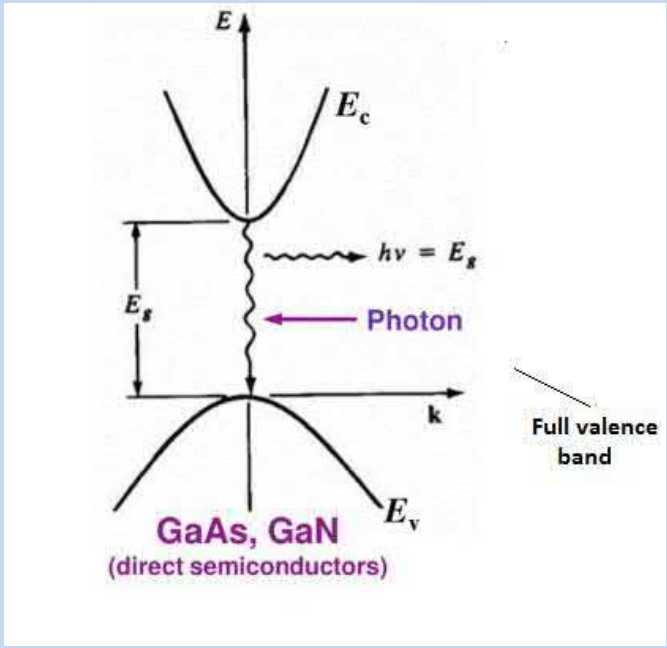


# Metals, Semiconductors and Insulators

- Forbidden gap plays a major role for determining the electrical conductivity of material. Based on the forbidden gap materials are classified in to three types, they are
  - Insulators
  - Conductors
  - semiconductors

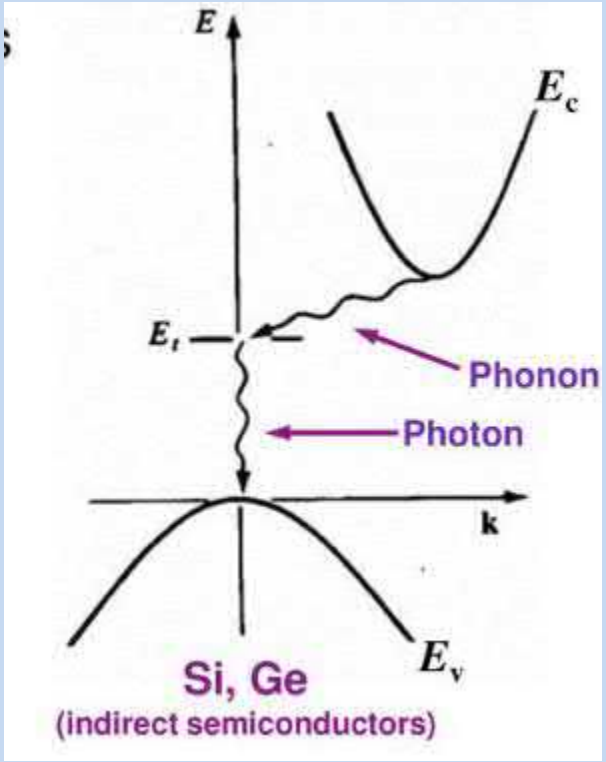
# Direct and Indirect Band Gap Semiconductors

- The band gap represents the minimum energy difference between the top of the valence band and the bottom of the conduction band
- However, the top of the valence band (valence band, VB maxima) and the bottom of the conduction band (conduction band minima, CB minima) are not generally at the same value of the electron momentum.



# Direct and Indirect Band Gap Semiconductors

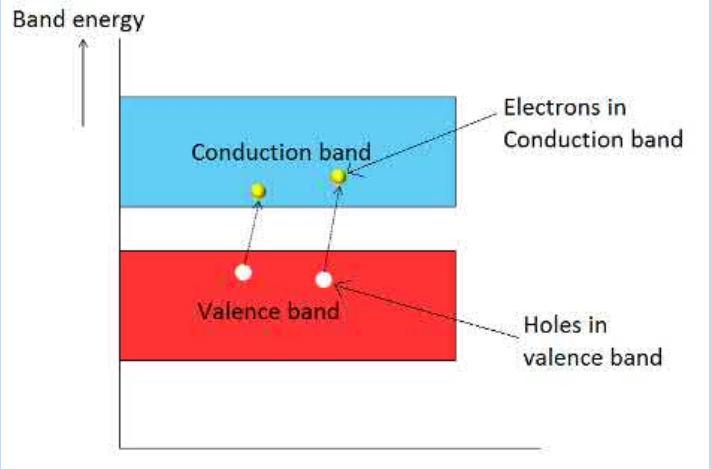
- if the k-vectors (Propagation constant or wave vector) are the different for conduction band minima (CB-minima) and valence Band maxima (VB-maxima) it is called a “Indirect band gap semiconductor”



# Holes

- The absence of electron in a particular place in an atom is called as hole.

- Hole is a electric charge carrier which has positive charge. The electric charge of hole is equal to electric charge of electron but have opposite polarity.



# Intrinsic materials

- Pure semiconductors are called intrinsic semiconductors.
- Silicon and germanium are the most common examples of intrinsic semiconductors. Both these semiconductors are most frequently used in the manufacturing of transistors, diodes and other electronic components.

# Extrinsic semiconductor

- The semiconductor in which impurities are added is called extrinsic semiconductor. When the impurities are added to the intrinsic semiconductor, it becomes an extrinsic semiconductor. The process of adding impurities to the semiconductor is called doping. Doping increases the electrical conductivity of semiconductor.

# Extrinsic semiconductor

Types of impurities

- Two types of impurities are added to the semiconductor. They are pentavalent and trivalent impurities.
- Classification of extrinsic semiconductors based on impurities added
- Based on the type of impurities added, extrinsic semiconductors are classified in to two types.
- N-type semiconductor
- P-type semiconductor

# N-type semiconductor

**N-type semiconductor**

- When pentavalent impurity is added to an intrinsic or pure semiconductor (silicon or germanium), then it is said to be an n-type semiconductor. Pentavalent impurities such as phosphorus, arsenic, antimony etc are called donor impurity.
- In n-type semiconductor, the population of free electrons is more whereas the population of holes is less. Hence in n-type semiconductor free electrons are called majority carriers and holes are called minority carriers. Therefore, in a n-type semiconductor conduction is mainly because of motion of free electrons.

# P-type semiconductor

- When the trivalent impurity is added to an intrinsic or pure semiconductor (silicon or germanium), then it is said to be an p-type semiconductor. Trivalent impurities such as Boron (B), Gallium (G), Indium(In), Aluminium(Al) etc are called acceptor impurity.
- In p-type semiconductor, the population of holes in valence band is more.
- So, current conduction is mainly because of holes in valence band. Free electrons in conduction band constitute little current. Hence in p-type semiconductor, holes are called majority carriers and free electrons are called minority carriers.

# Conductivity and Mobility

- The conductivity of a semiconductor is given by:

$$\sigma = q(\mu_n \mathrm{n} + \mu_p \mathrm{p})$$

- where μn and μp refer to the mobility's of the electrons and holes, and n and p refer to the density of electrons and holes, respectively.
- A doped semiconductor, majority carriers greatly outnumber minority carriers, so that above equation can be reduced to a single term involving the majority carrier.

# Effects of Temperature and Doping on Mobility

Conductivity of a material is determined by two factors:

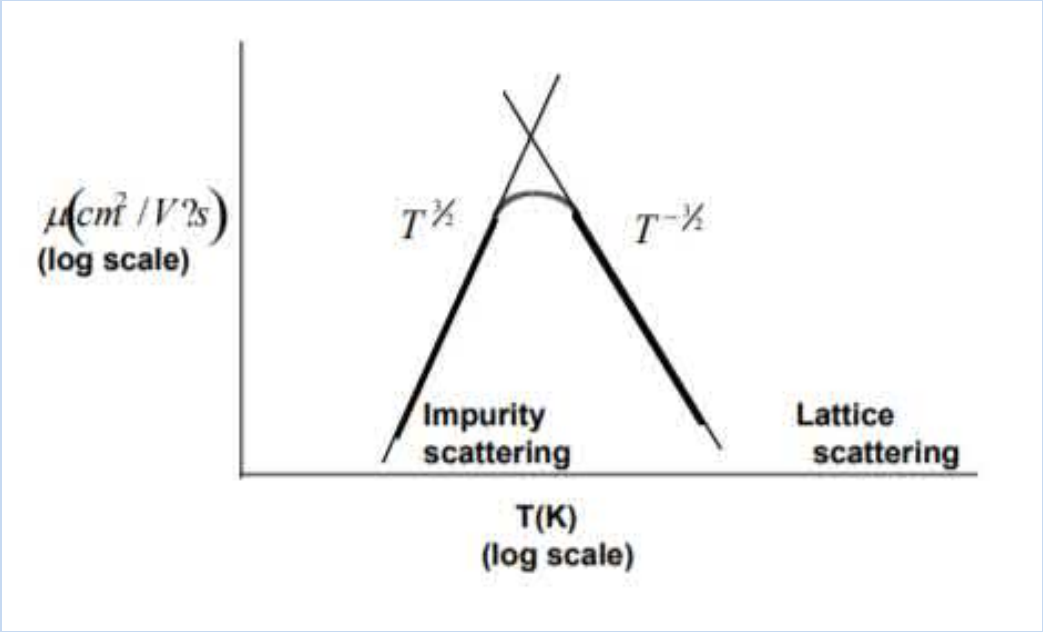
- the concentration of free carriers available to conduct current and their mobility (or freedom to move).
- In a semiconductor, both mobility and carrier concentration are temperature dependent Thus, it is important to view the conductivity as a function of temperature.

# Effects of Temperature and Doping on Mobility

- There are two basic types of scattering mechanisms that influence the mobility of electrons and holes:
- lattice vibrations cause the mobility to decrease with increasing temperature. However, the mobility of the carriers in a semiconductor is also influenced by the presence of charged impurities.
- Impurity scattering is caused by crystal defects such as ionized impurities. At lower temperatures, carriers move more slowly, so there is more time for them to interact with charged impurities. As a result, as the temperature decreases, impurity scattering increases, and the mobility decreases. This is just the opposite of the effect of lattice scattering.

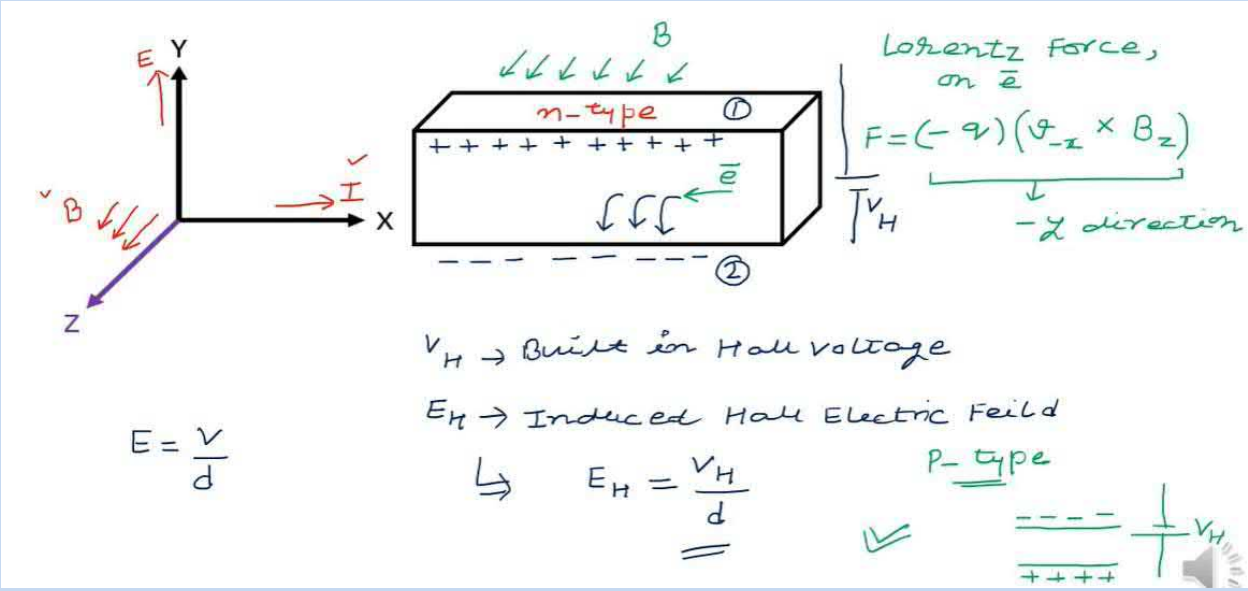
# Effects of Temperature and Doping on Mobility

The total mobility then is the sum of the lattice-scattering mobility and the impurity-scattering mobility.



# Hall effect

- Hall effect is defined as the production of a voltage difference across an electrical
- conductor which is transverse to an electric current and with respect to an applied magnetic Field it



# Hall effect

## Applications of Hall effect

- It is used to determine if the given material is a semiconductor or insulator.
- It is used to measure the magnetic field and is known as a magnetometer
- They find applications in position sensing as they are immune to water, mud, dust, and dirt.
- They are used in integrated circuits as Hall effect sensors.

ATME College of Engineering

# ATTENDANCE

Course Title with Code : MICROWAVES AND ANTENNA 17EC71

Semester & Section : 7th B

| Sl. No. | USN | Student Name | Date | 02 | 03 | 04 | 05 | 09 | 10 | 11 | 12 | 16 | 18 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Month | 09 | 09 | 09 | 09 | 09 | 09 | 09 | 09 | 09 | 09 |
| | | | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| 26 | 4AD17EC059 | ROHITH V | | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
| 27 | 4AD17EC061 | SOUNDARYA S G | | 1 | 2 | 3 | 4 | 4 | 5 | 6 | 7 | 8 | 9 |
| 28 | 4AD17EC062 | SAHANA N | | 0 | 0 | 0 | 0 | 1 | 2 | 3 | 4 | 5 | 6 |
| 29 | 4AD17EC063 | SANTHOSH TINARI C | | 1 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
| 30 | 4AD17EC064 | SHALINI D | | 1 | 2 | 3 | 4 | 4 | 5 | 6 | 7 | 8 | 9 |
| 31 | 4AD17EC065 | SHILPA R | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| 32 | 4AD17EC066 | SHRIVATHSA M | | 0 | 1 | 2 | 2 | 3 | 3 | 3 | 3 | 4 | 5 |
| 33 | 4AD17EC067 | SINDHU R | | 0 | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
| 34 | 4AD17EC068 | SONALI L U | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| 35 | 4AD17EC069 | SUCHITRA R S | | 1 | 2 | 3 | 3 | 3 | 4 | 5 | 6 | 7 | 8 |
| 36 | 4AD17EC070 | SUDARSHAN S | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| 37 | 4AD17EC071 | SUMA A M | | 0 | 0 | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 38 | 4AD17EC072 | SURYA SHANKARAMURTHY | | 0 | 0 | 1 | 2 | 3 | 4 | 4 | 5 | 6 | 7 |
| 39 | 4AD17EC073 | TARUN | | 1 | 1 | 2 | 3 | 4 | 5 | 5 | 6 | 7 | 8 |
| 40 | 4AD17EC074 | VENUGOPAL A S | | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
| 41 | 4AD17EC075 | YASHASWINI M P | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| 42 | 4AD18EC408 | RUMANA A | | 0 | 0 | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 43 | 4AD18EC409 | SANJAY M | | 1 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
| 44 | 4AD18EC410 | SHYAMALA P K | | 0 | 0 | 0 | 1 | 2 | 3 | 3 | 4 | 5 | 6 |
| 45 | 4AD18EC411 | SUHAS P | | 0 | 0 | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 6 |
| 46 | 4AD18EC413 | SUPRITHA A P | | 1 | 1 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
| 47 | 4AD18EC414 | SUPRITHA A S | | 0 | 0 | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 48 | 4AD18EC415 | SYED MOHAMMED ADNAN | | 1 | 1 | 1 | 1 | 2 | 2 | 2 | 3 | 4 | 4 |
| 49 | 4AD17EC426 | SUJITH R | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 7 | 8 | 8 |
| 50 | | | | | | | | | | | | | |
| | No. of Abs. | | | 11 | 11 | 08 | 04 | 01 | 02 | 03 | 01 | 01 | 02 |
| | Initials | | | | | | | | | | | | |

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| 8 | 9 | 10 | 11 | 12 | 13 | 13 | 13 | 13 | 14 | 15 |
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| | Assignments / Internal Test Marks | | | | | | | | SEE Marks | Total Marks |
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| AT | A1 | T1 | A2 | T2 | A3 | T3 | T4 | CIE Marks | | |
| | | 26 | | 24 | | 24 | 25 | 35 | 31 | 66 |
| | | 26 | | 28 | | 29 | 28 | 38 | 36 | 74 |
| | | 25 | | 24 | | 30 | 26 | 36 | 26 | 62 |
| | | 26 | | 23 | | 30 | 26 | 36 | 31 | 67 |
| | | 27 | | 29 | | 29 | 28 | 38 | 32 | 70 |
| | | 24 | | 21 | | 29 | 25 | 35 | 29 | 64 |
| | | 22 | | 24 | | 28 | 25 | 35 | 14 | 49 |
| | | 24 | | 26 | | 27 | 26 | 36 | 26 | 62 |
| | | 25 | | 28 | | 29 | 27 | 37 | 36 | 73 |
| | | 26 | | 23 | | 25 | 25 | 35 | 27 | 62 |
| | | 23 | | 23 | | 29 | 25 | 35 | 26 | 61 |
| | | 29 | | 28 | | 28 | 28 | 38 | 26 | 64 |
| | | 22 | | 23 | | 26 | 24 | 34 | 23 | 57 |
| | | 25 | | 24 | | 24 | 24 | 34 | 30 | 64 |
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| | | 29 | | 28 | | 29 | 29 | 39 | 24 | 63 |
| | | 27 | | 25 | | 28 | 27 | 37 | 29 | 66 |
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| | | 26 | | 25 | | 29 | 27 | 37 | 30 | 67 |
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ATME College of Engineering

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|---|---|
| **Semester** | **5** |
| **Department** | **ECE** |

**Regular Exam held during Feb/Mar 2021 (ARV)**

| SL | Course name with code | Name of the faculty handled | No. of students appeared | No. of students passed | No. of fails | Pass % |
|---|---|---|---|---|---|---|
| 1 | 18ES51 - TECHNOLOGICAL INNOVATION MANAGEMENT & ENTREPRENEURSHIP | Mrs.Harshitha N | 104 | 101 | 3 | 98 |
| 2 | 18EC52 - DIGITAL SIGNAL PROCESSING | Ms.Anupama Shetter | 104 | 77 | 27 | 75 |
| 3 | 18EC53 - PRINCIPLES OF COMMUNICATION SYSTEM | Mr.Girish M | 104 | 96 | 8 | 93 |
| 4 | 18EC54 - INFORMATION THEORY AND CODING | Mr.Chandrashekar P<br>Mr. Manjunath K | 104 | 95 | 9 | 92 |
| 5 | 18EC55 - ELECTROMAGNETIC WAVES | Dr. Prakash Kuravatti | 104 | 78 | 26 | 76 |
| 6 | 18EC56 - VERILOG HDL | Dr. Mahesh P K<br>Mr.Pradeep Kumar Y | 104 | 99 | 5 | 96 |

**Arrear Exam held during Aug/Sep 2021**

| SL | Course name with code | Name of the faculty engaged special class | No of students appeared (Failed during regular exam) | No. of students passed | No. of fails | Pass % | Overall Pass % |
|---|---|---|---|---|---|---|---|
| 1 | 18ES51 - TECHNOLOGICAL INNOVATION MANAGEMENT & ENTREPRENEURSHIP | ********** | 1 | 1 | 0 | 100 | 98 |
| 2 | 18EC52 - DIGITAL SIGNAL PROCESSING | Dr. Prathibha M K | 27 | 21 | 6 | 78 | 94 |
| 3 | 18EC53 - PRINCIPLES OF COMMUNICATION SYSTEM | Mr.Girish M | 8 | 7 | 1 | 88 | 99 |
| 4 | 18EC54 - INFORMATION THEORY AND CODING | Mr. Manjunath K | 8 | 5 | 3 | 63 | 96 |
| 5 | 18EC55 - ELECTROMAGNETIC WAVES | Mr.Girish M | 25 | 16 | 9 | 64 | 90 |
| 6 | 18EC56 - VERILOG HDL | ********** | 5 | 5 | 0 | 100 | 100 |

Professor & Head
Dept. of Electronics & Communication
ATME COLLEGE OF ENGINEERING
Mysuru - 570 028

**Arrear Exam held during Aug/Sep 2021**

| SL | Course name with code | Name of the faculty engaged special class | No of students appeared (Failed during regular exam) | No. of students passed | No. of fails | Pass % | Overall Pass % |
|---|---|---|---|---|---|---|---|
| 1 | 18MAT31<br>TRANSFORM CALCULUS, FOURIER SERIES AND NUMERICAL TECHNIQUES | Mrs. Priyanka N B<br>Mrs. Divya K | 23 | 17 | 6 | 74 | 92 |
| 2 | 18EC32<br>NETWORK THEORY | Dr. Yathisha L<br>Mr.Abhilash G | 53 | 14 | 39 | 26 | 62 |
| 3 | 18EC33<br>ELECTRONIC DEVICES | Mr. Guruprasad K N | 23 | 21 | 2 | 91 | 96 |
| 4 | 18EC34<br>DIGITAL SYSTEM DESIGN | Mrs.Harshitha N | 13 | 11 | 2 | 85 | 98 |
| 5 | 18EC35<br>COMPUTER ORGANIZATION AND ARCHITECTURE | Ms. Anupama Shetter | 12 | 8 | 4 | 67 | 94 |
| 6 | 18EC36<br>POWER ELECTRONICS AND INSTRUMENTATION | Mrs. Shalini V S | 21 | 18 | 3 | 86 | 95 |

Professor & Head
Dept. of Electronics & Communication
ATME COLLEGE OF ENGINEERING
Mysuru - 570 028

CBCS SCHEME

USN | | | | | | | | | | |

18EC33

# Third Semester B.E. Degree Examination, Dec.2019/Jan.2020
## Electronic Devices

Time: 3 hrs. Max. Marks: 100

**Note:** ***Answer FIVE full questions, choosing ONE full question from each module.***

Important Note : 1. On completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages.
2. Any revealing of identification, appeal to evaluator and /or equations written eg, 42+8 = 50, will be treated as malpractice.

### Module-1

1 a. What are the types of Bonding forceses in solids? Explain. **(06 Marks)**

b. Explain the classification of material based on conductivity and energy band diagram. **(08 Marks)**

c. Find the conductivity of the intrinsic germanium at 300 K. If a donar type impurity is added to the extent of 1 atom/$10^7$ germanium atom assume $\mu_n = 3800$, $\mu_P = 1800$, $n_i = 2.5\times10^{13}$, $Q = 1.602\times10^{-19}$. **(06 Marks)**

**OR**

2 a. What are Direct and Indirect band gap semiconductor? Explain with examples. **(08 Marks)**

b. Explain the concentration of electron-hole pair in Intrinsic semiconductor with energy band diagram. **(06 Marks)**

c. Calculate the Intrinsic carrier concentration in Silicon at room temperature T = 300 K, where B is the material dependent parameter $5.4\times10^{31}$ and $E_G$ as the bandgap energy 1.12 eV, where K is the Boltzman constant = $8.62\times10^{-5}$ eV/K. **(06 Marks)**

### Module-2

3 a. With energy band diagram, explain the doping level in extrinsic semiconductor at 0 K and at 50 K. **(09 Marks)**

b. What is the magnitude of HALL voltage in a N-Type germanium bar having an majority carrier concentration $N_D = 10^{17}$ cm$^3$. Assume B = 0.2 Wb/m$^2$, d = 2 mm, E = 10 V/cm. **(05 Marks)**

c. Explain the effect of temperature on semiconductor. **(06 Marks)**

**OR**

4 a. Explain the qualitative description of current flow at P-N junction under equilibrium and biased condition. **(08 Marks)**

b. Explain zener breakdown and avalanche breakdown under reverse biased P-N junction. **(06 Marks)**

c. Discuss the piece-wise linear approximations of junction diode under ideal condition. **(06 Marks)**

### Module-3

5 a. Explain the optical generation of carrier in a P-N junction. **(08 Marks)**

b. Discuss the configuration of a solar cell in enlarged view of the planar junction. **(06 Marks)**

c. What is injection-electroluminiscence and what are its applications? **(06 Marks)**





**OR**

6 a. Explain I-V characteristics of n-p junction as a function of emitter current. **(08 Marks)**

b. Discuss switching operation in common-emitter transistor. **(06 Marks)**

c. Figure Q6 (c) shows the common emitter amplifier circuit. Calculate $I_B$ and $I_C$ assume $\tau_P = 10\,\mu s$, $\tau_i = 0.1\,\mu s$ **(06 Marks)**

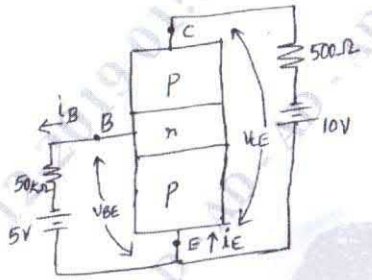



Fig Q6 (c)

### Module-4

7 a. Draw and explain the I-V characteristics of n-channel PNJFET for different biasing voltages. **(07 Marks)**

b. Draw and explain the small signal equivalent circuit of n-channel PNJFET. **(07 Marks)**

c. Explain the MOS structure with the aid of parallel-plate capacitor. **(06 Marks)**

**OR**

8 a. Explain the effect of frequency on gate voltage of a MOS capacitor with a P-type substrate. **(10 Marks)**

b. Explain P-channel enhancement and depletion type MOSFET with their circuit symbols. **(10 Marks)**

### Module-5

9 a. With schematic diagram, explain ION-implantation system. **(07 Marks)**

b. Explain low pressure chemical vapour deposition reactor. **(07 Marks)**

c. Discuss photolithography. **(06 Marks)**

**OR**

10 a. What are the different types of integrated circuits and its advantages? **(10 Marks)**

b. Explain the process of Integration. **(10 Marks)**

* * * * *

# ECE Decennial Event List 2020-21

| Sl. No | Date | Title | Convener/ Coordinators | Resource Person |
|---|---|---|---|---|
| 1 | 25/3/2021 to 31/3/2021 | Decennial Event - Five days National level Workshop on "Academic and Research Writing" | Dr. Prathibha M K<br>Mrs. Shalini V S<br>Mrs. Pavithra A C | Dr. Kinsuk Giri,<br>Assistant Professor,<br>Dept. of CSE<br>NITTTR, Kolkata<br>&<br>Dr. Shivaprakash K S, Professor<br>Department of ECE,<br>NMAM. Institute of Technology,NITTE<br>&<br>Dr. Ravikiran H.K, Assistant Professor,<br>Dept of ECE, RIT, Hassan<br>&<br>Dr. Rayapathi Subbarao, Associate Professor, Mechanical Engineering, NITTTR, Kolkata<br>&<br>Dr. Vidya S M, Professor, Department of Biotechnology Engineering, NMAMIT, NITTE<br>&<br>Dr. Jayanth J,<br>Associate Professor, GSSSIETW, Mysuru<br>&<br>Dr. Ajay Semalty,<br>& Dr. Mona Semalty<br>SWAYAM Coordinator Assistant Professor,<br>H.N.B. Garhwal University, Srinagar Garhwal, Uttarakhand |
| 2 | 26/4/2021 | Talk on " Career | Mr. Abhilash G | Sunil Kumar H V |

| | | | | |
|---|---|---|---|---|
| | | Opportunities in the IC Design Industry" | | Designated Partner<br>Vivarthan Technologies, Bangalore |
| 3 | 28/5/ 2021 | Decennial Event – E-Quiz on Current affairs | Mr. Pradeep Kumar Y &<br>Mr. Guruprasad K N &<br>Mrs. Keerthi A K | - |
| 4 | 24/6/2021<br>to<br>26/6/2021 | 3 days' workshop on LATEX | Mr. Pradeep Kumar Y &<br>Mr. Guruprasad K N<br>Ms. Anupama Shetter<br>Mr. Anil Kumar B H | Dr. Yathisha L, Asso. Prof, ATMECE, Mysuru<br>Mr. Pradeep Kumar Y, Asst. Prof, ATMECE, Mysuru &<br>Mr. Guruprasad K N, Asst. Prof, ATMECE, Mysuru |
| 5 | 21/6/2021 | "Industry Academic Interaction: Targeting Placements, Soft-Skills & Future Plans" | Mr. Guruprasad K N &<br>Mrs. Keerthi A K | Ms. Sangeetha V<br>(ATMECE Alumni, Dept of ECE, 2016-2020 batch),<br>Technical Solutions Consultant, Hewlett Packard Enterprise, Bangalore. |
| 6 | 20/7/2021 | HackXpo-2k21 | Dr. Prakash Kuravatti<br>Mrs. Keerthi A K<br>Mr. Girish M | - |
| 7 | 24/7/2021 | Webinar on " How to crack TCS Drive" for prefinal year students | Mr. Guruprasad K N &<br>Mrs. Keerthi A K | Ms. Maduri H N<br>(ATMECE Alumni, Dept of ECE, 2015-2019 batch)<br>Associate System Engineer,<br>Tata Consultancy Service<br>Bangalore. |

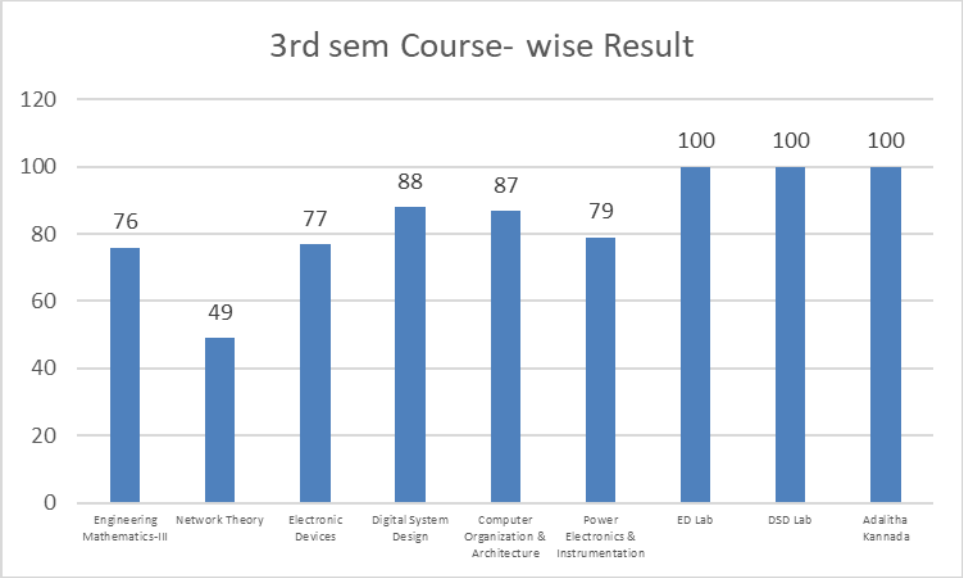
Professor & Head
Dept. of Electronics & Communication
ATME COLLEGE OF ENGINEERING
Mysuru - 570 028

## Department of Electronics and Communication Engineering

### Result analysis of Academic Year- 2020-21

| Class | No. of Students | No. of Pass | FCD | FC | SC | Pass % |
|---|---|---|---|---|---|---|
| 3rd semester | 105 | 44 | 41 | 3 | 0 | 42 |
| 4th Semester | 105 | 105 | 71 | 29 | 5 | 98 |
| 5th semester | 104 | 65 | 54 | 11 | 0 | 63 |
| 6th Semester | 104 | 104 | 94 | 9 | 1 | 100 |
| 7th semester | 89 | 70 | 0 | 0 | 70 | 79 |
| 8th Semester | 89 | 82 | 82 | 0 | 0 | 92 |

### 3rd Semester Course wise result

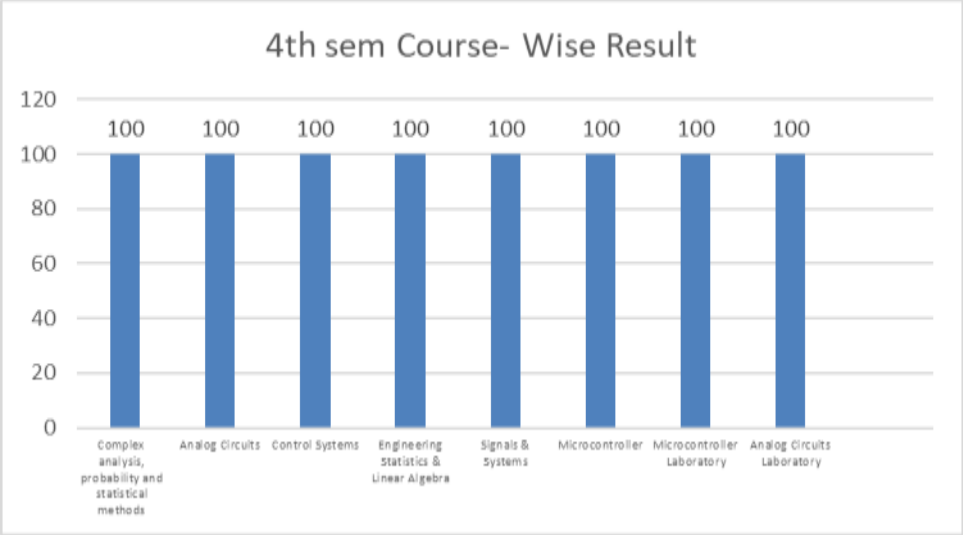



Result Analysis Coordinator

HoD

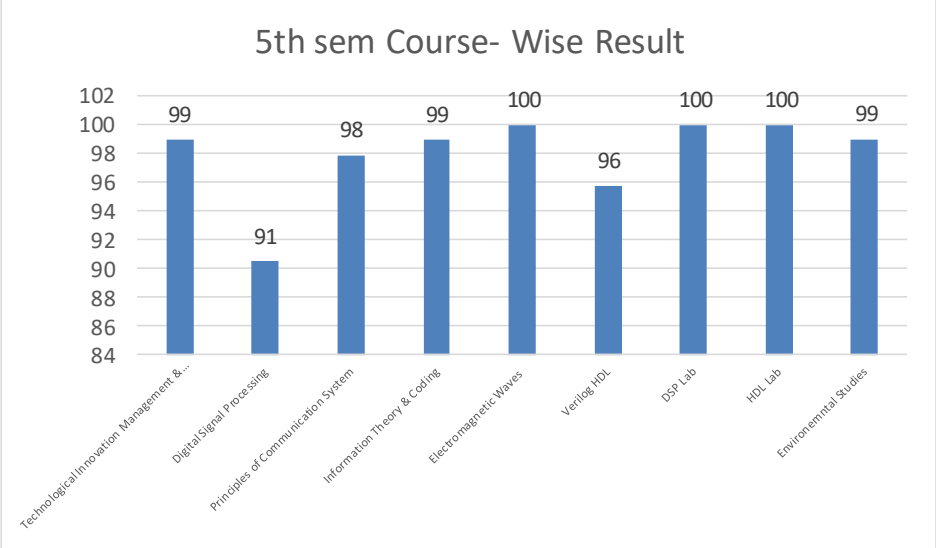
## Department of Electronics and Communication Engineering

### 4th Semester Course-wise Result



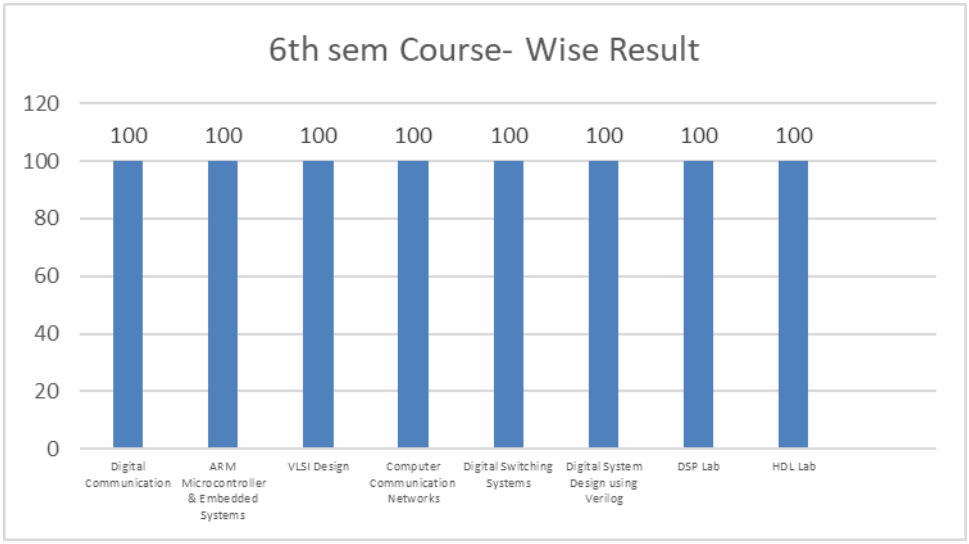

Result Analysis Coordinator HoD

### 5th Semester Course-wise Result



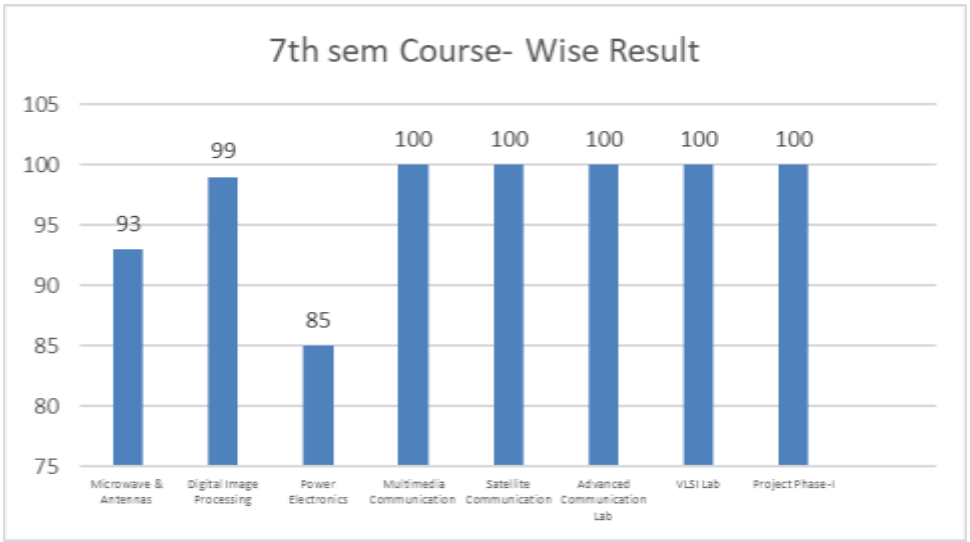

Result Analysis Coordinator HoD

## 6th Semester Course-wise Result



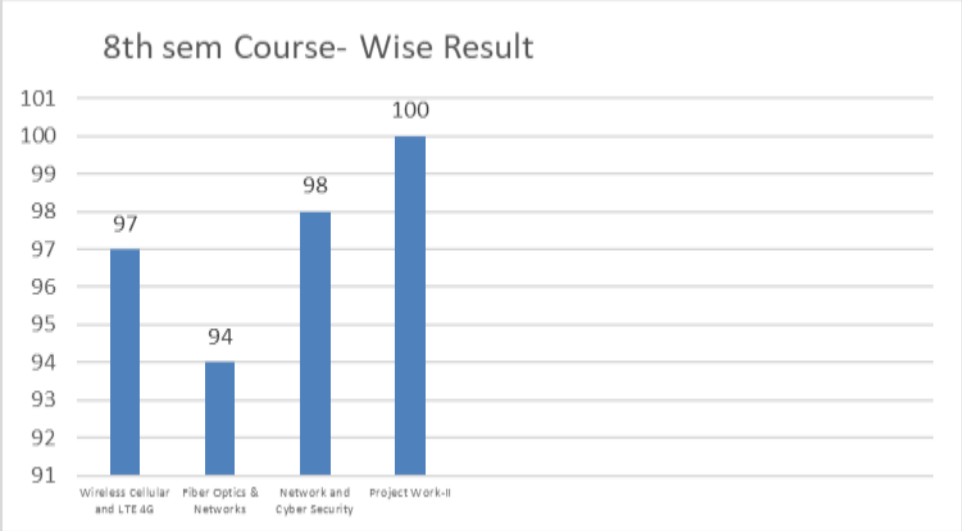

Result Analysis Coordinator HoD

## 7th Semester Course-wise Result




Result Analysis Coordinator HoD

## 8th Semester Course-wise Result




Result Analysis Coordinator

HoD

# WORK DONE DIARY

| WEEK 7 | | MONDAY 12-10-20 DATE | TUESDAY 13-10-20 DATE | WEDNESDAY 14-10-20 DATE |
|---|---|---|---|---|
| ACTIVITY | Class Hours | 9.45 AM to 11.45 AM<br>IAI - invigilation DUty<br>2.15 PM to 4.00 PM<br>IAI - invigilation DUty | Aptitude Question preparation for 7th B students.<br>Topic : TCS related questions.<br>TCS database Updation | 17EC71 - M&A - 7B classes are suspended due to TCS Aptitude training.<br>IAI scripts evaluation<br>12.15 to 1.15 PM<br>Aptitude - TCS aptitude test. |
| | Others | Meeting with Hon. Chairman Sir<br>Sub: Training and placement activities. | Brief meeting with HOD and TPO regarding Seventhsense training. | 3.00 PM to 4.00 PM<br>18ECL37 - EDI LAB - 3A<br>Expt NO.5 : SCR controlled HWR and FWR (compensatory class) |
| **WEEK 8** | | **MONDAY 19-10-20 DATE** | **TUESDAY 20-10-20 DATE** | **WEDNESDAY 21-10-20 DATE** |
| ACTIVITY | Class Hours | 18ECL37 - EDI LAb - 3A<br>2.00 PM to 3.00 PM<br>Characteristics of LDR and photodiode<br>IIRS - ISRO WORK :<br>program NO. 72 registration details Updation | Aptitude question preparation for 7th B students.<br>Topic : TCS related aptitude questions.<br>IIRS - ISRO program 72 details Updation to college Website. | 12.15 PM to 1.15 PM<br>TCS Aptitude test for 7th B students.<br>3.00 PM to 4.00 PM<br>17EC71 - M&A - 7B classes suspended due to TCS specific training. |
| | Others | Placement WORK :<br>placement opted student list was prepared (2021 batch) | UTU - PhD Online registration process. | International Webinar on "Importance of Citation and Indexing" at 9.15 AM<br>Access to NPTEL Videos<br>AEC - Week 6 |
| **WEEK 9** | | **MONDAY 26-10-20 DATE** | **TUESDAY 27-10-20 DATE** | **WEDNESDAY 28-10-20 DATE** |
| ACTIVITY | Class Hours | HOLIDAY<br>VIJAYA DASHAMI | Virtual interactive session on<br>"Free insight into Australia Admission Day". | 17EC71 - M&A - 7B<br>9.30 AM to 11.00 AM<br>Attenuators and phase shifters.<br>12.15 to 1.15 PM<br>Topic : Quantitative Aptitude and logic reasoning. |
| | Others | | Aptitude question preparation for 7th B students.<br>Topic : Quantitative Aptitude and logical reasoning | Access to NPTEL Videos - Analog electronic circuits Week 7. |

# WORK DONE DIARY

ATME College of Engineering

| WEEK 7 | | THURSDAY 15-10-20 DATE | FRIDAY 16-10-20 DATE | SATURDAY 17-10-20 DATE |
|---|---|---|---|---|
| ACTIVITY | Class Hours | 17EC71 - MVA - 7B Classes are suspended due to TCS training class.<br>NITTR : Submission of knowledge test-3<br>URAT preparation Topic : control systems | 17EC71 - MVA - 7B TCS specific training classes were suspended.<br>NITTT : Access to videos and submission of knowledge test-4.<br>3.00 PM to 4.00 PM TCS specific address to | 17EC71 - MVA - 7B classes were suspended due to TCS specific training.<br>NPTEL video Access: Analog Electronic circuits assignment 5 submission. |
| | Others | Absentees for TCS specific training session were sorted and informed to respective counselors and HOD. | 7th sem students by TPO.<br>Department meeting with HOD at 1.40 PM | |

| WEEK 8 | | THURSDAY 22-10-20 DATE | FRIDAY 23-10-20 DATE | SATURDAY 24-10-20 DATE |
|---|---|---|---|---|
| ACTIVITY | Class Hours | 17EC71 - MVA - 7B classes are suspended due to TCS training class<br>IA marks, Assignment marks Updation with class teacher. | CASUAL LEAVE | 17EC71 - MVA - 7B TCS Drive - classes are suspended.<br>Access to NPTEL videos.<br>Ayudha pooja Celebration. |
| | Others | NAAC criteria 1.1.3 supporting details were scanned and updated with the coordinator. | | Early log-out at 2PM |

| WEEK 9 | | THURSDAY 29-10-20 DATE | FRIDAY 30-10-20 DATE | SATURDAY 31-10-20 DATE |
|---|---|---|---|---|
| ACTIVITY | Class Hours | 17EC71 - MVA - 7B 9.30 AM to 11.00 AM Waveguide Tees and Magic Tees.<br>Access to NITTT videos. Knowledge quiz 5 and quiz 6 submission | HOLIDAY ED MILAD | HOLIDAY SHREE VALMIKI JAYANTHI |
| | Others | Counseling data were updated in CERP. | | |

| WEEK 10 | | THURSDAY 05-11-20 DATE | FRIDAY 06-11-20 DATE | SATURDAY 07-11-20 DATE |
|---|---|---|---|---|
| ACTIVITY | Class Hours | 17EC71 - M&A - 7B<br>10.00 AM to 11.00 AM<br>Coplanar strip lines and shielded strip lines.<br>NITTT videos:<br>Submission of Knowledge Quiz 7 and Quiz 8. | 17EC71 - M&A - 7B<br>11.15 to 12.15 PM<br>Chapter 2: Antenna basics - Introduction, Radiation pattern.<br>Access to NPTEL Videos - AEC Week 8 | 17EC71 - M&A - 7B<br>9.30 AM to 11.00 AM<br>Basic antenna parameters. |
| | Others | Webinar on NEP-2020 Making India a Global Knowledge Superpower. | Updating 1st IA marks in CERP. | NPTEL: Analog Electronic Circuit Assignment No. 8 Submission. |
| **WEEK 11** | | **THURSDAY 12-11-20 DATE** | **FRIDAY 13-11-20 DATE** | **SATURDAY 14-11-20 DATE** |
| ACTIVITY | Class Hours | Internal Assessment-2<br>Invigilation Duty from 9.45 AM to 11.30PM<br>Invigilation Duty from 2.15PM to 4.00PM | Internal Assessment-2<br>Invigilation Duty from 9.45 AM to 11.30PM<br>Invigilation Duty from 2.15 PM to 4.00PM | HOLIDAY<br>NARAKA CHATURDASHI |
| | Others | | Meeting with Dean (Std. Affairs) and TPO Sub: Employement Accelerator program. | |
| **WEEK 12** | | **THURSDAY 19-11-20 DATE** | **FRIDAY 20-11-20 DATE** | **SATURDAY 21-11-20 DATE** |
| ACTIVITY | Class Hours | 17EC71 - M&A - 7B<br>10.00 AM to 11.00 AM<br>Power patterns, power theorem, Radiation Intensity<br>Placement work:<br>Dhruv Technologies Solutions List of eligible students were mailed. | 17EC71 - M&A - 7B<br>11.15 AM to 12.15 PM<br>Radiation Intensity, Field patterns.<br>Webinar on "IPR & its role in research and innovation" | 17EC71 - M&A - 7B<br>10.00 AM to 11.00 AM<br>Phase pattern, Array of point sources. |
| | Others | IIRS-ISRO Work: Course 67 Certificates download.<br>Meeting with Mrs. Rashmi Dept. of CSE → Effia Work | Dept. meeting with HOD at 1.30 PM.<br>Telecalling to counseling students regarding admission fees. | NPTEL course: Analog Electronic Circuits Assignment No. 10 Submission. |

| WEEK 13 | | MONDAY 23-11-20 DATE | TUESDAY 24-11-20 DATE | WEDNESDAY 25-11-20 DATE |
|---|---|---|---|---|
| ACTIVITY | Class Hours | 18ECL37 - EDI lab - 3A<br>2.00PM to 3.00PM<br>Live demo on EDI lab components and instruments.<br>IIRS-ISRO : Report on 67th program is prepared and submitted to the principal | Aptitude questions preparation for 7th B students.<br>Topic: Quantitative aptitude and verbal<br>Addressing final year students regarding Seventhsense training. | 17EC71 - M&A - 7th B<br>10.00AM to 11.00AM<br>Forms of Antenna Array and Array of point sources.<br>12.15PM to 1.15PM<br>Aptitude → Quantitative and Verbal. |
| | Others | R-42 file updation and Flutter installation work. | Updation of 2nd IA Marks in CERP<br>Flutter installation in project lab. | JARO PI round.<br>Coordination with shortlisted students.<br>Blue book attainment<br>HALF DAY CL |
| **WEEK 14** | | **MONDAY 30-11-20 DATE** | **TUESDAY 01-12-20 DATE** | **WEDNESDAY 02-12-20 DATE** |
| ACTIVITY | Class Hours | 18ECL37 - EDI lab - 3A<br>2.00PM to 3.00PM<br>Live demo on EDI lab<br>Expt No. 1 Rectifiers HWR and FWR.<br>IIRS-ISRO : Report on 66th program is prepared. | RH | 17EC71 - M&A - 7th B<br>10.00AM to 11.00AM<br>Numerical problems.<br>Chapter 2 : Short Dipoles introduction.<br>12.15 to 1.15PM - 7th B<br>Aptitude quiz on verbal reasoning and logical sequence of words. |
| | Others | IIRS-ISRO course 70 and 72 poster contents were prepared. | | 11.15 to 12.15PM<br>AE lab - introduction to EDI lab. |
| **WEEK 15** | | **MONDAY 07-12-20 DATE** | **TUESDAY 08-12-20 DATE** | **WEDNESDAY 09-12-20 DATE** |
| ACTIVITY | Class Hours | CASUAL LEAVE | 18ECL37 - EDI Lab<br>10.00AM to 1.00PM<br>OFFLINE LAB<br>Expt No. 1 : Half wave rectifier with and without Rectifier. | 17EC71 - M&A - 7th B<br>10.00AM to 11.00AM<br>Radiation resistance of short electric dipole, Thin linear antenna.<br>12.15 to 1.15PM - 7th B<br>Verbal reasoning : logical sequence of words. |
| | Others | | Aptitude questions preparation for 7th B students.<br>Topic : Verbal Reasoning Logical sequence of words. | 3.00PM to 4.00PM<br>Orientation session on Institution Innovation council<br>Course file updation |

# ATME College of Engineering

## C1.1.1 - The Institution ensures effective curriculum delivery through a well-planned and documented process

## Supporting Documents

### Index

| Sl. No. | Academic Year | Particulars |
|---|---|---|
| 1 | 2020-21 | Academic Calendar- College & Department |
| 2 | | Teaching Plan |
| 3 | | Department Meeting – Sample MoM |
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| 5 | | Time Table |
| 6 | | Teaching – Learning resources |
| 7 | | Attendance Record |
| 8 | | Bridge & Remedial Classes |
| 9 | | Question Bank-VTU Previous Year QP |
| 10 | | Academic Activity and its Planning |
| 11 | | Result Analysis |
| 12 | | Teachers Diary |

# Department of Civil Engineering

**ATME COLLEGE OF ENGINEERING**
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Email: info@atme.in, Web : www.atme.in

# ATME COLLEGE OF ENGINEERING, MYSURU

## Revised Academic Calendar (ODD SEMESTER, 2020-21)

| WEEK | MONTH | SUN | MON | TUE | WED | THU | FRI | SAT | HOLIDAY (H) | COLLEGE EVENTS |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | SEPTEMBER | | | 1 | 2 | 3 | 4 | 5 | | 3rd , 5th & 7th Semster : commencement of Online Classes |
| 2 | | 6 | 7 | 8 | 9 | 10 | 11 | 12 | | |
| 3 | | 13 | 14 | 15 | 16 | 17 | 18 | 19 | Mahalaya Amavasya | |
| 4 | | 20 | 21 | 22 | 23 | 24 | 25 | 26 | | |
| 5 | | 27 | 28 | 29 | 30 | | | | | |
| 5 | OCTOBER | | | | | 1 | 2 | 3 | Gandhi Jayanthi | |
| 6 | | 4 | 5 | 6 | 7 | 8 | 9 | 10 | | First I A for 3rd , 5th and 7th Semester |
| 7 | | 11 | 12 | 13 | 14 | 15 | 16 | 17 | | |
| 8 | | 18 | 19 | 20 | 21 | 22 | 23 | 24 | | |
| 9 | | 25 | 26 | 27 | 28 | 29 | 30 | 31 | Ayudha Pooja, Vijaya Dashami, Eid-Milad , Valmiki Jayanthi | |
| 10 | NOVEMBER | 1 | 2 | 3 | 4 | 5 | 6 | 7 | Kannada Rajyotsava | |
| 11 | | 8 | 9 | 10 | 11 | 12 | 13 | 14 | Naraka Chaturdashi | Second IA for 3rd , 5th and 7th Semester |
| 12 | | 15 | 16 | 17 | 18 | 19 | 20 | 21 | Balipadyami | Commencement of On-Campus Classes for Semseter 7. |
| 13 | | 22 | 23 | 24 | 25 | 26 | 27 | 28 | | |
| 14 | | 29 | 30 | | | | | | | |

Non Working Saturdays

# ATME COLLEGE OF ENGINEERING, MYSURU

**Revised Academic Calendar (ODD SEMESTER, 2020-21)**

| WEEK | MONTH | SUN | MON | TUE | WED | THU | FRI | SAT | HOLIDAY (H) | COLLEGE EVENTS |
|---|---|---|---|---|---|---|---|---|---|---|
| 14 | DECEMBER | | | 1 | 2 | 3 | 4 | 5 | Kanakadasa Jayanthi | |
| 15 | | 6 | 7 | 8 | 9 | 10 | 11 | 12 | | |
| 16 | | 13 | 14 | 15 | 16 | 17 | 18 | 19 | | |
| 17 | | 20 | 21 | 22 | 23 | 24 | 25 | 26 | Christmas | |
| 18 | | 27 | 28 | 29 | 30 | 31 | | | | Third IA for Semesters 3, 5 and 7 |
| 18 | JANUARY | | | | | | 1 | 2 | | |
| 19 | | 3 | 4 | 5 | 6 | 7 | 8 | 9 | | LAB Interenals for Semesters 3,5 and 7 |
| 20 | | 10 | 11 | 12 | 13 | 14 | 15 | 16 | Makra Sankranthi | Improvement IA for Semesters 3,5 and 7, LAST working day for ODD Sem 2020-21 |
| 21 | | 17 | 18 | 19 | 20 | 21 | 22 | 23 | | Comencement of Odd Semester Practical Exams |
| 22 | | 24 | 25 | 26 | 27 | 28 | 29 | 30 | Republic Day | |
| 23 | | 31 | | | | | | | | |
| 23 | FEBRUARY | | 1 | 2 | 3 | 4 | 5 | 6 | | End of Odd Semester Practical Exams |
| 24 | | 7 | 8 | 9 | 10 | 11 | 12 | 13 | | Commencement of Odd Semester Theory Exams |
| 25 | | 14 | 15 | 16 | 17 | 18 | 19 | 20 | | |
| 26 | | 21 | 22 | 23 | 24 | 25 | 26 | 27 | | |
| 27 | | 28 | | | | | | | | |
| | | | | | | | | Non Working Saturdays | | |
| No. Of Working Days | | | 17 | 20 | 20 | 17 | 17 | 9 | Total No. Of Working Days | 100 |

# ATME COLLEGE OF ENGINEERING, MYSURU

## Revised Academic Calendar (ODD SEMESTER, 2020-21)

| WEEK | MONTH | SUN | MON | TUE | WED | THU | FRI | SAT | HOLIDAY (H) | COLLEGE EVENTS |
|---|---|---|---|---|---|---|---|---|---|---|
| 14 | MARCH | | 1 | 2 | 3 | 4 | 5 | 6 | | |
| 15 | | 7 | 8 | 9 | 10 | 11 | 12 | 13 | Mahashivaratri | |
| 16 | | 14 | 15 | 16 | 17 | 18 | 19 | 20 | | |
| 17 | | 21 | 22 | 23 | 24 | 25 | 26 | 27 | | 25th End of odd semester Theory exams, 26th Mar 2021 Commencement of Even Semester |
| 18 | | 28 | 29 | 30 | 31 | | | | | |
| 18 | APRIL | | | | | 1 | 2 | 3 | Good Friday | |
| 19 | | 4 | 5 | 6 | 7 | 8 | 9 | 10 | | |
| 20 | | 11 | 12 | 13 | 14 | 15 | 16 | 17 | Chadramana Yugadi, Ambedkar Jayanthi | |
| 21 | | 18 | 19 | 20 | 21 | 22 | 23 | 24 | | |
| 22 | | 25 | 26 | 27 | 28 | 29 | 30 | | Mahavir Jayanthi | |
| 23 | MAY | | | | | | | 1 | May Day (Labour Day) | |
| 23 | | 2 | 3 | 4 | 5 | 6 | 7 | 8 | | |
| 24 | | 9 | 10 | 11 | 12 | 13 | 14 | 15 | Idul-Fitr, Basava Jayathi | |
| 25 | | 16 | 17 | 18 | 19 | 20 | 21 | 22 | | |
| 26 | | 23 | 24 | 25 | 26 | 27 | 28 | 29 | | |
| 27 | | 30 | 31 | | | | | | | |

Non Working Saturdays

Sd-
Dr. L Basavaraj
Principal

# ATME COLLEGE OF ENGINEERING, MYSURU

**Revised Academic Calendar (EVEN SEMESTER, 2020-21)**

| WEEK | MONTH | SUN | MON | TUE | WED | THU | FRI | SAT | HOLIDAY (H) | COLLEGE EVENTS |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | APRIL | | | | | 1 | 2 | 3 | | |
| 2 | | 4 | 5 | 6 | 7 | 8 | 9 | 10 | | |
| 3 | | 11 | 12 | 13 | 14 | 15 | 16 | 17 | | |
| 4 | | 18 | 19 | 20 | 21 | 22 | 23 | 24 | | Commencement of 4th, 6th and 8th Semester Classes |
| 5 | | 25 | 26 | 27 | 28 | 29 | 30 | | | |
| 5 | MAY | | | | | | | 1 | May Day | |
| 6 | | 2 | 3 | 4 | 5 | 6 | 7 | 8 | | |
| 7 | | 9 | 10 | 11 | 12 | 13 | 14 | 15 | Basava Jayanthi, Ramzan | |
| 8 | | 16 | 17 | 18 | 19 | 20 | 21 | 22 | | |
| 9 | | 23 | 24 | 25 | 26 | 27 | 28 | 29 | | FIRST IA 4TH AND 6TH SEM |
| | | 30 | 31 | | | | | | | |
| 10 | JUNE | | | 1 | 2 | 3 | 4 | 5 | | |
| 11 | | 6 | 7 | 8 | 9 | 10 | 11 | 12 | | |
| 12 | | 13 | 14 | 15 | 16 | 17 | 18 | 19 | | |
| 13 | | 20 | 21 | 22 | 23 | 24 | 25 | 26 | | |
| 14 | | 27 | 28 | 29 | 30 | | | | | |

**Non Working Saturdays**

# ATME COLLEGE OF ENGINEERING, MYSURU

## Revised Academic Calendar (EVEN SEMESTER, 2020-21)

| WEEK | MONTH | SUN | MON | TUE | WED | THU | FRI | SAT | HOLIDAY (H) | COLLEGE EVENTS |
|---|---|---|---|---|---|---|---|---|---|---|
| 14 | JULY | | | | | 1 | 2 | 3 | | SECOND IA 4TH AND 6TH SEM |
| 15 | | 4 | 5 | 6 | 7 | 8 | 9 | 10 | | |
| 16 | | 11 | 12 | 13 | 14 | 15 | 16 | 17 | | |
| 17 | | 18 | 19 | 20 | 21 | 22 | 23 | 24 | Bakrid | 8th Sem Last Working Day, 8th Sem Theory Exam Begins |
| 18 | | 25 | 26 | 27 | 28 | 29 | 30 | 31 | | 8th Sem Theory Exam Ends, THIRD IA 4th AND 6th SEM |
| 18 | AUGUST | 1 | 2 | 3 | 4 | 5 | 6 | 7 | | 4th and 6th Sem Last Working Day, 8th Sem Internship Viva Voce. LAB IA 4th and 6th Sem. |
| 19 | | 8 | 9 | 10 | 11 | 12 | 13 | 14 | | Practical Exams Starts for 4th and 6th Sem |
| 20 | | 15 | 16 | 17 | 18 | 19 | 20 | 21 | Muharram | Practical Exams Ends for 4th and 6th Sem |
| 21 | | 22 | 23 | 24 | 25 | 26 | 27 | 28 | | Theory Exams Starts for 4th and 8th Sem |
| 22 | | 29 | 30 | 31 | | | | | | |
| 23 | SEPTEMBER | | | | 1 | 2 | 3 | 4 | | |
| 24 | | 5 | 6 | 7 | 8 | 9 | 10 | 11 | Ganesha Chathurthi | Theory Exams Starts for 4th and 8th Sem |
| 25 | | 12 | 13 | 14 | 15 | 16 | 17 | 18 | | |
| 26 | | 19 | 20 | 21 | 22 | 23 | 24 | 25 | Non Working Saturdays | |
| 27 | | 26 | 27 | 28 | 29 | 30 | 31 | 32 | | |
| WORKING DAYS (8th Sem) | | | 14 | 14 | 13 | 13 | 13 | 6 | 73 | |
| WORKING DAYS(4th & 6th) | | | 16 | 16 | 15 | 16 | 16 | 7 | 86 | Inclusive of IA tests and other activities |

DEAN ACADEMICS
DR. M S GOVINDE GOWDA

PRINCIPAL
DR. L BASAVARAJ

**ATME COLLEGE OF ENGINEERING**
Department Of Civil Engineering
Academic Year: APR – AUG 2020 - 2021
## Calendar of Events for EVEN Semester

| Week No. | Month | Day | | | | | | No. of Working Days | Activities |
|---|---|---|---|---|---|---|---|---|---|
| | | MON | TUE | WED | THU | FRI | SAT | | |
| 1 | Apr | 19 CB | 20 | 21 | 22 | 23 | 24 | 6 | |
| 2 | Apr / May | 26 | 27 | 28 | 29 | 30 | 1 H | 5 | May Day |
| 3 | May | 3 | 4 | 5 | 6 | 7 | 8 | 6 | |
| 4 | | 10 | 11 | 12 | 13 | 14 H | 15 | 5 | Basava Jayanthi Akshaya Tritiya, Khutub-E-Ramzan |
| 5 | | 17 RH | 18 | 19 | 20 | 21 | 22 | 6 | Shankaracharya Jayanthi |
| 6 | | 24 | 25 | 26 RH | 27 | 28 | 29 | 6 | Buddha Poornima |
| 7 | May / Jun | 30 | 31 | 1 | 2 | 3 | 4 | 6 | |
| 8 | Jun | 7 | 8 | 9 | 10 | 11 | 12 | 6 | |
| 9 | | 14 | 15 | 16 | 17 | 18 | 19 | 6 | |
| 10 | | 21 | 22 | 23 | 24 | 25 | 26 | 6 | |
| 11 | Jun / Jul | 28 | 29 | 30 | 1 | 2 | 3 | 6 | |
| 12 | Jul | 5 | 6 | 7 | 8 | 9 | 10 | 6 | |
| 13 | | 12 | 13 | 14 | 15 | 16 | 17 | 6 | |
| 14 | | 19 | 20 | 21 H | 22 | 23 | 24 | 5 | Bakrid |
| 15 | | 26 | 27 | 28 | 29 | 30 | 31 | 6 | |
| 16 | Aug | 2 | 3 | 4 | 5 | 6 | 7 | 6 | |
| 17 | | 9 | 10 | 11 | 12 | 13 | 14 LWD | 6 | Last Working Day VTU Practical Exam from 09-08-21 to 19-08-21 |
| 18 | | 16 | 17 | 18 | 19 | 20 H | 21 RH | 5 | Moharram Last Day |
| 19 | | 23 | 24 | 25 | 26 | 27 | 28 | 6 | |
| 20 | Aug / Sep | 30 | 31 | 1 | 2 | 3 | 4 | 6 | VTU Theory Exam from 23-08-21 to 09-09-21 |
| 21 | Sep | 6 | 7 | 8 | 9 | 10 | 11 | 6 | |

- CB - Commencement of BE Even Semester
- IA1, IA2 & IA3 - 1st, 2nd & 3rd Internal Assessment
- IT – Improvement Test
- LIA - Lab Internal Assessment
- LWD - Last Working Day for BE

**To Be Planned** :

- CR- Counseling Report
- RA – Result Analysis
- CP – CO PO Assessment and attainment
- IV – Industrial Visit
- TT – Technical Talk
- IOP – Industry outreach Program
- IC-National Conference
- AS- Attendance Status
- ASP – IA & Attendance Status to Parents
- PTM - Parent Teacher Meeting

| Particulars | Date as Planned on | Date Done on |
|---|---|---|
| Commencement Of Online Classes | 19th Apr 2021 | 19th Apr 2021 |
| Commencement Of Offline Classes | NA | NA |
| Technical Talk | *** | 05, 12, 14, 18, 19 June 2021 |
| STTP | *** | 15th – 30th Mar 2021 |
| Parents Teacher Meeting | *** | *** |
| Ist Internal Test (Online) | *** | 07th to 09th June 2021 (4th, 6th, & 8th Sem) |
| IInd Internal Test (Online) | *** | 05th & 07th July 2021 ( 8th Sem)<br>29th – 31st July 2021 ( 4th,6th Sem) |
| IIIrd Internal Test (Online) | *** | 17th & 19th July 2021 (8th Sem)<br>09th - 11th Aug 2021 ( 4th,6th Sem) |
| Lab Internal Test (Online) | *** | |
| Improvement IA (Online) | *** | NA |
| Last Working Day | 20th July 2021<br>14th Aug 2021 | As Planned for 8th Sem<br>As Planned for 4th,6th Sem |

COVID 19 – Lockdown : - 28th Apr 2021 to 25th June 2021

Covid 19 Vaccination Drive : - (1) 30th June 2021

(2) 07th July 2021

HOD
DEPARTMENT OF CIVIL ENGINEERING
ATME COLLEGE OF ENGINEERING
MYSORE-570028

**ATME COLLEGE OF ENGINEERING**
Department Of Civil Engineering
Academic Year: SEPT – JAN 2020 - 2021
## Calendar of Events for ODD Semester

| Week No. | Month | Day | | | | | | No. of Working Days | Activities |
|---|---|---|---|---|---|---|---|---|---|
| | | MON | TUE | WED | THU | FRI | SAT | | |
| 1 | Sept | | 1 CB# RH | 2 RH | 3 | 4 | 5 | 4 | Yajur-Upakarma Brahmashri Narayana Guruji Jayanthi |
| 2 | | 7 | 8 RH | 9 | 10 | 11 | 12 | 6 | Kanya Mariamma Jayanti |
| 3 | | 14 | 15 | 16 | 17 H | 18 | 19 | 4 | Mahalaya Amavasya |
| 4 | | 21 | 22 | 23 | 24 | 25 | 26 | 6 | |
| 5 | Sept / Oct | 28 | 29 | 30 | 1 | 2 H | 3 | 4 | Gandhi Jayanthi |
| 6 | Oct | 5 | 6 | 7 | 8 IA1 | 9 IA1 | 10 IA1 | 6 | |
| 7 | | 12 | 13 | 14 | 15 | 16 | 17 RH | 5 | Thula Sankramana Kaala |
| 8 | | 19 | 20 | 21 | 22 | 23 | 24 | 6 | |
| 9 | | 26 H | 27 | 28 | 29 | 30 H | 31 H | 3 | Vijayadasami Eid – Milad Valmiki Jayanthi |
| 10 | Nov | 2 | 3 | 4 | 5 | 6 | 7 | 5 | |
| 11 | | 9 | 10 | 11 IA2 | 12 IA2 | 13 IA2 | 14 H | 5 | Naraka Chaturdashi |
| 12 | | 16 H | 17 CB* | 18 | 19 | 20 | 21 | 4 | Balipadyami |
| 13 | | 23 | 24 | 25 | 26 | 27 | 28 | 6 | |
| 14 | Nov / Dec | 30 RH | 1 RH | 2 | 3 H | 4 | 5 | 4 | Guru Nanak Jayanti Huttari Kanakadasa Jayanthi |
| 15 | Dec | 7 | 8 | 9 | 10 | 11 | 12 | 6 | |
| 16 | | 14 | 15 | 16 | 17 | 18 | 19 | 4 | |
| 17 | | 21 | 22 | 23 | 24 RH | 25 H | 26 | 5 | Christmas Eve Christmas |
| 18 | Dec / Jan | 28 IA3 | 29 IA3 | 30 IA3 | 31 | 1 | 2 | 6 | |
| 19 | Jan | 4 LIA | 5 LIA | 6 LIA | 7 LIA | 8 LIA | 9 LIA | 6 | Lab Internals From 04-01-21 to 09-01-21 |
| 20 | | 11 IT | 12 IT | 13 IT | 14 H | 15 IT | 16 LWD | 5 | Makara Sankranthi Last Working Day |
| 21 | | 18 | 19 | 20 | 21 | 22 | 23 | 6 | VTU Practical Exam from 21-01-21 to 02-02-21 |
| 22 | | 25 | 26 H | 27 | 28 | 29 | 30 | 5 | Republic Day |
| 23 | Feb | 1 | 2 | 3 | 4 | 5 | 6 | 6 | VTU Theory Exam from 08-02-21 to 05-03-21 |
| 24 | | 8 | 9 | 10 | 11 | 12 | 13 | 6 | |

- CB# - Commencement of BE Odd Semester (3rd, 5th & 7th) - (Online Classes)
- CB* - Commencement of On-Campus Classes for 7th Semester.
- IA1, IA2 & IA3 - 1st, 2nd & 3rd Internal Assessment
- IT – Improvement Test
- LIA - Lab Internal Assessment
- LWD - Last Working Day for BE

**To Be Planned** :

- CR- Counseling Report
- RA – Result Analysis
- CP – CO PO Assessment and attainment
- IV – Industrial Visit
- TT – Technical Talk
- IOP – Industry outreach Program
- IC-National Conference
- AS- Attendance Status
- ASP – IA & Attendance Status to Parents
- PTM - Parent Teacher Meeting

| Particulars | Date as Planned on | Date Done on |
|---|---|---|
| Commencement Of Online Classes | Sept 1st 2020 | As Planned |
| Commencement Of Offline Classes | Oct 1st 2020 | Continuation of Online Classes |
| Commencement Of On – Campus Offline Classes for 7th Semester | 17th Nov 2020 | As Planned |
| Technical Talk | ( Online ) | 22nd Oct 2020<br>19th Nov 2020 |
| Webinar Series | ( Online ) | 14th – 18th July 2020<br>21st – 22nd July 2020<br>3rd - 6th Aug 2020 |
| Industrial Visit | ( Online – Virtual Tour Plant ) | 17th Oct 2020 |
| Parents Teacher Meeting | ***** | 14 Oct 2020 Online for 7th Sem Regarding Placements TCS |
| Ist Internal Test (Online) | 8 , 9 & 10 Oct 2020 | 10 Oct 20 - IA postponed to 12 Oct 20 due to College 10th Anniversary |
| IInd Internal Test (Online) | 11 , 12 & 13 Nov 2020 | 11 Oct 20 – IA postponed to 17 Oct 20 due to ATMECE-FDP on Importance of NAAC in HEI |
| IIIrd Internal Test (Online) | 28, 29 & 30 Dec 2020 | As Planned |
| Lab Internal Test (Offline) | 04 – 09 Jan 2021 (5,7)<br><br>26/02/21 to 03/03/21 (3) | Conducted from 13th – 16th Jan 2021 for 5th & 7th Sem<br>Conducted from 26th Feb to 02th Mar 2021 for 3rd Sem |
| Improvement IA (Online) | 11 – 15 Jan 2021 | Conducted from 11th – 16th Jan 2021 for 5th & 7th Sem |
| Last Working Day | Jan 16th 2021<br>Mar 10th 2021 | As Planned for 5th and 7th Sem<br>As Planned for 3rd Sem |

HOD
DEPARTMENT OF CIVIL ENGINEERING
ATME COLLEGE OF ENGINEERING
MYSORE-570028

## Lesson Plan & Work-done Diary for AY:2020-21, ODD Semester

| Course with Code: Design of RCC & Steel Structures (17CV72) | | | | | Faculty: SRIVATHSA H U | | Semester & Section: 7th Sem 'A' | |
|---|---|---|---|---|---|---|---|---|
| Module | Class No. | Date planned (DD/MM) | Topics to be covered | TLP Planned | Date of Conduction (DD/MM) | Topics Covered | TLP Executed | Remarks if any deviation |
| MODULE-1 | 1 | 2/9/2020 | Introduction and Design of Rectangular combined footing | PPT | 2/9/2020 | Introduction and Design of Rectangular combined footing | PPT | |
| | 2 | 3/9/2020 | Design Rectangular combined footing | PPT | 3/9/2020 | Design Rectangular combined footing | PPT | |
| | 3 | 5/9/2020 | Design Rectangular combined footing | PPT | 5/9/2020 | Design Rectangular combined footing | PPT | |
| | 4 | 7/9/2020 | Design Rectangular combined footing | PPT | 7/9/2020 | Design Rectangular combined footing | PPT | |
| | 5 | 9/9/2020 | Design Rectangular combined footing | PPT | 9/9/2020 | Design Rectangular combined footing | PPT | |
| | 6 | 10/9/2020 | Design Rectangular combined footing | PPT | 10/9/2020 | Design Rectangular combined footing | PPT | |
| | 7 | 12/9/2020 | Introduction and design of Cantilever retaining wall with Horizontal backfill | PPT | 12/9/2020 | Introduction and design of Cantilever retaining wall with Horizontal backfill | PPT | |
| | 8 | 14/9/2020 | Design of Cantilever retaining wall with Horizontal backfill | PPT | 14/9/2020 | Design of Cantilever retaining wall with Horizontal backfill | PPT | |
| | 9 | 16/9/2020 | Design of Cantilever retaining wall with Horizontal backfill | PPT | 16/9/2020 | Design of Cantilever retaining wall with Horizontal backfill | PPT | |
| | 10 | 19/9/2020 | Design of Cantilever retaining wall with Horizontal backfill | PPT | 19/9/2020 | Design of Cantilever retaining wall with Horizontal backfill | PPT | |
| | 11 | 21/9/2020 | Design of Cantilever retaining wall with Sloped backfill | PPT | 21/9/2020 | Design of Cantilever retaining wall with Sloped backfill | PPT | |
| | 12 | 23/9/2020 | Design of Cantilever retaining wall with Sloped backfill | PPT | 23/9/2020 & 24/9/2020 | Design of Cantilever retaining wall with Sloped backfill | PPT | Extra class required to clarify the concept |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | 13 | 24/9/2020 | Design of Cantilever retaining wall with Sloped backfill | PPT | 26/9/2020 | Design of Cantilever retaining wall with Sloped backfill | PPT | |
| | 14 | 26/9/2020 | Design of Counter fort retaining wall | PPT | 28/9/2020 | Design of Counter fort retaining wall | PPT | |
| | 15 | 28/9/2020 | Design of Counter fort retaining wall | PPT | 29/9/2020 | Design of Counter fort retaining wall | PPT | |
| | 16 | 30/9/2020 | Design of Counter fort retaining wall | PPT | 01/10/2020 & 03/10/2020 | Design of Counter fort retaining wall | PPT | Extra class required to clarify the concept |
| | 17 | 1/10/2020 | Introduction and Design of portal frames with fixed based supports. | PPT | 05/10/2020 & 07/10/2020 | Introduction and Design of portal frames with fixed based supports. | PPT | Extra class required to clarify the concept |
| | 18 | 3/10/2020 | Design of portal frames with fixed based supports. | PPT | 21/10/2020 , 22/10/2020 & 28/10/2020 | Design of portal frames with fixed based supports. | PPT | Extra class required to clarify the concept |
| | 19 | 5/10/2020 | Design of portal frames with hinged based supports. | PPT | 29/10/2020 | Design of portal frames with hinged based supports. | PPT | |
| | 20 | 7/10/2020 | Design of portal frames with hinged based supports. | PPT | 30/10/2020 | Design of portal frames with hinged based supports. | PPT | |
| | 21 | 12/10/2020 | Introduction and design of circular water tanks with Flexible base | PPT | 31/10/2020 | Introduction and design of circular water tanks with Flexible base | PPT | |
| | 22 | 14/10/2020 | Design of circular water tanks with Flexible base | PPT | 01/11/2020 & 02/11/2020 | Design of circular water tanks with Flexible base | PPT | Extra class required to clarify the concept |
| | 23 | 15/10/2020 | Design of circular water tanks with Rigid base | PPT | 04/11/2020 | Design of circular water tanks with Rigid base | PPT | |
| | 24 | 17/10/2020 | Introduction and Design of Rectangular water tank resting on ground | PPT | 05/11/2020 | Introduction and Design of Rectangular water tank resting on ground | PPT | |
| | 25 | 19/10/2020 | Design of Rectangular water tank resting on ground | PPT | 07/11/2020 | Design of Rectangular water tank resting on ground | PPT | |
| | 26 | 21/10/2020 | Design of Rectangular water tank resting on ground | PPT | 07/11/2020 | Design of Rectangular water tank resting on ground | PPT | |
| | 27 | 22/10/2020 | Design of Rectangular water tank resting on ground | PPT | 09/11/2020 | Design of Rectangular water tank resting on ground | PPT | |

| Course with Code: Design of RCC & Steel Structures (17CV72) | | | | | Faculty: SRIVATHSA H U | | Semester & Section: 7th Sem 'A' | |
|---|---|---|---|---|---|---|---|---|
| **Module** | **Class No.** | **Date planned (DD/MM)** | **Topics to be covered** | **TLP Planned** | **Date of Conduction (DD/MM)** | **Topics Covered** | **TLP Executed** | **Remarks if any deviation** |
| MODULE-2 | 28 | 24/10/2020 | Introduction and Design of Roof truss with bolted connection | PPT | 09/11/2020 | Introduction and Design of Roof truss with bolted connection | PPT | |
| | 29 | 28/10/2020 | Design of Roof truss with bolted connection | PPT | 11/11/2020 & 18/11/2020 | Design of Roof truss with bolted connection | PPT | Extra class required to clarify the concept |
| | 30 | 29/10/2020 | Design of Roof truss with bolted connection | PPT | 19/11/2020 & 21/11/2020 | Design of Roof truss with bolted connection | PPT | Extra class required to clarify the concept |
| | 31 | 02/11/2020 | Design of roof truss with welded connection | PPT | 23/11/2020 | Design of roof truss with welded connection | PPT | |
| | 32 | 04/11/2020 | Design of roof truss with welded connection | PPT | 25/11/2020 | Design of roof truss with welded connection | PPT | |
| | 33 | 05/11/2020 | Design of roof truss with welded connection | PPT | 26/11/2020 | Design of roof truss with welded connection | PPT | |
| | 34 | 07/11/2020 | Design of Roof Truss with Load combinations | PPT | 30/11/2020 & 01/12/2020 | Design of Roof Truss with Load combinations | PPT | Extra class required to clarify the concept |
| | 35 | 09/11/2020 | Design of Roof Truss with Load combinations | PPT | 02/12/2020 & 04/12/2020 | Design of Roof Truss with Load combinations | PPT | Extra class required to clarify the concept |
| | 36 | 18/11/2020 | Design of Gantry Girder | PPT | 07/12/2020 & 09/12/2020 | Design of Gantry Girder | PPT | Extra class required to clarify the concept |
| | 37 | 19/11/2020 | Design of Gantry Girder | PPT | 10/12/2020 | Design of Gantry Girder | PPT | |
| | 38 | 21/11/2020 | Design of Gantry Girder | PPT | 14/12/2020 | Design of Gantry Girder | PPT | |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | 39 | 23/11/2020 | Design of Gantry Girder | PPT | 16/12/2020 | Design of Gantry Girder | PPT | |
| | 40 | 23/11/2020 | Design of Gantry Girder | PPT | 17/12/2020 | Design of Gantry Girder | PPT | |
| | 41 | 24/11/2020 | Design of Gantry Girder | PPT | 19/12/2020 | Design of Gantry Girder | PPT | |
| | 42 | 25/11/2020 | Design of Gantry Girder | PPT | 21/12/2020 | Design of Gantry Girder | PPT | |
| | 43 | 25/11/2020 | Design of Plate Girder without Stiffener using bolted connection | PPT | 21/12/2020 | Design of Plate Girder without Stiffener using bolted connection | PPT | |
| | 44 | 26/11/2020 | Design of Plate Girder without Stiffener using bolted connection | PPT | 23/12/2020 | Design of Plate Girder without Stiffener using bolted connection | PPT | |
| | 45 | 27/11/2020 | Design of Plate Girder without Stiffener using welded connection | PPT | 24/12/2020 | Design of Plate Girder without Stiffener using welded connection | PPT | |
| | 46 | 28/11/2020 | Design of Plate Girder without Stiffener using welded connection | PPT | 26/12/2020 | Design of Plate Girder without Stiffener using welded connection | PPT | |
| | 47 | 02/12/2020 | Design of Plate Girder with Stiffener using bolted connection | PPT | 31/12/2020 | Design of Plate Girder with Stiffener using bolted connection | PPT | |
| | 48 | 04/12/2020 | Design of Plate Girder with Stiffener using bolted connection | PPT | 31/12/2020 | Design of Plate Girder with Stiffener using bolted connection | PPT | |
| | 49 | 04/12/2020 | Design of Plate Girder with Stiffener using welded connection | PPT | 04/01/2021 | Design of Plate Girder with Stiffener using welded connection | PPT | |
| | 50 | 05/12/2020 | Design of Plate Girder with Stiffener using welded connection | PPT | 05/01/2021 | Design of Plate Girder with Stiffener using welded connection | PPT | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |

| | Activity | Planned | Actual | Remarks |
|---|---|---|---|---|
| 1 | Theory Classes | 50 | 61 | More classes required to clarify the design concepts |
| 2 | Assignments/Quizzes/ Self study | 3 | 1 | |
| 3 | Tutorials/ Extra classes | - | - | |
| 4 | Internal Assessments | 3 | 3 | |
| 5 | ICT based Teaching (% of usage in Curriculum) | 100% | 100% | |

| Planning | Execution |
|---|---|
| **Faculty Signature:** Avatika | **Faculty Signature:** Avatika |
| **HoD Signature:** | **HoD Signature:** |

## MINUTES OF MEETING

### 05/10/2020

The following discussions were made,

- **IA QP:**

  Part A: Answer any 3/4

  1. a. 2Marks (MCQ)

     b. 8Marks (Descriptive)

  Part B: Answer any 2/3

The same pattern shall be followed for all remaining questions.

a) MCQ can be descriptive choice or Numerical choice.

b) Uniformity should be maintained throughout the college.

- **IA Test Dates**: 8th, 9th and 10th October 2020

  Morning Schedule: 10AM to 11.30AM

  Afternoon Schedule: 2.30PM to 4PM

- **Test instructions:**

a) Students ought to be present 10min beforehand of the schedule.

15-20 college students have to be monitored through every faculty.

b) Internal Assessment 2020-2021 Team Should be created by Test coordinator--Under that create the Channel and add faculty members and corresponding students in that channel.

c) Papers to be deployed through Assignment-MS teams.
QP_PDF can also be released 1min prior to the test in Chat box.

d) Submission time:
Morning session: 11.30AM to 11.45AM
Afternoon session: 4PM to 4.15PM

e) Student Name, USN, Signature, Page no mandatory in every sheet.

f) Test Coordinator can make a note: In the test paper format provided by the Dean Office, College logo is deformed which is to be corrected as informed by Principal Sir. Department logo should appear on the right top side. (Can contact Mrs. Sneha, DOR for clarification)

g) Course Outcome, RBTL will appear after the questions as followed before.

- Classes will be suspended during the IA dates.

- All Faculty members should map lesson plan for online class conduction from 1st October up-to 30th October 2020 in CERP.
- Format for Face slide and information slide of the PPT will be shared after approval from Chairman Sir.
- CO attainment method was explained by Dean Academics Representative. Discussion was held and final approval is yet to be arrived. However, method is relatively easy and can be easily followed by Course coordinators.
- Students having attendance shortage has to be mentored and advice.

Note:

**a)** Students those who have not paid fees (old due: Previous years) only for those students MS teams account will be locked. If such instances are observed and test coordinator in consultation with HOD can consider if students are good in academics.

**b)** Students who have not attended session with critical attendance % can be advice specially and warned if not genuine case.

**Mr. ManuVijay (HOD) :**

Dr. Akshaya B J :

Prof. Suneeth Kumar S M

Mrs. Shruthi HG:

Mrs. Jyothi DN :

Mr. Mandeep G :

Mr. Srivathsa HU :

Mrs. Bharathi B :

Mr. Rudresh AN :

Mr. ShanshankP :

Mr. Puneeth K :

# MINUTES OF MEETING

## 28/09/2020

The following discussions were made,

- Virtual lab in the college has to be used effectively since we are registered as nodal center, recognized by NITK Surathkal.
- The entire labs activities need to be planned as virtual lab and ask the student to complete lab experiments within 17th October 2020.
- Question paper pattern will be uniform throughout the department and carrying of objective & descriptive questions.
- Committee has to be re-established within the department.
- Staff member are advised to go valuation after 2 o clock with permission of HOD.
- Personal files need to be updated and maintained within the department.

**Mr. ManuVijay (HOD) :**

Dr. Akshaya B J : Akshaya BJ

Prof. Suneeth Kumar S M

Mrs. Shruthi HG: Shruthi

Mrs. Jyothi DN :

Mr. Mandeep G :

Mr. Srivathsa HU : Srivathsa

Mrs. Bharathi B : Bharathi B

Mr. Rudresh AN :

Mr. Shanshank P :

Mr. Puneeth K : Puneeth

## MINUTES OF MEETING

**25/09/2020**

The following discussions were made,

- PAC & DAB committee meeting revising PSO if any should be completed by early as possible.
- Mapping of Co & Po for the academic year 2019-20 need to be verified.
- PALM matrix need to verify for the academic year 2020-21.
- Update R-44 file as soon as and also update the result analysis file as soon as result announced by the university.
- Personal file need to be updated by faculty for the academic year 2019-20.
- Course file need to maintain in the department with effect from 2019-20.

**Mr. ManuVijay (HOD) :**

Dr. Akshaya B J : Akshaya BJ

Prof. Suneeth Kumar S M : Suneeth Kumar S M

Mrs. Shruthi HG : Shruthi HG

Mrs. Jyothi DN :

Mr. Mandeep G :

Mr. Srivathsa HU : Srivathsa

Mrs. Bharathi B : Bharathi B

Mr. Rudresh AN :

Mr. Shanshank P :

Mr. Puneeth K : Puneeth

## Course Modules of the Subject Taught For the Session Sept-Jan 2020-21 (ODD Semester)

## Course Syllabi with CO's

| Faculty Name **: PUNEETH K** | | | Academic Year: 2020-21 | | | | |
|---|---|---|---|---|---|---|---|
| Department: CIVIL ENGINEERING | | | | | | | |
| Course Code | Course Title | Core/Elective | Prerequisite | Contact Hours | | | Total Hrs/ Sessions |
| | | | | L | T | P | |
| **17CV81** | **Quantity Surveying & Contract Management** | **CORE** | **RCC & Steel Engineering** | **3** | **-** | **-** | **40** |
| **Objectives** | The objectives of this course is to make students to learn:<br>1. Estimate the quantities of work, develop the bill of quantities and arrive at the Cost of civil engineering Project<br>2. Understand and apply the concept of Valuation for Properties<br>3. Understand, Apply and Create the Tender and Contract document. | | | | | | |

**Topics Covered as per Syllabus**

**Module-1**

Quantity Estimation for Building; study of various drawing attached with estimates, important terms, units of measurements, abstract, Types of estimates - Approximate, detailed, supplementary and revised.

Estimation of building - Short wall and long wall method - centre line method.

Estimate of R.C.C structures including Slab, beam, column, footings, with bar bending schedule.

**Module-2**

Estimate of Steel truss, manhole and septic tanks.

Quantity Estimation for Roads: Road estimation, earthwork fully in banking, cutting, partly cutting and partly Filling, Detailed estimate and cost analysis for roads.

**Module-3**

Specification for Civil Engineering Works: Objective of writing specifications essentials in specifications, general and detail specifications of different items of works in buildings.

Analysis of Rates : Factors Affecting Cost of Civil Works , Concept of Direct Cost , Indirect Cost and Project Cost

Rate analysis and preparation of bills, Data analysis of rates for various items of Works, Sub-structure components, Rate analysis for R.C.C. slabs, columns and beams.

**Module-4**

Contract Management-Tender and its Process: Invitation to tender, Prequalification, administrative approval & Technical sanction. Bid submission and Evaluation process.

Contract Formulation: Covering Award of contract, letter of intent, letter of acceptance and notice to proceed. Features / elements of standard Tender document (source: PWD / CPWD / International Competitive Bidding – NHAI / NHEPC / NPC). Law of Contract as per Indian Contract act 1872 , Types of Contract, Entire contract, Lump sum contract, Item rate, % rate, Cost plus with Target, Labour, EPC and BOT, Sub Contracting.

Contract Forms : FIDIC contract Forms , CPWD , NHAI , NTPC , NHEPC

**Module-5**

Contract Management-Post award : Basic understanding on definitions, Performance security, Mobilization and equipment advances, Secured Advance, Suspension of work, Time limit for completion, Liquidated damages and bonus, measurement and payment, additions and alterations or variations and deviations, breach of contract, Escalation, settlement of account or final payment, claims, Delay's and Compensation, Disputes & its resolution mechanism,

Contract management and administration

Valuation: Definitions of terms used in valuation process, Cost, Estimate, Value and its relationship, Capitalized value. Concept of supply and demand in respect to properties ( land , building , facilities'), freehold and lease hold , Sinking fund, depreciation–methods of estimating depreciation, Outgoings, Process and methods of valuation : Rent fixation, valuation for mortgage, valuation of land.

**List of Text Books**

1. Datta B.N., "Estimating and costing", UBSPD Publishing House, New Delhi
2. B.S. Patil, " Civil Engineering Contracts and Estimates", Universities Press
3. M. Chakraborthi; "Estimation, Costing and Specifications", Laxmi Publications

**List of Reference Books**

1. T Vazirani V.N and Chandana S.P, "Estimating and costing", Khanna Publishers, 2015.
2. Rangwala, C. "Estimating, Costing and Valuation", Charotar Publishing House Pvt. Ltd., 2015.

| **URLs :** https://www.youtube.com/watch?v=D04uxZpgp6M | | **RBT LEVELS** |
|---|---|---|
| **Course Outcomes** | **After the completion of the course the student will be able to ,**<br>1. Prepare detailed and abstract estimates for roads, building, RCC structures and sewer appurtenance | L3 |
| | 2. Prepare valuation reports of buildings. | L3 |
| | 3. Interpret Contract document's of domestic & international construction works | L3 |

Internal Assessment Marks: 40 (3 Session Tests are conducted during the semester and marks allotted based on average of best performances).

**The Correlation of Course Outcomes (CO's) and Program Outcomes (PO's)**

| Subject Code: | 17CV81 | TITLE: Quantity Surveying & Contract Management | | | | | Faculty Name: | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| List of Course Outcomes | Program Outcomes | | | | | | | | | | | |
| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | Total |
| CO-1 | 2 | 0 | 0 | 2 | 1 | 0 | 1 | 1 | 0 | 0 | 1 | 1 | 9 |
| CO-2 | 2 | 0 | 0 | 1 | 0 | 0 | 1 | 1 | 0 | 0 | 1 | 2 | 8 |
| CO-3 | 1 | 0 | 0 | 1 | 0 | 0 | 1 | 1 | 0 | 0 | 1 | 2 | 7 |
| Total | **5** | **0** | **0** | **4** | **1** | **0** | **3** | **3** | **0** | **0** | **3** | **5** | **24** |

**Note:** 3 = Strong Contribution 2 = Average Contribution 1 = Weak Contribution 0 = No Contribution

**The Correlation of Course Outcomes (CO's) and Program Specific Outcomes (PSO's)**

| Subject Code: | 17CV81 | TITLE: | Quantity Surveying & Contract Management | | Faculty Name: | | **RBT LEVELS** |
|---|---|---|---|---|---|---|---|
| List of Course Outcomes | Program Specific Outcomes | | | | | | |
| | PSO1 | PSO2 | PSO3 | PSO4 | PSO5 | Total | |
| CO-1 | 1 | 0 | 0 | 0 | 0 | 1 | L3 |
| CO-2 | 1 | 0 | 0 | 0 | 0 | 1 | L3 |
| CO-3 | 0 | 0 | 0 | 0 | 0 | 0 | L3 |
| Total | **2** | 0 | **0** | **0** | **0** | **2** | L3 |

**Note:** 3 = Strong Contribution 2 = Average Contribution 1 = Weak Contribution 0 = No Contribution

ATME College of Engineering

# ATME COLLEGE OF ENGINEERING

## DEPARTMENT OF CIVIL ENGINEERING

### PERSONAL TIME TABLE FOR ODD SEMESTER - 2020-21

**STAFF NAME: SRIVATHSA H U**

| DAY \ TIME | 9.00 - 10.00 | 10.00 -11.00 | 11.00 -11.15 | 11.15 - 12.15 | 12.15 - 1.00 | 1.00- 2.00 | 2.00 - 2.55 | 2.55 - 3.50 | 3.50 - 4.45 |
|---|---|---|---|---|---|---|---|---|---|
| Mon | | | TEA BREAK | | | Lunch Break | | | |
| Tue | | 18CV34 - A | | | 17CVL77 - B3 | | | | |
| Wed | | 17CV72 | | | | | | | |
| Thu | | 17CV72 | | | 18CV34 - A | | | | |
| Fri | | | | | | | 18CV34 - A | | |
| Sat | | | | 17CV72 | | | 17CVL77 - B2 | | |

| Curricular | | Units | Co-curricular | Units |
|---|---|---|---|---|
| Lecture | 7h*2units | 14 | Shilpi Co-ordinator | 1 |
| Lab | 2h*1unit | 2 | Placement Committee | 1 |
| | | | | |
| | | 16 | | 2 |
| | | | Total | 18 |

HOD

# ATME College of Engineering

**13th K M Stone, Bannur Road, Mysore – 570028**




A T M E

College of Engineering

## DEPARTMENT OF CIVIL ENGINEERING

## (ACADEMIC YEAR 2020-21)

**SUBJECT: BASIC GEO-TECHNICAL ENGINEERING**

**SUBJECT CODE: 18CV54**

**SEMESTER: 5TH**

# INSTITUTE

**Vision of the Institute**

Development of academically excellent, culturally vibrant, socially responsible and globally competent human resources.

**Mission of the Institute**

- To keep pace with advancements in knowledge and make the students competitive and capable at the global level.
- To create an environment for the students to acquire the right physical, intellectual, emotional and moral foundations and shine as torchbearers of tomorrow's society.
- To strive to attain ever-higher benchmarks of educational excellence.

# DEPARTMENT

**Vision of the Department**

To develop globally competent civil engineers who excel in academics, research and are ethically responsible for the development of the society.

**Mission of the Department**

- To provide quality education through faculty and state of the art infrastructure.
- To identify current problems in the society pertaining to Civil Engineering disciplines and to address them effectively and efficiently.
- To inculcate the habit of research and entrepreneurship in our graduates to address current infrastructure needs of society.

## PROGRAM OUTCOMES (PO's)

**PO1:** Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

**PO2:** Problem analysis: Identify, formulate, research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

**PO3:** Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

**PO4:** Conduct investigations of complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

**PO5:** Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.

**PO6:** The engineer and society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice. 44

**PO7:** Environment and sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

**PO8:** Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

**PO9:** Individual and team work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

**PO10:** Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

**PO11:** Project management and finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

**PO12:** Life-long learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

## PROGRAM EDUCATIONAL OBJECTIVES (PEO's)

Graduates who complete their UG course through our institution will be,

**PEO l-** Engaged in professional practices, such as construction, environmental, geotechnical, structural, transportation, or water resources engineering by using technical, communication and management skills.

**PEO 2-** Engaged in higher studies and research activities in various Civil Engineering fields and a life time commitment to learn ever changing technologies to satisfy increasing demand of sustainable infrastructural facilities

**PEO 3-** Serve in a leadership position in any professional or community organization, or local/state engineering board

**PEO 4-** Registered as a professional engineer or developed a strong ability leading to professional licensure being an entrepreneur.

## PROGRAM SPECIFIC OUTCOMES (PSO's)

**PSO1:** Provide the necessary infrastructure for all situations through competitive plans, maps and designs with the aid of a thorough Engineering Survey and Quantity Estimation.

**PSO2:** Assess the impact of anthropogenic activities leading to environmental imbalance on land, in water & in air and provide necessary viable solutions revamping water resources and transportation for a sustainable development

## COURSE SYLLABUS:

| **BASIC GEO-TECHNICAL ENGINEERING** | |
|---|---|
| Sub Code: **18CV54** | IA Marks: **40** |
| Hrs/ Week: **03** | Exam Hours: **03** |
| Total Hrs. **40** | Exam Marks: **60** |

**Module -1**

**Introduction:** Origin and formation of soil, Regional soil deposits in India, Phase Diagram, phase relationships, definitions and their interrelationships.

Determination of Index properties: Specific gravity, water content, in-situ density, relative density, particle size analysis(sieve and Hydrometer analysis)

Atterberg's Limits, consistency indices. Activity of clay, Field identification tests, Plasticity chart, BIS soil classification (IS: 1498-1970).

**Module -2**

Soil Structure and Clay Mineralogy Single grained, honey combed, flocculent and dispersed structures, Valence bonds, Soil-Water system, Electrical diffuse double layer, adsorbed water, base-exchange capacity, Isomorphous substitution. Common clay minerals in soil and their structures- Kaolinite, Illite and Montmorillonite and their application in Engineering

**Compaction of Soils:** Definition, Principle of compaction, Standard and Modified proctor's compaction tests, factors affecting compaction, effect of compaction on soil properties, Field compaction control-compactive effort & method of compaction, lift thickness and number of passes, Proctor's needle, Compacting equipments and their suitability.

**Module -3**

**Flow through Soils:** Darcy's law-assumption and validity, coefficient of permeability and its determination (laboratory and field), factors affecting permeability, permeability of stratified soils, Seepage velocity, superficial velocity and coefficient of percolation, Capillary Phenomena.

**Seepage Analysis:** Laplace equation, assumptions, limitation sand its derivation. Flow nets characteristics and applications. Flow nets for sheet piles and below the dam section.

Unconfined flow, phreatic line (Casagrande's method–with and without toe filter), flow through dams, design of dam filters.

**Effective Stress Analysis:**

Geostatic stresses, Effective stress concept-total stress, effective stress and Neutral stress and impact of the effective stress in construction of structures, quick sand phenomena.

**Module -4**

**Shear Strength of Soil:** Concept of shear strength, Mohr–Coulomb Failure Criterion, Modified Mohr–Coulomb Criterion Total and effective shear strength parameters, factors affecting shear strength of soils. Thixotrophy and sensitivity, Measurement of shear strength parameters - Direct shear test, unconfined compression test, triaxial compression test and field Vane shear test, Test under different drainage conditions.

**Module -5**

**Consolidation of Soil:** Definition, Mass-spring analogy, Terzaghi's one dimensional consolidation theory-assumptions and limitations. Governing differential Equation and solution (No derivation).

Consolidation characteristics of soil (Cc, $a_v$, $m_v$ and $C_v$). Laboratory one dimensional consolidation test, characteristics of e-log ( $\sigma$ ') curve, Pre-consolidation pressure and its determination by Casagrande's method. Over consolidation ratio, normally consolidated, under consolidated and over consolidated soils.

Determination of consolidation characteristics of soils- compression index and coefficient of Consolidation (square root of time fitting method, logarithmic time fitting method). Primary and secondary consolidation.

**After the completion of the course the student will be able to ,**

1. Ability to plan and execute geotechnical site investigation program for different civil engineering projects.
2. Understanding of stress distribution and resulting settlement beneath the loaded footings on sand and clayey soils.
3. Ability to estimate factor of safety against failure of slopes and to compute lateral pressure distribution behind earth retaining structures.
4. Ability to determine bearing capacity of soil and achieve proficiency in proportioning shallow isolated and combined footings for uniform bearing pressure.
5. Capable of estimating load carrying capacity of single and group of piles.

**MODULE 1**

1.0 INTRODUCTION

1.1 SOIL PROFILE

1.2 FORMATION OF SOIL

1.3 REGIONAL SOIL DEPOSITS IN INDIA

1.4 PHASE DIAGRAM

1.5 IMPORTANT DEFINITIONS

1.6 INTER-RELATIONSHIPS

1.7 INDEX PROPERTIES

1.8 WATER CONTENT

1.9 SPECIFIC GRAVITY

1.10 INSITU DENSITY

1.11 PARTICLE SIZE ANALYSIS

1.12 CONSISTENCY OF SOIL

1.13 IMPORTANT QUESTIONS

## 1.0 INTRODUCTION

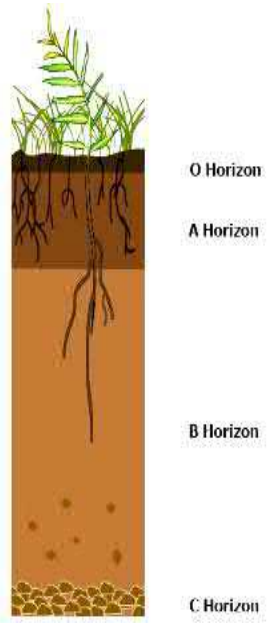
Soil is the thin layer of material covering the earth's surface and is formed from the weathering of rocks. Soil minerals form the basis of soil. They are produced from rocks (parent material) through the processes of weathering and natural erosion. Water, wind, temperature change, gravity, chemical interaction, living organisms and pressure differences all help break down parent material.

**Definitions of soil:-**

- ***Agriculturist:*** **-** Loose material on the earth's crust consisting of disintegrated rock which supports the plant life.
- ***Geologist:*** **-** Disintegrated rock material not transported from the place of origin.
- ***Civil Engineer:*** **-** Loose, unconsolidated inorganic material on the earth's crust.

## 1.1 SOIL PROFILE

As soils develop over time, layers (or horizons) form a soil profile. Most soil profiles cover the earth as 2 main layers topsoil and subsoil. Soil horizons are the layers in the soil as you move down the soil profile. A soil profile may have soil horizons that are easy or difficult to distinguish.




Most soils exhibit 3 main horizons:-

**A horizon –** humus rich topsoil where nutrient, organic matter and biological activity are highest (i.e. most plant roots, earthworms, insects and micro-organisms are active). The A horizon is usually darker than other horizons because of the organic materials.

**B horizon** - clay-rich subsoil. This horizon is often less fertile than the topsoil but holds more moisture. It generally has a lighter color and less biological activity than the A horizon. Texture may be heavier than the A horizon too.

**C horizon** - underlying weathered rock (from which the A and B horizons form).

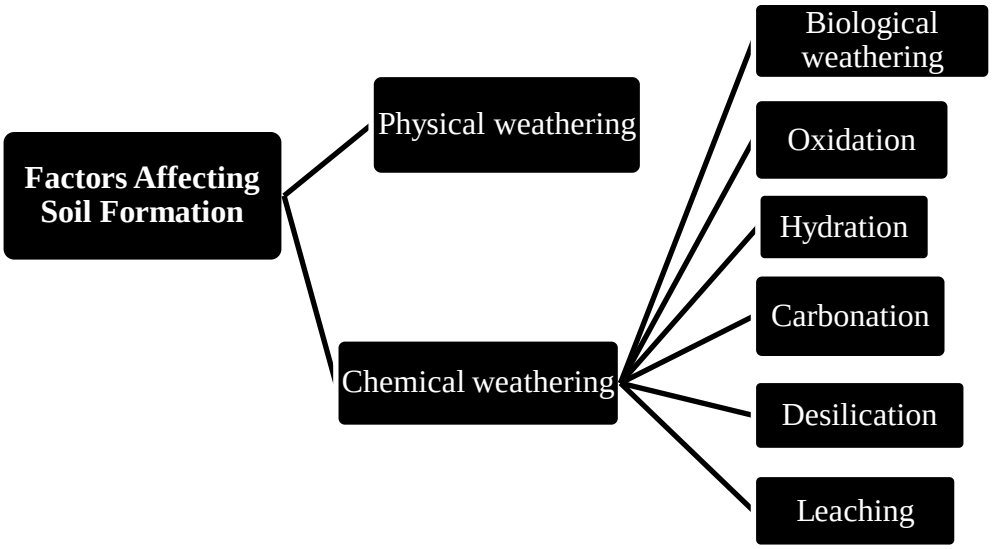
Some soils also have an **O horizon** mainly consisting of plant litter which has accumulated on the soil surface.

The properties of horizons are used to distinguish between soils and determine land-use potential.

## 1.2 FORMATION OF SOIL

Soil is an unaggregated or uncemented deposit of mineral and/or organic materials or fragments covering large portion of Earth's crust. The range of particle size varies from few microns in diameter to large size boulders. It includes silts, clay, gravels, sand etc.

The formation of soil is a result of the geologic cycle which consists of weathering, transportation, deposition and again followed by weathering and so on.




**Physical weathering** is caused by agencies such as periodical temperature changes, impact and splitting action of flowing water, ice and wind, plants and animals.

Eg: - All cohesion less soils like sand

**Chemical weathering** is caused due to oxidation hydration, carbonation, desilication leaching by organic acids and water.

**a)** Oxidation: - It occurs frequently in rocks. It is in a manner similar to the rusting of Steel when it comes in contact with moist air.

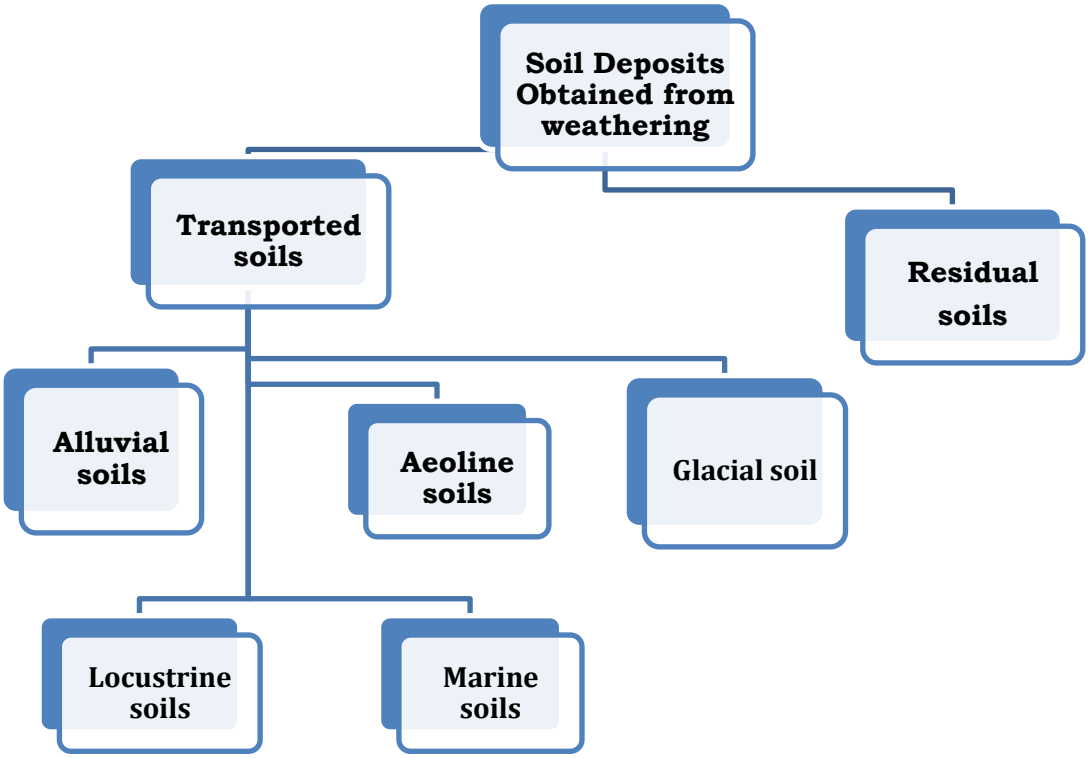
**b)** Carbonation: - The minerals containing iron calcium, magnesium, sodium or potassium can be decomposed by carbonic acid which is formed by carbon dioxide with water.

**c)** Hydration: - It is a common process of rock decay by which it is combined with some other soil substances producing certain new minerals. The process of hydration are more intense you in humid than in the arid climates.

**d)** Desilication: - It consists in leaching out of dissolved or colloidal silica freed in the course of other chemical process.

**e)** Leaching: - It is the process when water soluble parts (Calcium Carbonate) are dissolved and washed out from the soil by rainfall, circulating water, subsurface flow or other water.

❖ **Soil obtained due to weathering are off 2 types namely transported and residual.**




**Residual Soils**: - These soils remain in place over the parent Rock. They are relatively found in shallow depth.

**Transported Soils**: - These are soils that are picked up, mixed, disintegrated, transported and are redeposited. They are found in considerable depth. They may be homogeneous and heterogeneous or they may have alteration of particle shape, size and texture depending upon the manner of their transportation and deposition.

Transported soils may be further subdivided as:-

1. Alluvial soils: - Soils transported by rivers and stream.

Example: Sedimentary Clay

2. Aeoline soils: - Soils transported by wind.

Example: Loess

3. Glacial soil: - Soils transported by glaciers.

Example: Glacial Fill

4. Locustrine soils: - Soils deposited in lake and beds.

Example: Locustrine clays

5. Marine soils: - Soils deposited in sea bed.

Example: Marine silts, Marine clays

## 1.3 REGIONAL SOIL DEPOSITS IN INDIA

1. Alluvial Deposits
2. Black Cotton Soils
3. Lateritic Soils
4. Desert Soil
5. Marine Deposits

### 1.3.1 Alluvial Deposits

Alluvial deposit, are the soils deposited by rivers. It consists of silt, sand, clay, and gravel, as well as much organic matter. Alluvial deposits are usually most extensive in the lower part of a river's course but they may form at any point where the river overflows its banks or where the flow of a river is checked.

Most alluvial soils are derived from the sediment being deposited by the river Ganga in the Indo–Gangetic plain, ranging from Punjab in the west to West Bengal and Assam in the east, as well as in the coastal areas of northern parts of Gujarat, Narmada, and Tapi valleys, which are formed by sea waves.

- **Alluvial soil** can be classified into **two** groups on the basis of its age - the khaddar and the bhangar. The color of the alluvial soils varies from the **light grey** to **ash grey** depending on the depth of the deposition, the texture of the materials, and the time taken for attaining maturity.
- The main **advantages of alluvial soil** are; they are very humus rich in nature and are fertile. They are rich in potassium and are highly suitable for the agriculture.

### 1.3.2 Black Cotton Soils

**Black cotton soil** is heavy clay **soil**, varying from clay to loam; it is generally light to dark grey in color. It is a soil formed in the Deccan region of India by the disintegration of black lava.

The **black cotton soil** by observation looks dark in color and by sample test it is characterized by the phenomenon of swelling when wet and shrinks when dry.

- **Black soils** are highly argillaceous, very fine grained and dark, and contain a high proportion of calcium and magnesium carbonates. They are very tenacious of moisture and exceedingly sticky, when wet. Due to considerable contraction on drying large and deep cracks are formed.

- As such **Black cotton soil** (BC **soil**) has very low bearing capacity and high swelling and shrinkage characteristics. Due to its peculiar characteristics, it forms a very poor foundation material for road **construction**. Soaked laboratory CBR values of **Black Cotton soils** are generally found in the range of 2% to 4%.
- **Black soil** is rich in calcium, potassium and magnesium but has poor nitrogen content. Crops like cotton, tobacco, chilly, oil seeds, jowar, ragi and maize grow well in it.

### 1.3.3 Lateritic Soils

**Laterite** is a **soil** and rock type rich in iron and aluminium and is commonly considered to have formed in hot and wet tropical areas. Nearly all **laterites** are of rusty-red coloration, because of high iron oxide content. They develop by intensive and prolonged weathering of the underlying parent rock.

- The laterite soils are commonly found in Karnataka, **Kerala**, **Tamil Nadu**, **Madhya Pradesh** and the hilly areas of **Orissa** and **Assam**. Soil Color is Reddish brown in color due to the presence of **iron** oxide.
- The **laterite soil is formed** under conditions of high temperature and heavy rainfall with alternate wet and dry periods, which leads to leaching of **soil**, leaving only oxides of iron and aluminum. It lacks fertility due to a lower base-exchanging capacity and a lower content of nitrogen, phosphorus, and potassium.

### 1.3.4 Desert Soil

**Desert soil** is mostly sandy **soil** (90–95%) found in low-rainfall regions. It has a low content of nitrogen and organic matter with very high calcium carbonate and phosphate, thus making it infertile. The amount of calcium is 10 times higher in the lower layer than in the topsoil.

- Most desert soils are called **Aridisols** (**dry soil**). However, in really dry regions of the Sahara and Australian outback, the soil orders are called **Entisols**. **Entisols** are new soils, like **sand** dunes, which are too dry for any major soil horizon development.
- The four main types of desert include hot and dry deserts, semi-arid deserts, coastal deserts, and cold deserts. In hot and dry deserts, also known as arid deserts, the temperatures are warm and dry year-**round**.

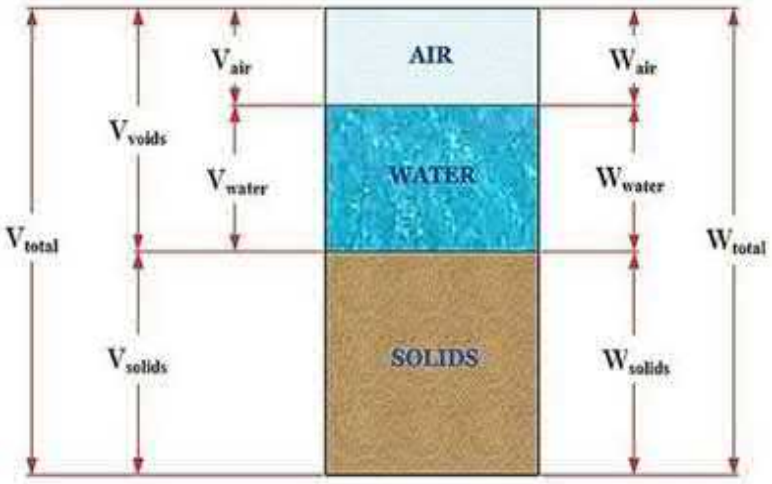
### 1.3.5 Marine Deposits

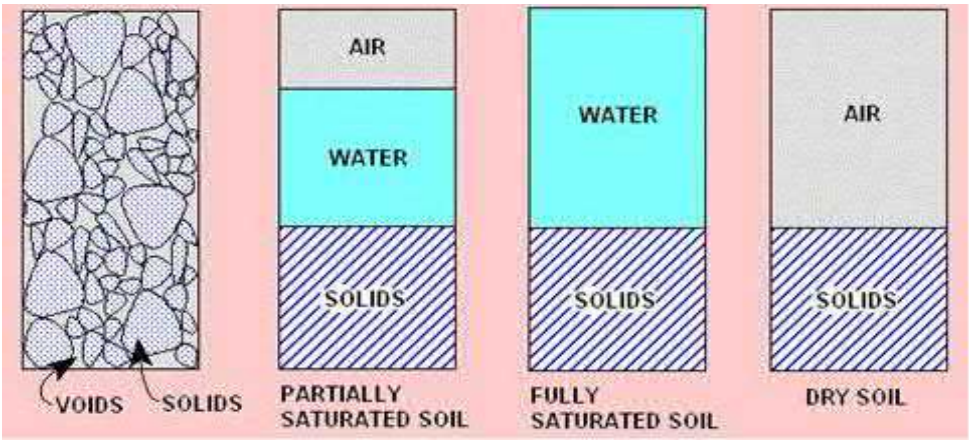
**Marine sediment**, any **deposit** of insoluble material, primarily rock and soil particles, transported from land areas to the **ocean** by wind, ice, and rivers, as well as the remains

of **marine** organisms, products of submarine volcanism, chemical precipitates from seawater, and materials from outer space.

There are four kinds of marine sediments, Lithogenous, **biogenous**, **hydrogenous** and cosmogenous. Lithogenous are from the land; they form through the **weathering** process and are composed of small particles from weathered rock and volcanic activity.

## 1.4 PHASE DIAGRAM




In general the soil sample will be consisting of soil solids, water and air which are designated as three phase system of soil. The sum of air content and water content of sample is called as voids.

If the voids are completely filed with water such a sample is called as a purely saturated sample or 100% saturated sample.

If the voids are completely filled with air such a sample is called as purely dried sample.

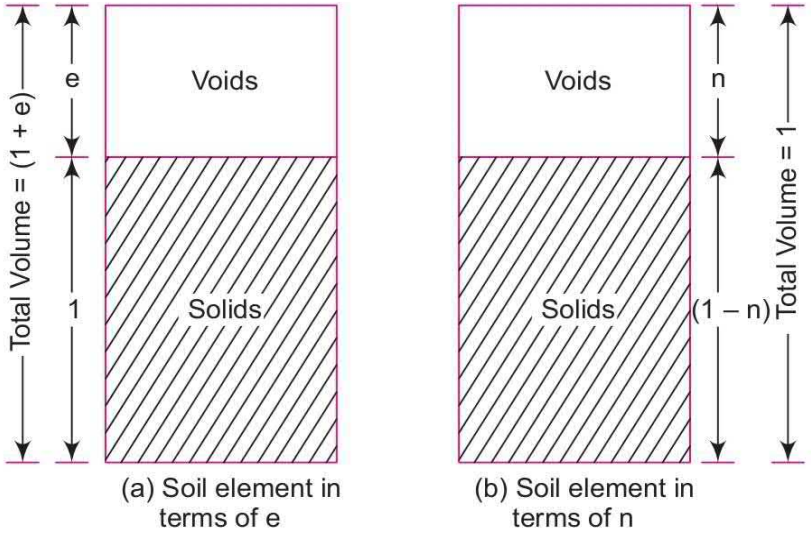
On the other hand if a part of the voids are filled with water and the remaining with air that is called as moist sample. The figure shows the diagrammatic representation of three phase system of soil element in terms of volume and weights respectively.

In the figure,

- W = weight of the soil sample
- $W_S$ = Weight of the solids in soil sample, $W_W$ = Weight of water in the sample, $W_a$ = Weight of air in the soil sample
- V = Total volume of the soil sample, $V_a$ = Volume of sir in the sample, $V_w$ = Volume of water in the sample, Vs = Volume of the solids in the sample, $V_V$ = Volume of voids in the sample

**Note: -**

- In the figure, weight of air ($W_a$) is assumed to be zero, weight of the voids is equal to the weight of water i.e $W_w = W_V$
- The total weight of the partially and completely saturated soil is $W = W_s + W_w$ whereas, the total weight of completely dry soil is $W = W_s$
- The total volume of the soil is $V = V_v + V_s$, where $V_v$ is the volume of voids ($V_v = V_w + V_a$).
- In case of completely saturated and dry soil the volume of voids $V_v = V_w$ and $V_v = V_a$, respectively. .
- For (a) Fully Saturated soil (b) For fully dry soil




## 1.5 IMPORTANT DEFINITIONS

2. **Water content (W)**: - It is defined as the ratio weight of water to the wet of solids present in a soil sample. Expressed in terms of percentage (%).

$$W = \frac{W_W}{W_S}$$

3. **Void ration (e)**: - Ratio of volume of voids to the volume of soil solids present in a soil mass. Expressed in terms of decimals.

$$e = \frac{V_V}{V_S}$$

4. **Porosity (n)**: - Ratio of volume of voids to the total volume of soil sample. Expressed in terms of percentage (%).

$$n = \frac{V_V}{V}$$

5. **Degree of saturation (S):-** Ratio of volume water present in a given soil mass too the volume of voids. Expressed in terms of percentage (%).

$$S = \frac{V_W}{V_V}$$

   - Fully saturated soil sample; S = 1
   - Perfectly dry soil sample; S = 0

6. **Percentage of air voids ($\eta_a$):-** Ratio of volume of air voids to the total volume of soil mass. Expressed in terms of percentage (%).

$$\eta_a = \frac{V_a}{V}$$

7. **Air content ($a_c$):-** Ratio of volume of air voids to the volume of voids.

$$a_C = \frac{V_a}{V_V}$$

- Relation between air content and Degree of Saturation:

$$a_C = \frac{V_a}{V_V} = \frac{V_V - V_W}{V_V}$$

$$a_C = \frac{V_V}{V_V} - \frac{V_W}{V_V}, \quad a_C = 1 - S$$

8. **Bulk density ($\gamma_B$): -** Ratio of weight of soil sample to its volume. The unit weight of bulk density is Kg/m$^3$ or N/m$^3$.

$$\gamma_b = \frac{W}{V}$$

9. **Dry density ($\gamma_d$):-** Ratio of weight of soil solids to its volume. The unit weight of Dry density is Kg/m$^3$ or N/m$^3$.

$$\gamma_d = \frac{W_S}{V}$$

10. **Unit weight of soil solids ($\gamma_S$):-** Ratio of weight of soil solids to the volume of soil solids.

$$\gamma_S = \frac{W_S}{V_S}$$

11. **Unit weight of water ($\gamma_W$):-** Ratio of weight of water to the volume of water.

$$\gamma_w = \frac{W_w}{V_w}$$

12. **Specific Gravity (G): -** It is defined as the ratio of unit weight of soil solids to that of water.

$$G = \frac{\gamma_s}{\gamma_W}$$

13. **Density of solids ($\gamma_S$):-** Ratio of weight of mass of soil solids per unit volume of solids.

$$\gamma_S = \frac{M_S}{V_S}$$

14. **Saturated density ($\gamma_{Sat}$)**: – when soil mass is saturated its bulk density is called saturated density. It is the ratio of the total soil mass of saturated sample to its total volume of the soil.

$$\gamma_{Sat} = \frac{W_{Sat}}{V}$$

15. **Submerged density ($\gamma_{Sub}$)**: – It is the ratio of the total soil mass of submerged sample to its total volume of the soil.

$$\gamma_{Sub} = \frac{W_{Sub}}{V}$$

$$\gamma_{Sub} = \gamma_{Sat} - \gamma_W$$

## 1.6 INTER-RELATIONSHIP

1. **Relationship between e and n**

(i) $e = \frac{V_V}{V_S}$ & $n = \frac{V_V}{V}$

$$e = \frac{V_V}{V - V_V}$$

- Dividing numerator and denominator by V

$$e = \frac{\frac{V_V}{V}}{\frac{V}{V} - \frac{V_V}{V}}$$

$$\boxed{\mathbf{e = \frac{n}{1 - n}}}$$

(ii) $e = \frac{V_V}{V_S}$ & $n = \frac{V_V}{V}$

$$n = \frac{V_V}{V_V + V_S}$$

- Dividing numerator and denominator by $V_s$

$$n = \frac{\frac{V_V}{V_S}}{\frac{V_V}{V_S} + \frac{V_S}{V_S}}$$

$$\boxed{\mathbf{n = \frac{e}{1 + e}}}$$

2. **Relation between G, W, S & e**

$$G = \frac{\gamma_S}{\gamma_W}, \quad W = \frac{W_W}{W_S}, \quad S = \frac{V_W}{V_V}, \quad e = \frac{V_V}{V_S}$$

$$W = \frac{W_W}{W_S}$$

$$\gamma_W = \frac{W_W}{V_W} \quad \& \quad \gamma_S = \frac{W_S}{V_S}$$

$$W = \frac{\gamma_W \times V_W}{\gamma_S \times V_S}$$

- Multiplying & Dividing by $V_V$

$$W = \frac{\gamma_W \times V_W}{\gamma_S \times V_S} \times \frac{V_V}{V_V}$$

$$W = \left(\frac{1}{\frac{\gamma_S}{\gamma_W}}\right) \times \left(\frac{V_W}{V_V}\right) \times \left(\frac{V_V}{V_S}\right)$$

$$W = \left(\frac{1}{G}\right) \times (e) \times (s)$$

$$\boxed{\mathbf{GW = eS}}$$

**3. Relation between e, S and $\eta_a$**

$$\eta_a = \frac{V_a}{V}$$

$$V_a = V_V - V_W = e - e_W$$

$$V = V_s + V_V = 1 + e$$

$$\eta_a = \frac{e - e_W}{1 + e}$$

$$S = \frac{V_W}{V_V} = \frac{e_W}{e}$$

$$e_W = e \times S$$

$$\eta_a = \frac{e - e \times S}{1 + e}$$

$$\boxed{\boldsymbol{\eta_a = \frac{e(1 - S)}{1 + e}}}$$

4. **Relation between $a_c$, n, $\eta_a$**

$$a_c = \frac{V_a}{V_V}, \quad n = \frac{V_V}{V}, \quad \eta_a = \frac{V_a}{V}$$

$$\eta_a = \frac{V_a}{V}$$

- Multiplying & Dividing by $V_V$

$$\eta_a = \frac{V_a}{V} \times \frac{V_V}{V_V}, \qquad \eta_a = \frac{V_a}{V_V} \times \frac{V_V}{V}$$

$$\boxed{\boldsymbol{\eta_a = a_c \times n}}$$

**5. Relation between $\gamma_d$ , G, & e (or n)**

(i) $\gamma_d = \frac{W_S}{V}$

$$\gamma_s = \frac{W_S}{V_S}, \qquad W_S = \gamma_s \times V_S$$

$$\gamma_d = \frac{\gamma_s \times V_S}{V}$$

$$G = \frac{\gamma_s}{\gamma_W}, \quad V_S = 1, \quad V = 1 + e$$

$$\boxed{\boldsymbol{\gamma_d = \frac{G\gamma_W}{1+e}}}$$

(ii) $n = \frac{e}{1+e}$

$$\frac{1}{1+e} = \frac{n}{e}$$

$$\gamma_d = \frac{G \times \gamma_W \times n}{e}$$

$$e = \frac{n}{1-n}, \qquad n = e \times (1-n)$$

$$\gamma_d = \frac{G \times \gamma_W \times e \times (1-n)}{e}$$

$$\boxed{\boldsymbol{\gamma_d = G \times \gamma_W \times (1-n)}}$$

**6. Relation between $\gamma_{sat}$ , G, & e**

$$\gamma_{Sat} = \frac{W_{sat}}{V}$$

$$W_{sat} = W_S + W_W$$

$$\gamma_W = \frac{W_W}{V_W}, \quad \gamma_S = \frac{W_S}{V_S}$$

$$\gamma_{Sat} = \frac{\gamma_S V_S + \gamma_W V_W}{V_S + V_V}$$

$$G = \frac{\gamma_S}{\gamma_W}, \quad V_S = 1, \quad V_V = V_W = e$$

$$\gamma_{Sat} = \frac{(G \times \gamma_W \times 1) + (\gamma_W \times e)}{(1+e)}$$

$$\boldsymbol{\gamma_{Sat} = \frac{\gamma_W(G+e)}{(1+e)}}$$

**7. Relation between γ, G, e & S**

$$\gamma = \frac{W}{V}$$

$$W = W_S + W_W$$

$$\gamma_W = \frac{W_W}{V_W}, \quad \gamma_S = \frac{W_S}{V_S}$$

$$\gamma = \frac{\gamma_S V_S \times \gamma_W V_W}{V_S + V_V}$$

$$\gamma = \frac{(G \times \gamma_W \times 1) + (\gamma_W \times e_W)}{(1 + e)}$$

$$e_W = eS$$

$$\gamma = \frac{(G \times \gamma_W \times 1) + (\gamma_W \times eS)}{(1 + e)}$$

$$\boldsymbol{\gamma = \frac{\gamma_W(G + eS)}{(1 + e)}}$$

- **For a fully saturated soil sample S=1**

$$\boldsymbol{\gamma_{sat} = \frac{\gamma_W(G + e)}{(1 + e)}}$$

- **For a fully submerged soil sample**

$$\gamma_{sub} = \gamma^1 = \gamma_{sat} - \gamma_w$$

$$\gamma_{sub} = \gamma^1 = \frac{\gamma_W(G + e)}{(1 + e)} - \gamma_w$$

$$\gamma_{sub} = \gamma^1 = \gamma_w \frac{(G + e) - (1 + e)}{(1 + e)}$$

$$\boldsymbol{\gamma_{sub} = \gamma^1 = \gamma_w \frac{(G - 1)}{(1 + e)}}$$

**8. Relation between $\gamma_d$, $\gamma$, w**

$$w = \frac{w_w}{w_d}$$

- **Add 1 both side of the equation**

$$1 + w = 1 + \frac{w_w}{w_d}$$

$$1 + w = \frac{w_d + w_w}{w_d}$$

$$w = w_d + w_w$$

$$w_d = \frac{w}{1+w}$$

$$\gamma_d = \frac{w_d}{V}$$

$$\gamma_d = \frac{1}{V} \times \frac{w}{1+w}$$

$$\gamma = \frac{W}{V}$$

$$\boldsymbol{\gamma_d = \frac{\gamma}{1+w}}$$

9. **Relation between $\gamma_{sat}$ , $\gamma$, $\gamma_d$ & S**

$$\gamma = \frac{\gamma_W (G + eS)}{(1+e)}$$

$$\gamma = \frac{G\gamma_W}{(1+e)} + \frac{\gamma_W eS}{(1+e)}$$

- Add and subtract "$\boldsymbol{S}\frac{G\gamma_W}{(1+e)}$" on right side of the equation

$$\gamma = \frac{G\gamma_W}{(1+e)} + \frac{\gamma_W eS}{(1+e)} + s\frac{G\gamma_W}{(1+e)} - s\frac{G\gamma_W}{(1+e)}$$

$$\gamma_d = \frac{G\gamma_W}{(1+e)}$$

$$\gamma = \gamma_d + \{S(\frac{G\gamma_W}{(1+e)} + \frac{\gamma_W e}{(1+e)}) - S\frac{G\gamma_W}{(1+e)})\}$$

$$\gamma = \gamma_d + \{S(\frac{(G+e)\gamma_W}{(1+e)}) - S\frac{G\gamma_W}{(1+e)})\}$$

$$\gamma_{sat} = \frac{\gamma_W (G+e)}{(1+e)}$$

$$\gamma = \gamma_d + \{S\gamma_{sat} - S\frac{G\gamma_W}{(1+e)})\}$$

$$\gamma = \gamma_d + \{S\gamma_{sat} - S\gamma_d)\}$$

$$\boldsymbol{\gamma = \gamma_d + S(\gamma_{sat} - \gamma_d)}$$

**10. Relation between $\gamma_d$, G, W& $\eta_a$**

$$V = V_a + V_W + V_S$$

$$\gamma_W = \frac{W_W}{V_W} \;\&\; \gamma_S = \frac{W_S}{V_S}$$

$$V = V_a + \frac{W_W}{\gamma_W} + \frac{W_S}{\gamma_S}$$

$$W = \frac{W_W}{W_S} \;\&\; W_W = W \times W_S$$

$$V = V_a + \frac{W \times W_S}{\gamma_W} + \frac{W_S}{\gamma_S}$$

- **Divide throughout by V**

$$\frac{V}{V} = \frac{V_a}{V} + \frac{W \times W_S}{\gamma_W \times V} + \frac{W_S}{\gamma_S \times V}$$

$$1 - \frac{V_a}{V} = \left[\frac{W}{\gamma_W} \times \frac{W_S}{V}\right] + \left[\frac{W_S}{V} \times \frac{1}{\gamma_S}\right]$$

$$1 - \eta_a = \left[\frac{W \times \gamma_d}{\gamma_W}\right] + \left[\frac{\gamma_d}{\gamma_S}\right]$$

$$G = \frac{\gamma_S}{\gamma_W}$$

$$1 - \eta_a = \left[\frac{W \times \gamma_d}{\gamma_W}\right] + \left[\frac{\gamma_d}{G \times \gamma_W}\right]$$

$$1 - \eta_a = \frac{\gamma_d}{\gamma_W}\left(W + \frac{1}{G}\right)$$

$$\boldsymbol{\gamma_d = \frac{G\gamma_W(1 - \eta_a)}{(1 + wG)}}$$

- **Density Index and Relative compaction**

**<u>Density Index</u> ($I_D$): -** It is defined as the ratio of difference between the void ratio of soil in its loosest state '$e_{max}$' & its natural void ratio 'e' to the difference between the void ratios in the loosest '$e_{max}$' and dense state '$e_{min}$'.

$$\boldsymbol{I_D = \frac{e_{max} - e}{e_{max} - e_{min}}}$$

$$\gamma_{d_{max}} = \frac{G\gamma_W}{(1 + e_{min})}$$

$$\gamma_{d_{min}} = \frac{G\gamma_W}{(1 + e_{max})}$$

Relative density or Degree of density is used to express the relative compactness of a cohensionless soil. Its value varies between '0 to 1'.

**Relative compaction ($R_C$): -** It is defined as the ratio of natural dry density to the maximum dry density.

$$R_C = \frac{\gamma_d}{\gamma_{d_{max}}} = \frac{1 + e_{min}}{1 + e}$$

## 1.7 INDEX PROPERTIES

The properties which help to access the engineering behaviour of the soil and the test results obtained on a soil in a laboratory are called Index properties.

The determination of water content, specific gravity, particle size distribution, consistency limits, in-situ density, Relative density & activity of clays, these properties are known as Index properties.

So index properties can be divided into two general types namely:-

(i) Soil grain properties.

(ii) Soil aggregate properties.

Soil grain properties depend on the individual grain of soil mass and are independent of manner of soil formation. The soil aggregate properties depend on the soil history, mode of soil formation and the soil structure.

## 1.8 WATER CONTENT

The water content of a soil sample can be determined by the following methods:-

1. Oven drying method
2. Sand bath method
3. Pycnometer method
4. Calcium carbide/Rapid moisture method
5. Alcohol method

### 1.8.1 Oven Drying Method

The most accurate approach and is adopted in the laboratory. The soil specimen should be representative of the soil mass. The quantity of the specimen taken would depend upon the gradation and the maximum size of particle.

- **Procedure:**

1. A clean container of non corrodible material is taken and its empty weight along with lid is taken (W1).
2. Small quantity of moist soil is placed in the container and the lid is placed and weight is taken (W2).
3. The lid is then removed and the container with the soil is placed thermostatically controlled oven for 24 hours where the temperature is being maintained between $105^0$C - $110^0$C.
4. After drying, the container is cooled in a desiccator and the lid is placed and its weight is taken (W3).

- Empty weight of container ($W_1$)
- Weight of soil sample and container with lid ($W_2$)
- Weight of dry soil and Container with lid ($W_3$)
- Weight of water ($W_2$-$W_3$)
- Weight of dry soil ($W_3$-$W_1$)
- Water content = $\boldsymbol{W = \frac{W2-W3}{W3-W1} \times 100}$

**Note:-**

1. Sandy soil needs only about 4 hours of driving while clay needs about 15 to 16 hours. To ensure complete drying 24 hours of oven drying is recommended.
2. Temperature of more than $110^0$C may result in loss of chemically bound water around clay particles and hence should not be used. A low value of 60°C is preferred in the case of organic soil such as to prevent the oxidation of the organic matter.
3. If gypsum is suspected to be present in the soil, drying at 80°C for a longer period is preferred to prevent the loss of water due to crystallization of the system.

### 1.8.2 Sand Bath Method

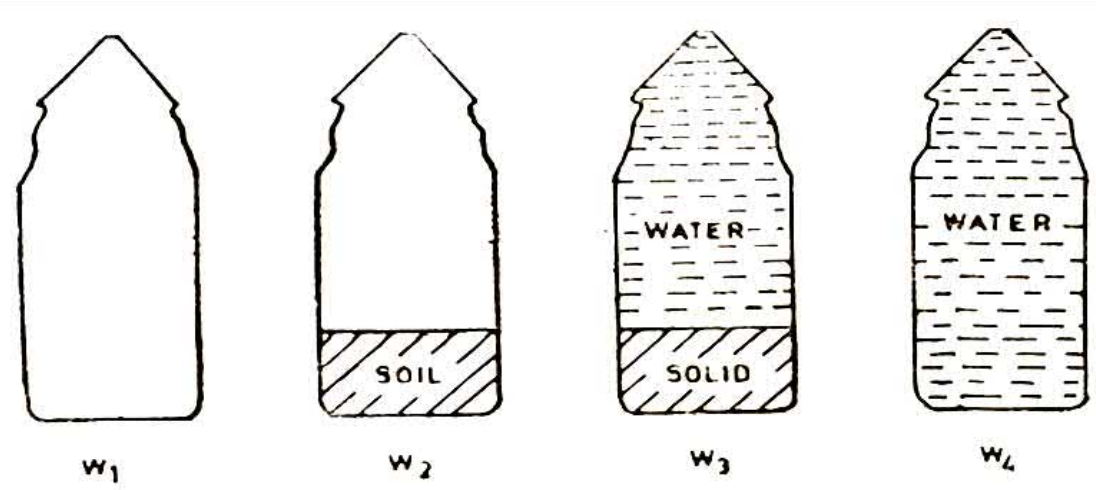



Sand Bath method for the determination of soil water content is a quick field method which is employed when an electric oven is not available for drying of wet soil. Sand is kept on a tray to a height of about 3 cm. A container is filled with wet soil and dried by keeping on the sand bath and heating with stirring. Few white papers are kept on top of the wet soil in the container. The soil is said to be dry when these white papers turn brown. Finally, dry soil is obtained and the water content can be determined with the help of the equation obtained for oven drying method.

- Water content = $\mathbf{W = \frac{W2-W3}{W3-W1} \times 100}$

However higher temperature may break the crystalline structure of the soil. This method should not be used for organic soil or for soil having higher percentage of gypsum

### 1.8.3 Pycnometer Method




1. Take the empty weight of the Pycnometer, W1.
2. The Pycnometer is filled with a sample of **wet soil** about 200 to 400gms in weight and the bottle is weighed, W2.
3. The Pycnometer with sample is filled with water up to the tip of the Pycnometer and its weight is taken, W3.
4. Then the Pycnometer is emptied and thoroughly washed. After washing, the Pycnometer is filled with water up to the tip and its weight is taken. (The Pycnometer should be completely dry on the outer face) W4.
5. Calculate the moisture content by formula.

$$\left[\left(\frac{\mathbf{W_2 - W_1}}{\mathbf{W_3 - W_4}}\right) \times \left(\frac{\mathbf{G - 1}}{\mathbf{G}}\right) - \mathbf{1}\right] \times \mathbf{100}$$

### 1.8.4 Calcium Carbide/ Rapid Moisture Method

It is a method for rapid determination of water content from the gas pressure developed by the reaction of calcium carbide with the free water of the soil. From the calibrated scale of the pressure gauge the percentage of water on total mass of wet soil is obtained and the same is converted to water content on dry mass of soil.



- In this method 6 gram of wet sample is placed in an airtight container and is mixed with sufficient quantity of fresh calcium carbide powder and it is shaken vigorously.
- The acetylene gas produced by the reaction of the moisture of the soil and the calcium carbide exerts pressure on a sensitive diaphragm placed at the end of the container.
- The dial gauge such that gives the water content based on the wet weight of the soil sample.
- The method is very quick and the results can be obtained in 5 to 10 minutes
- Knowing the water content $w^1$ based on wet weight, the water content w based on dry weight can be found by the equation

$$\mathbf{w = \frac{w^1}{1 - w^1}}$$

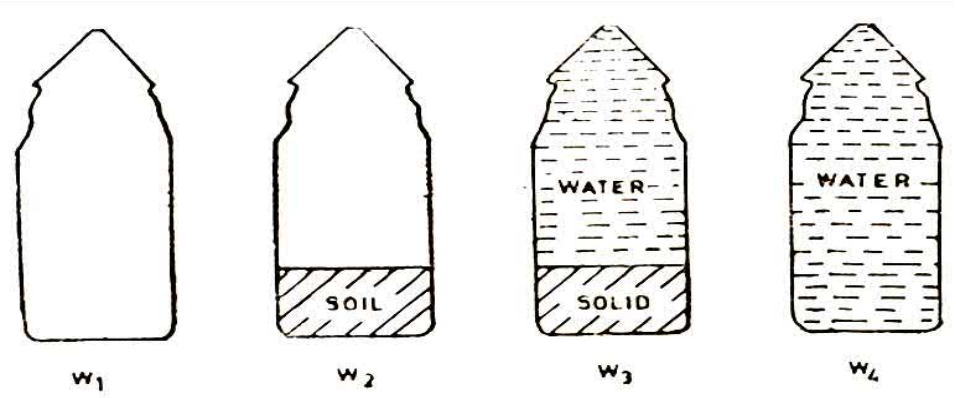
The field kit contains the moisture tester, small single Pan weighing balance, a bottle containing calcium carbide and a brush. This method is specially suited to circumstances where water content is to be quickly determined for the purpose of proper field control

### 1.8.5 Alcohol Method

- The wet soil sample is first taken in an evaporating dish. Its mass is determined.
- The sample is mixed with methylated spirit (1 ml for 1 gm of soil). The mixture is made uniform by turning the soil several times with the help of a knife.
- The methylated spirit is then burned. The mixture is stirred with a spatula when ignition is taking place.
- After the spirit is burnt away completely, the dish is allowed to be cooled, and the mass of the dry soil thus obtained is determined.
- The whole procedure takes about 10 minutes.

## 1.9 SPECIFIC GRAVITY

Specific gravity of an aggregate is defined as the ratio of the mass of a given volume of sample to the mass of equal volume of water at the same temperature. Specific gravity of fine aggregate is generally required for calculations in connection with concrete mix design. It is used in the calculation of volume yield concrete, moisture content and it gives information on the properties of aggregate. It also indicates the change in the shape and grading of aggregates used in mix design.




- Specific Gravity: The empty weight of the Pycnometer is taken as $W_1$.
- The sample of fine aggregates for which specific gravity has to be found out (sample must be saturated and free from surface moisture) are filled upto 1/3rd of Pycnometer and its weight is measured as $W_2$.
- The Pycnometer with sample is filled with water up to the tip of the Pycnometer and its weight is taken as $W_3$.
- Then the Pycnometer is emptied and thoroughly washed. After washing, the Pycnometer is filled with water up to the tip and its weight is taken (The Pycnometer should be completely dry on the outer face) as $W_4$.
- The specific gravity of the fine aggregate sample is calculated by the formula:

**Specific Gravity = Dry weight of aggregates/weight of equal volume of water**

$$\mathbf{G = \frac{W_2 - W_1}{((W_2 - W_1) - (W_3 - W_4))}}$$

If kerosene is used instead of water then,

$$\mathbf{G = \frac{(W_2 - W_1)G_K}{((W_2 - W_1) - (W_3 - W_4))}}$$

$G_K$ = Specific gravity of kerosene.

### 1.10 INSITU DENSITY

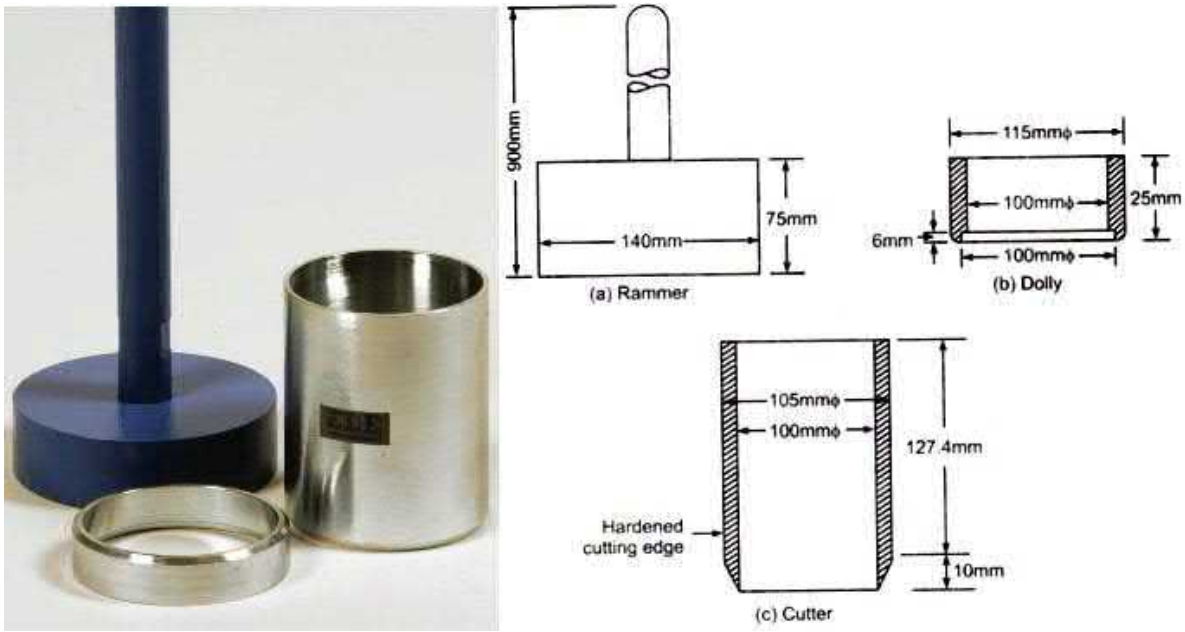
Density is defined as the mass per unit volume of soil. The in-situ density is defined as the bulk density of soil measured at its actual depth. By conducting this test, it is possible to determine the field density of the soil. The moisture content is likely to vary from time and hence the field density also.

The in situ density of natural soil is needed for the determination of bearing capacity of soils, for the purpose of stability analysis of slopes, for the determination of pressures on

underlying strata for the calculation of settlement and the design of underground structures. It is a quality control test, where compaction is required, in the cases like embankment and pavement construction.

The two methods used to determine the field density are core cutter and sand replacement method.

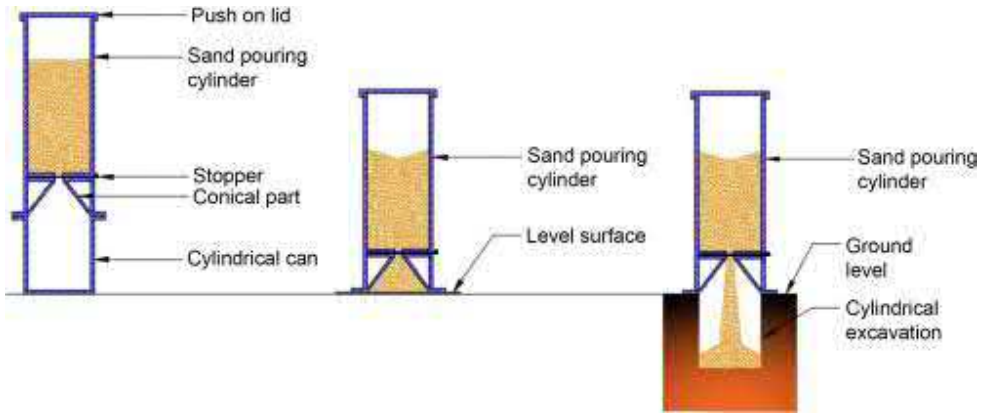
### 1.10.1 Core Cutter Method




- Measure the inner dimensions of the core cutter and calculate its volume. Determine the mass of the core cutter (without dolly) accurate to 1 g. Oil the inside surfaces of the core cutter and the dolly.
- Level the area where the in-situ density of the soil is required to be measured. Keep the dolly on the top of the core cutter and drive the assembly in to the soil with the help of the rammer until the top of the dolly protrudes about 1.5 cm above the surface.
- Dig out the core cutter along with the dolly from the surrounding soil such that some soil projects from the lower end of the core cutter. Take out the dolly, and trim the soil mass at both the ends of the core cutter.
- The mass of the core cutter with the soil is determined.
- The water content of the soil is determined by oven drying method.
- Repeat the test at two or three locations nearby to get the average result.

### 1.10.2 Sand Replacement Method






The sand replacement method is used to determine in-place density. The sand replacement method of determination of in situ density uses a sand-pouring cylinder, cylindrical calibrating container, tray with a central circular hole, and a chisel.

The sand replacement method has two steps in determining the insitu density:-

Step 1: Determination of the bulk density of soil

Step 2: Determination of the field density of soil

**(a) Determination of the Bulk density of the sand:**

1. Fill the sand in the sand pouring cylinder up to a height 1cm below the top. Determine the total initial mass of the cylinder with the sand (M1), which is to be maintained constant throughout the test.

2. Keep the cylinder on a glass plate. Open the shutter and allow the sand to run out. Close the shutter when no movement of sand is observed. Remove the cylinder and record the mass of the sand collected on the glass plate (M2). This represents the mass of the sand filling the

cone portion of the sand pouring cylinder. Place the sand back into the cylinder to maintain the constant mass M1.

3. Measure the inner diameter and height of the calibrating container and hence, determine the volume of the calibrating container.

4. Place the cylinder with sand concentrically on the top of the container. Open the shutter, and allow the sand to the run into the container. Close the shutter when no further movement of sand is observed. Remove the cylinder and record its mass along with the remaining sand (M3). Put the sand back into the container to maintain the constant mass M1.

5. **Calculate the density of sand in the cylinder:**

- Inside diameter of the calibrating container (d) = ……. Cm
- Inside height of the calibrating container (h) =…….. cm
- Volume of the calibrating container (Vc) = …….. $cm^3$
- Mass of the (sand + cylinder) before pouring (M1) = …… g
- Mass of the sand in the cone (M2) =…… g
- Mass of the (sand + cylinder), after pouring into the calibrating container (M3) = …… g
- Mass of the sand, filling the calibrating container =

  $(M_{sand}) = (M1 – M3 – M2)$ = …….. g
- Bulk density of the sand $(\rho_{sand}) = (M_{sand} / V_c)$ = …… $g/cm^3$

**(b) Determination of the dry density of the soil in-situ:**

1. Level the surface where the in-situ density of the soil is required to be determined. Keep the metal tray on the level surface and excavate a circular hole of about 15 cm deep. Collect the excavated soil in the tray. Immediately record the mass of the excavated soil (M), and keep some soil for moisture content determination.

2. Remove the tray and place the cylinder with sand on the excavated hole. Open the shutter, and allow the sand to run into the hole. When the no further movement of the sand is seen, close the shutter. Determine the mass of the cylinder with the remaining sand in it (M4).

3. Determine the bulk density, field water content and field dry density of the soil.

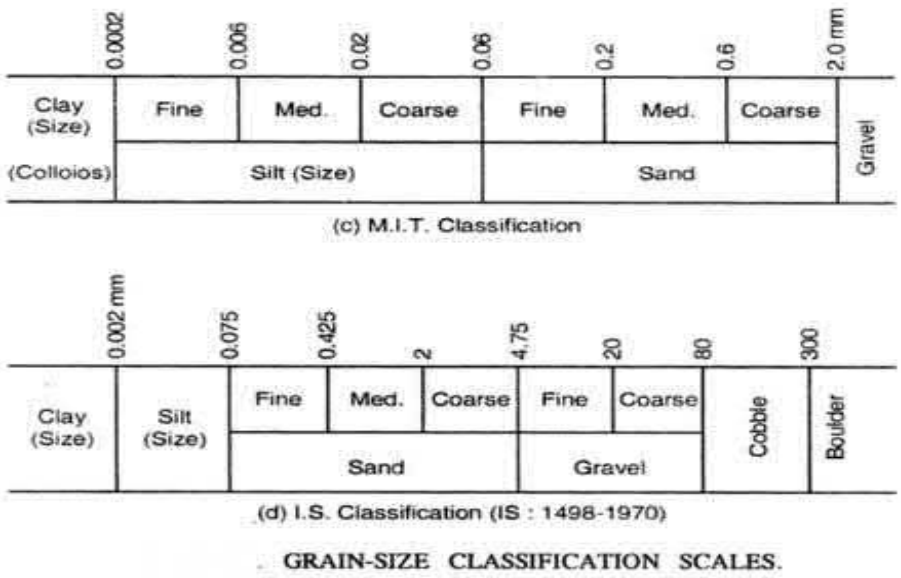
- Mass of the wet soil excavated from the hole (M) = ……. G
- Mass of (sand + cylinder) after pouring into the hole (M4) = …….. g
- Mass of sand in the hole $(M_h) = (M1- M4 - M2)$ = …….. g
- Volume of the hole $(V) = M_h/ \rho_{sand}$ = …… $cm^3$
- Bulk density of the soil in-situ $(\rho_b)$ = …… $g/cm^3$

## 1.11 PARTICLE SIZE ANALYSIS

The distribution of particle size is quantitatively determined by performing the particle size analysis.

1. Sieve analysis – Gravel and sand
2. Sedimentation Analysis – Silt and clay

### 1.11.1 Sieve Analysis




GRAIN-SIZE CLASSIFICATION SCALES.

Sieve analysis is carried out on particles coarser than 75 micron. Samples (with fines removed) are dried and shaken through a set of sieves of descending size. The weight retained in each sieve is measured. The cumulative percentage quantities finer than the sieve sizes (passing each given sieve size) are then determined.

The resulting data is presented as a distribution curve with **grain size** along x-axis (log scale) and **percentage passing** along y-axis (arithmetic scale).

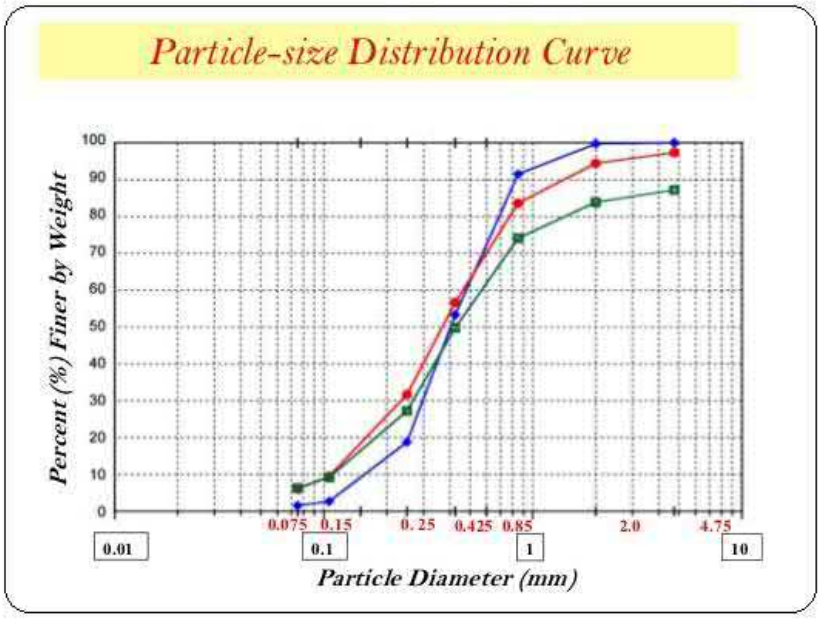
- Take 1Kg of sand from a laboratory sample of 10 Kg by quartering and break clay lumps, if any, in a clean dry rice plate.
- Arrange the sieves in order of IS sieve no's: 4.75mm, 2.36mm, 1.18mm, 600µm, 300µm and 150µm keeping sieve nos. 4.75mm at the top and 150µm at the bottom. Fix them in the sieve shaking machine with the pan at the bottom and cover at the top.
- Place 1000 gms of sand sample on the top sieve; carry out sieving in the set of sieves as arranged before for not less than 10minutes.
- Find the mass retained on each sieve.
- Fineness modulus is an empirical factor which is obtained by dividing the cumulative sum of the percentage of aggregate retained on each IS sieves taken in order by 100.

- Total mass of soil taken for analysis = M = …….. g

| Sieve size in mm | Mass retained ($m^1$), g | Corrected mass retained m, g | % mass retained | Cumulative % retained | % Finer |
|---|---|---|---|---|---|
| 4.75 | | | | | |
| 2.36 | | | | | |
| 1.18 | | | | | |
| 0.6 | | | | | |
| 0.425 | | | | | |
| 0.3 | | | | | |
| 0.212 | | | | | |
| 0.15 | | | | | |
| 0.075 | | | | | |
| Receiver | | | | | |
| | $M^1$ = …… gms | | | | |

Corrected mass = $\boldsymbol{m = \frac{m^1}{M^1} * M}$

- Fineness modulus of fine aggregates = Sum of Cumulative weight retained /100 =ΣC/100
- Graph: Semi log graph is used and percentage passing is taken in the ordinary scale (Y axis) and IS sieve sizes on the logarithm scale (X-axis)



From Graph:

- The given soil is ……
- Sand = …… %, Silt + clay = ……. %
- Gravel = ……. %
- $D_{10}$ = ……..mm
- $D_{30}$ = ……..mm
- $D_{60}$ = ……..mm
- Co-efficient of uniformity, $C_U = \frac{D_{60}}{D_{10}}$
- Co-efficient of curvature, $C_C = \frac{D_{30}^2}{D_{10} \times D_{60}}$

### 1.11.2 Sedimentation Analysis

Sedimentation analysis is used only for the soil fraction finer than 75 microns. Soil particles are allowed to settle from a suspension. The decreasing density of the suspension is measured at various time intervals. The procedure is based on the principle that in a suspension, the terminal velocity of a spherical particle is governed by the diameter of the particle and the properties of the suspension.

Sedimentation analysis is based on stoke's law.

**STOKE'S LAW:-** "If a particle is freely allowed to settle in a fluid it will do so at a constant velocity proportional to square of diameter of particle".

$$V \alpha D^2$$

$$V = \frac{2}{9} \times r^2 \times \frac{\gamma_S - \gamma_W}{\mu}$$

$$V = \frac{2}{9} \times (\frac{D}{2})^2 \times \frac{\gamma_S - \gamma_W}{\mu}$$

$$V = D^2 (\frac{\gamma_S - \gamma_W}{18\mu})$$

$$D = \sqrt{\frac{18\mu V}{\gamma_W (\frac{\gamma_S}{\gamma_W} - 1)}}$$

$$D = \sqrt{\frac{18\mu V}{\gamma_W (G - 1)}}$$

$$D = 17.487 \times \sqrt{\frac{\mu}{(G-1)}} \times \sqrt{\frac{H_e}{t}}$$

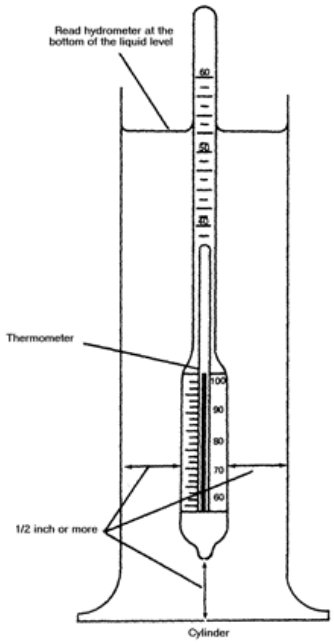
❖ **Assumptions of stokes law**

1. Particles are perfectly spherical.
2. Space required for settling particle is of infinite extent.
3. Particles settlement is independent.
4. A wall of the jar does not impact on settlement of soil particles.
5. Specific gravity is of soil particles is same.

❖ **Limitations of stokes law**

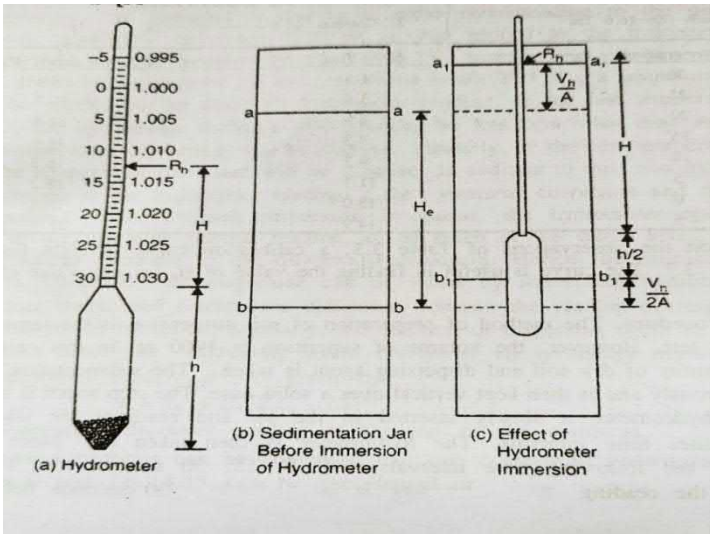
1. All soil particles are not truly spherical.
2. Sedimentation analysis is carried out in a glass jar the body of water used is finite.
3. Brownian movement affects the settlement.
4. Specific gravity of different size soil particles varies.

### 1.11.2.1 Hydrometer Method




A hydrometer is an instrument used for measuring the relative density of liquids based on the concept of buoyancy. They are typically calibrated and graduated with one or more scales such as specific gravity.

- **Calibration Of Hydrometer**




- To determine the depth at which specific gravity is measured, calibration of hydrometer is done.
- The volume of hydrometer ($\mathbf{V_h}$) should be first determined by immersing in a cylinder partly filled with water & noting down the volume due to rise in water level.

$$H_e = H + \frac{h}{2} + \frac{V_h}{2A} - \frac{V_h}{A}$$

$$H_e = H + \frac{1}{2}(h - \frac{V_h}{A})$$

➢ **Procedure:-**

- Calibrate the hydrometer to be used in the test.
- Determine the meniscus correction.
- Take about 50 g of oven dried soil sample passing 75 μ IS sieve.
- Subject the soil to pre-treatment to remove soluble salts or organic matter or calcium compounds, if necessary.
- Dissolve 3.3 g of sodium hexametaphosphate and 0.7 g of sodium carbonate in 100 ml distilled water. Transfer the solution to 1000 ml capacity jar and add distilled water to make the volume of the solution to 1000 ml (This dispersion agent solution is required for getting the composite correction).

- Take the measured quantity of soil in a beaker. Add 100 ml of solution prepared by dissolving 3.3 g of sodium hexametaphosphate and 0.7 g of sodium carbonate in distilled water to the beaker.
- Transfer the soil suspension to the cup of a mechanical stirrer using about 100 ml of distilled water. Stir the suspension for about 15 minutes.
- Transfer the stirred soil suspension to another 1000 ml capacity measuring jar. Add distilled water to the suspension to make its volume to 1000 ml.
- Place suitable covers on the top of the two 1000 ml measuring jars – one containing the dispersion agent solution and the other containing the soil suspension. Shake the contents in the two jars vigorously and place them slowly on a level platform. Start a stop watch immediately.
- Insert the hydrometer in to the jar containing the soil suspension slowly and allow it to float freely.
- Note down the hydrometer readings corresponding to upper meniscus after suitable time intervals or note down the time intervals corresponding to well define hydrometer readings.
- After 4 minutes reading, take out the hydrometer from the jar, rinse it with distilled water and allow it to stand in another 1000 ml jar containing distilled water.
- Insert the hydrometer in to the jar containing soil suspension from time to time and note down the hydrometer readings and corresponding time intervals. After removing the hydrometer from the jar each time, rinse it with distilled water and store it in the jar containing distilled water.
- Record the temperature of the soil suspension and the composite correction in the beginning of the test and also after each time the hydrometer reading is taken beyond 15 minutes period.
- Calculate the equivalent diameter of the soil particles corresponding to the noted time intervals (D) and also the corresponding values of percentage finer based on the dry mass of the soil sample taken for the test (N') and based on the total mass of the dry soil sample taken for the grain size analysis(N).
- Carry out the test till the equivalent diameter of the particles is less than 2 μm.
- Using the values of equivalent diameter of the particles (D) and the values of corresponding percentage finer (N), plot the grain size distribution curve. From the plotted curve, note down the percentage of silt size and clay size fractions present in the soil.

### 1.11.2.2 Corrections for Hydrometer

- **Meniscus Correction:-**

The meniscus correction = Reading between the top of the meniscus & level of the suspension.

As the marking on the stem increases downward the correction is **positive**.

- **Temperature correction:-**

The hydrometer is generally calibrated at $27^0$C. If the temperature of suspension is different from $27^0$C, a temperature correction is required for hydrometer. If the temperature is more than $27^0$C the suspension is lighter and actual reading will be less than the corrected reading. Therefore temperature correction is **positive**. On the other hand if the temperature is less than $27^0$C the temperature correction is **negative**.

- **Dispersion agent correction:-**

Addition of dispersing agent to the soil suspension causes increase in specific gravity of soil suspension. The dispersing agent correction is always **negative**.

- **Composite Correction:-**

The composite correction is the algebraic sum of all the corrections.

$$\mathbf{C = C_m \pm C_t - C_d}$$

$$\mathbf{R = R_h^1 + C_m \pm C_t - C_d}$$

$$\mathbf{R = R_h^1 + C}$$

❖ **Computation of D & $N^1$ (Diameter & % Finer)**

$$D = 17.487 \times \sqrt{\frac{\mu}{(G-1)}} \times \sqrt{\frac{H_e}{t}}$$

Let us take

G = 2.65, $\gamma_W$ = 9.81 kN/$m^3$, $\mu = 1.004 \times 10^{-6}$ kPa-sec

$$D = 1.06 \sqrt{\frac{H_e}{t}} \text{ in mm}$$

Where, $H_e$ = Effective depth

$$v = \frac{H_e}{t} \text{ in m/s}$$

$$N^1 = \frac{100GR}{M_D(G-1)}$$

Where, $M_D$ = Mass of solids

$$M_D = \frac{R}{100}\frac{G}{(G-1)}$$

## 1.12 CONSISTENCY OF SOIL

Consistency is a term used to indicate the firmness of the cohesive soil and is directly related to strength. It is defined as one in which the given soil mass can be moulded into any shape. The term consistency is usually applied to fine grained soil such as clay. The consistency describes the soil as soft, stiff, very stiff and hard. Consistency of water is expressed in terms of **Atterberg's limit & unconfined compressive strength of soil**.

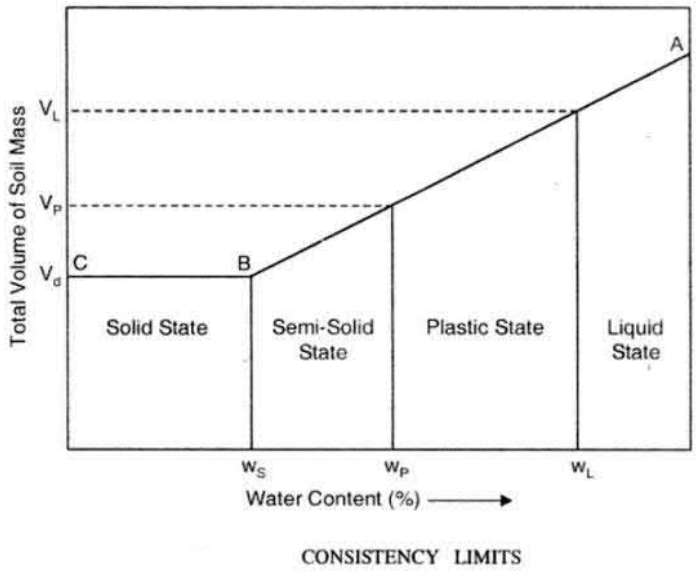



**Fig: Variation of total volume of given soil with water content**

### 1.12.1 Atterberg's Limits of soil

In 1911 Swedish scientist "Atterberg" considered the consistency of soil & divided the entire range from liquid to solid state into 4 stages.

1. Liquid state
2. Plastic state
3. Semi solid state
4. Solid state

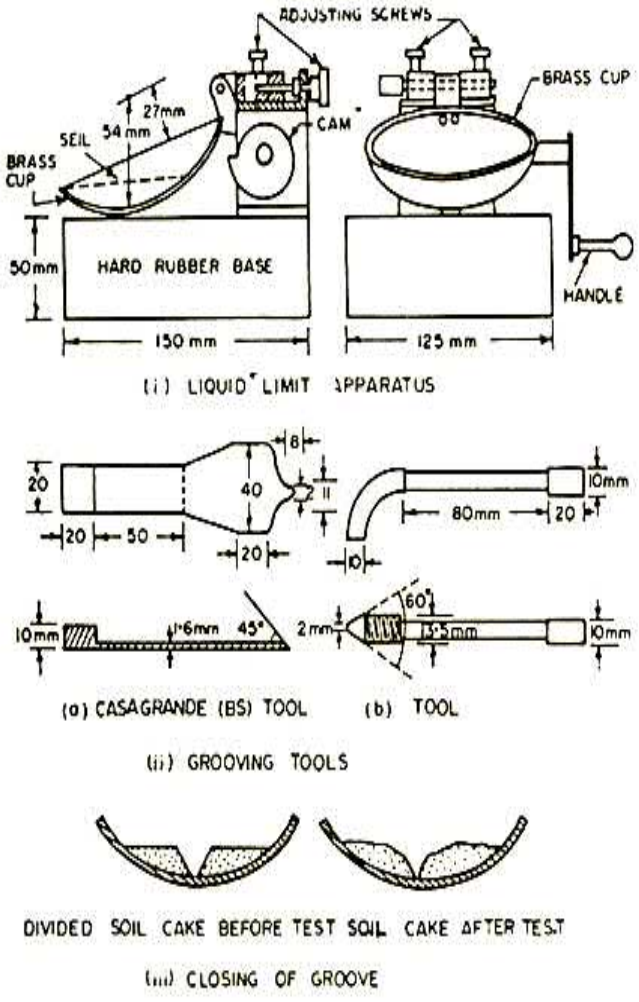
### 1.12.1.1 Liquid Limit ($W_L$)

- It is the moisture content at which a fine-grained soil no longer flows like a liquid.
- The boundary between the liquid and plastic states.
- The water content at which the soil has such a small shear strength that it flows to close a groove of standard width when jarred in a specified manner.

- **Experimental Determination of liquid limit**

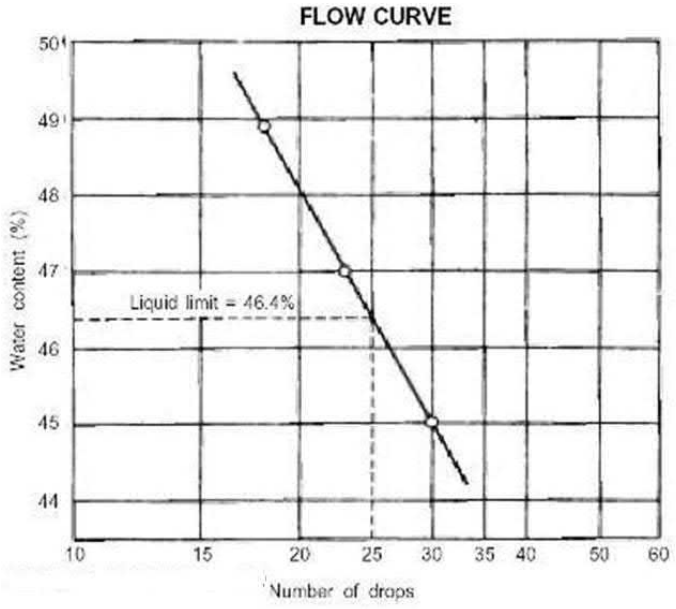
### A. Casagrande's Method

The liquid limit is the moisture content at which the groove, formed by a standard tool into the sample of soil taken, in the standard cup, closes for 10 mm on being given 25 blows in a standard manner. At this limit the soil possess low shear strength.




- Take about 120 g of soil sample passing through 425 micron IS sieve and mix it thoroughly with distilled water on the glass plate to form uniform paste. Allow sufficient time to ensure uniform moisture distribution throughout the soil mass.

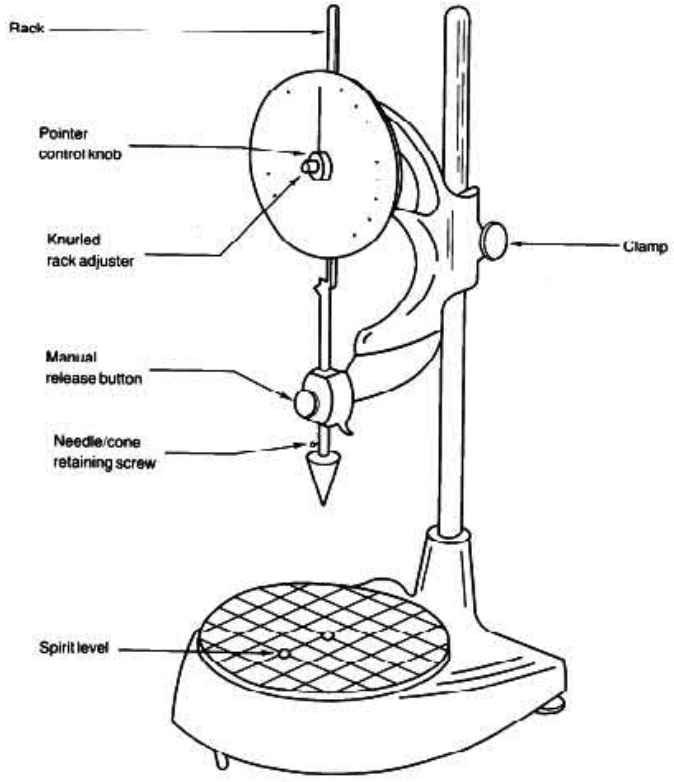
- Remix the soil thoroughly. Take a portion of the soil paste with the spatula and place it in the central portion of the cup and spread it into position with the spatula so that the soil surface is parallel to the rubber base with the maximum depth of the soil as 1.0 cm at the centre.
- With the help of the grooving tool, divide the soil paste in the cup along the diameter of the cup (through the centre line of the cam follower) to get a clean, sharp groove of proper dimensions.
- Turn the handle of the apparatus at a rate of 2 revolutions per second until the two parts of the soil paste come in contact at the bottom of the groove for a distance of about 12 mm and record the number of revolutions to achieve this.



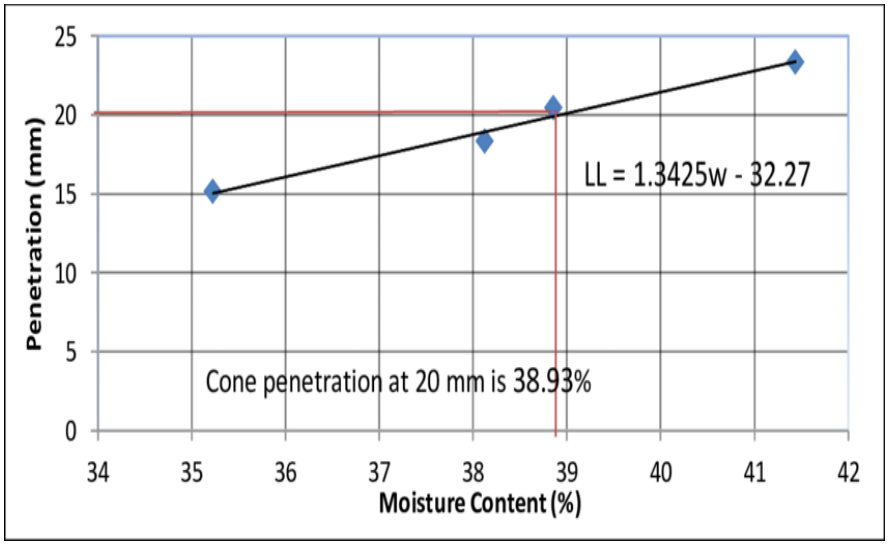

**Flow index $I_f = (W_2-W_1) / \log (N_1/N_2)$ = slope of the flow curve = ……**

**B. Cone Penetration Method**

The moisture content corresponding to cone penetration of 20 mm. is taken as the liquid limit of the soil.




- About 150 gm. of air dried soil from thoroughly mixed portion of material passing 425 micron IS sieve is obtained.
- Distilled water is mixed to the soil thus obtained in a mixing disc to form a uniform paste.
- Then the wet soil paste is transferred to the cylindrical cup of cone penetrometer apparatus, ensuring that no air is trapped in this process.
- Finally the wet soil is leveled up to the top of the cup and placed on the base of the cone penetrometer apparatus.
- The penetrometer is so adjusted that the cone point just touches the surface of the soil paste in the cup and the initial ready is to be taken.
- The vertical clamp is then released allowing the cone to penetrate into soil paste under its own weight for 5 seconds. After 5 seconds the penetration of the cone is noted to the nearest millimeter.
- The test is repeated at least to have four sets of values of penetration in the range of 14 to 28 mm.
- The exact moisture content of each trial is determined.
- Graph representing water content on X – axis and the cone penetration on Y – axis is prepared. A best fitting straight line is then drawn.




### 1.12.1.2 Plastic Limit ($W_P$)

- It is the moisture content at which a fine-grained soil can no longer be remolded without cracking.
- The boundary between the plastic and semi-solid states.
- The water content at which the soil begins to crumble when rolled into threads of specified size.

❖ **Experimental determination of Plastic Limit**

- Take about 20gm of thoroughly mixed portion of the material passing through 425 micron I.S. Sieve obtained in accordance with I.S. 2720 (part 1).
- Mix it thoroughly with distilled water in the evaporating dish till the soil mass becomes plastic enough to be easily molded with fingers.
- Allow it to season for sufficient time (for 24 hrs) to allow water to permeate throughout the soil mass.
- Take about 10gms of this plastic soil mass and roll it between fingers and glass plate with just sufficient pressure to roll the mass into a threaded of uniform diameter throughout its length. The rate of rolling shall be between 60 and 90 strokes per minute.
- Continue rolling till you get a threaded of 3 mm diameter.
- Kneed the soil together to a uniform mass and re-roll.
- Continue the process until the thread crumbles when the diameter is 3 mm.
- Collect the pieces of the crumbled thread in air tight container for moisture content determination.

Faculty Member : NAMITHA. A-P

Designation : Assistant Professor

Department : Civil Engineering

Faculty Member ID : CV0103

| Sl. No. | Sem. / Sec. / Branch | Course Title | Course Code |
|---|---|---|---|
| 1 | III rd | Engineering geology | 18CV36 |
| 2 | V Sem. A | Environmental Studies | 18CIV59 |
| 3 | | | |
| 4 | | | |

| | Review at the end of the | | | | End of Semester |
|---|---|---|---|---|---|
| | 1st Month | 2nd Month | 3rd Month | 4th Month | |
| Staff | | | | | |
| HOD / Reviewer | | | | | |



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| Course Outcomes | Course Title | Engineering Geology | Course Code | |
|---|---|---|---|---|
| CO-1 | Students will be able to apply the knowledge of Geology and its role in Civil Engineering. | | | |
| CO-2 | Students will acquire knowledge on durability and competence of foundation rocks, & confidence enough to use the best building materials. | | | |
| CO-3 | Civil Engineering are competent enough for the safety stability, economy and life of the structures that they construct. | | | |
| CO-4 | Students will be able to solve various issues rela-ted to ground water exploration, buildup dams, bridges tunnels which are confronted with ground the problems | | | |
| CO-5 | Analyze the natural disaster and their mitigation intelligent enough to apply GIS, GPS and remote sensing as a latest tool in a different civil engineering. | | | |
| CO-6 | | | | |

| Course Title with Code : | Engineering Geology 18CV36 | | | | | | | | | | | | Semester : | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Course Outcomes | Program Outcomes | | | | | | | | | | | | Program Specific Outcomes | | | |
| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 | PSO4 |
| CO-1 | 1 | – | – | | – | – | – | – | – | – | – | 2 | 1 | 1 | | |
| CO-2 | 2 | | 1 | 1 | – | – | – | – | – | – | – | 2 | 2 | 2 | | |
| CO-3 | 2 | | 1 | 1 | – | – | – | – | – | – | – | 2 | 2 | 3 | | |
| CO-4 | 2 | | 2 | 1 | | | 1 | – | – | – | – | 2 | 2 | 2 | | |
| CO-5 | 2 | | | | | | – | – | – | – | – | 1 | 2 | – | | |
| CO-6 | | | | | | | | | | | | | | | | |

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| Course Outcomes | Course Title | Environmental Studies | Course Code | |
|---|---|---|---|---|
| CO-1 | Understand the principles of ecology and environment issues that apply to air, land, and water issues on a global scale. | | | |
| CO-2 | Develop critical thinking and/or observation skills, and apply them to the analysis of a problem or question related to the environment. | | | |
| CO-3 | Demonstration ecology knowledge of a complex relationship between biotic and a biotic components. | | | |
| CO-4 | Apply their ecological knowledge to illustrate and graph a problem and describe the realities that managers face when dealing with complex issues. | | | |
| CO-5 | | | | |
| CO-6 | | | | |

| Course Title with Code : | Environmental Studies 18CIV59 | | | | | | | | | | | | Semester : | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Course Outcomes | Program Outcomes | | | | | | | | | | | | Program Specific Outcomes | | | |
| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 | PSO4 |
| CO-1 | – | – | – | – | – | – | 3 | 1 | – | – | – | 2 | – | 3 | | |
| CO-2 | – | – | – | – | – | – | 2 | 2 | – | – | – | 3 | – | – | | |
| CO-3 | – | – | – | – | – | – | 1 | – | – | – | – | 2 | – | 2 | | |
| CO-4 | – | – | – | – | – | – | 2 | – | – | – | – | 3 | – | – | | |
| CO-5 | | | | | | | | | | | | | | | | |
| CO-6 | | | | | | | | | | | | | | | | |

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# Lesson Plan

Engineering geology - 18CV36 Semester & Section : 3rd A

| Class No | Date Planned | Topics proposed to be covered | Topic Covered Date | Remarks |
|---|---|---|---|---|
| 1 | 3.11.20 | Introduction :- Application of Geology in Civil Engineering. | 3/11/20 | |
| 2 | 4/11/20 | Mineral properties - Quartz group. | 4/11/20 | |
| 3 | 5/11/20 | Feldspar group | 5/11/20 | Extra class |
| 4 | 5/11/20 | Kaolin, Asbestos group | 5/11/20 | was taken. |
| 5 | 6/11/20 | Carbonate group | 6/11/20 | |
| 6 | 7/11/20 | One minerals - Iron ore, | 7/11/20 | |
| 7 | 10/11/20 | Petrology and Geomorphology - Formation and classification. | 10/11/20 | |
| 8 | 18/11/20 | Sedimentary Rocks - Sandstone | 18/11/20 | |
| 9 | 19/11/20 | Metamorphic Rocks - Gneiss | 19/11/20 | |
| 10 | 21/11/20 | Weathering - types and their effects | 21/11/20 | |
| 11 | 24/11/20 | Geomorphological landforms | 24/11/20 | |
| 12 | 26/11/20 | Drainage pattern and types. | 26/11/20 | |
| 13 | 28/11/20 | Soil formation and profile | 28/11/20 | |
| 14 | 1/12/20 | Index properties of Rocks | 1/12/20 | |
| 15 | 5/12/20 | Concrete aggregates, Road metals | 5/12/20 | |
| 16 | 8/12/20 | Structural geology & Rock mech. | 8/12/20 | |
| 17 | 10/12/20 | Structural aspects of Rocks | 10/12/20 | |
| 18 | | Classification of folds | | |
| 19 | 12/12/20 | Dam, tunnels, Slope treatment | 12/12/20 | |
| 20 | | Recognition of structures | | |
| 21 | 15/12/20 | Geological site Characterization | 15/12/20 | |
| 22 | | Rock Quality Determination | | |
| 23 | 17/12/20 | Tunnels - Site investigation | 17/12/20 | |
| 24 | 19/12/20 | Hydrogeology - Cycle, Vertical dist. | 19/12/20 | |
| 25 | 22/12/20 | Artesian groundwater | 22/12/20 | |

| | | | | |
|---|---|---|---|---|
| 26 | 24/12/20 | Aquifer and its types. | 24/12/20 | |
| 27 | 28/12/20 | Porosity, Specific yield | 28/12/20 | |
| 28 | 31/12/20 | Determination of Quality - SAR | 31/12/20 | |
| 29 | 2/1/20 | Groundwater Exploration. | 2/1/20 | |
| 30 | 5/1/20 | Artificial Recharge of groundw | 5/1/20 | |
| 31 | 7/1/20 | Groundwater pollution. | 7/1/20 | |
| 32 | 9/1/20 | Seismology and Geodesy. | 9/1/20 | |
| 33 | 12/1/20 | Engineering Problems - Earthquak | 12/1/20 | |
| 34 | 14/1/20 | Tsunami Causes and effects | 14/1/20 | |
| 35 | 16/1/20 | Landslides - types, Causes. | 16/1/20 | |
| 36 | 19/1/20 | Study of topographic maps | 19/1/20 | |
| 37 | 21/1/20 | Remote Sensing. | 21/1/20 | |
| 38 | 23/1/20 | Geographic information System | 23/1/20 | |
| 39 | 26/1/20 | Aerial photography. | 26/1/20 | |
| 40 | 28/1/20 | Impact of Mining. | 28/1/20 | |
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Faculty Member Signature

HOD Signature

# ATTENDANCE

ATME College of Engineering

Course Title with Code

Semester & Section

| Sl No | USN | Student Name | Date | 3 | 4 | 5 | 5 | 6 | 7 | 10 | 18 | 19 | 20 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Month | | | | | | | | | | |
| | | | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| 1. | 1AD19CV001 | Bharath Gowda | | A | 1 | 2 | 3 | A | 4 | 5 | 6 | 7 | 8 |
| 2. | 1AD19CV002 | Adnan Ahmed Khan | | ← | | | | P | → | | | | |
| 3. | 1AD19CV005 | Charan. P | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| 4. | 1AD19CV008 | Chowdam Ranna | | 1 | 2 | A | A | 3 | 4 | 5 | 6 | 7 | 8 |
| 5. | 1AD19CV018 | Manu M | | 1 | 2 | 3 | 4 | A | A | 5 | 6 | 7 | 8 |
| 6. | 1AD19CV023 | Nikitha Prakash | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| 7. | 1AD19CV029 | Sindhu S | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| 8. | 1AD19CV033 | Sumanth Uthappa. B | | A | 1 | A | A | 2 | 3 | 4 | 5 | 6 | 7 |
| 9. | 1AD19CV034 | Sushmitha. C | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| 10. | 1AD19CV002 | Abhishek. K | | 1 | 2 | A | A | 3 | 4 | 5 | 6 | 7 | 8 |
| 11. | 19CV008 | Ajaq Ahmad Khan | | → | | | | | 1 | 2 | 3 | 4 | 5 |
| 12. | 19CV013 | Amith Yallur | | 1 | 2 | A | A | A | A | 3 | 4 | 5 | 6 |
| 13. | 19CV014 | Anavya S.P | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| 14. | 19CV015 | Ani Gowda | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| 15. | 19CV016 | Anitha Ashok | | 1 | | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
| 16. | 19CV017 | Bhanupriya | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| 17. | 19CV018 | Bhavgarb | | A | A | A | A | 1 | 2 | 3 | 4 | 5 | 6 |
| 18. | 19CV019 | Chirag | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | A |
| 19. | 19CV020 | Dhanush | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| 20. | 19CV021 | Dheeraj. D | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| 21. | 19CV022 | Dinakar K. Dev | | A | A | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
| 22. | 19CV023 | Divika K.R | | ← | | | | | | | | | → |
| 23. | 19CV024 | Gowardhan Nayaka. S J | | A | A | A | A | A | A | - | - | - | - |
| 24. | 19CV025 | Guruprasad K.M | | A | A | A | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 25. | 19CV026 | Hanchanandhan | | A | A | A | A | A | 1 | 2 | 3 | 4 | 5 |
| | | No of Abs | | | | | | | | | | | |
| | | Initials | | | | | | | | | | | |

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# ATTENDANCE

Course Title with Code : .....

Semester & Section : .....

| Sl. No. | USN | Student Name | Date / Month |
|---|---|---|---|
| 1. | 4AD18CV005 | Bharath Gowda | |
| 2. | 4AD18CV001 | Adnan Ahmed Khan | |
| 3. | 4AL18CV005 | Charan. P | |
| 4. | 4AD18CV011 | Chowdam Ramya | |
| 5. | 4AD18CV018 | Manu. M | |
| 6. | 4AD18CV003 | Nikitha Prakash | |
| 7. | 4AD18CV040 | Sindhu. S | |
| 8. | 4AD18CV046 | Sumanth Uthappa. B | |
| 9. | 4AD18CV044 | Sushmitha. C | |
| 10. | 4AD18CV001 | Abhishek. K | |
| 11. | 19CV002 | Afaq Ahmad Khan | |
| 12. | 19CV003 | Amith Yadhav | |
| 13. | 19CV004 | Ananya S.P | |
| 14. | 19CV005 | Ani Gowda | |
| 15. | 19CV006 | Ankitha Ashok | |
| 16. | 19CV007 | Bhanupriya | |
| 17. | 19CV008 | Bhargava | |
| 18. | 19CV009 | Chirag | |
| 19. | 19CV010 | Dhanush | |
| 20. | 19CV011 | Dheeraj. D | |
| 21. | 19CV012 | Dinakar K. Dev | |
| 22. | 19CV013 | Divisha K.R | |
| 23. | 19CV014 | Goverdhan Nayaka. S.J | |
| 24. | 19CV015 | Guruprasad K.M | |
| 25. | 19CV016 | Harshavardhan | |
| | No. of Abs. | | |
| | Initials | | |

# ATTENDANCE

ATME College of Engineering

Course Title with Code : .....

Semester & Section : .....

| Sl. No. | USN | Student Name | Date | 3 | 4 | 5 | 5 | 6 | 7 | 10 | 18 | 19 | 21 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Month | 1 | 11 | 11 | 11 | 11 | 11 | 11 | 11 | 11 | 11 |
| | | | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| 01 | 1AD19CV017 | Harshitha. B | | Ab | Ab | - | - | - | 1 | 2 | 3 | 4 | 5 |
| 02 | 19CV018 | Harshitha N | | Ab | Ab | - | - | - | 1 | 2 | 3 | 4 | 5 |
| 03 | 19CV019 | Hruthik. R | | 1 | 2 | 3 | 4 | Ab | 5 | Ab | Ab | 6 | 7 |
| 04 | 19CV020 | Shankar. G | | 1 | 2 | Ab | 3 | Ab | Ab | 4 | 5 | 6 | 7 |
| 20 | 19CV021 | Junaid Ahmed | | 1 | 2 | Ab | Ab | Ab | 3 | 4 | 5 | 6 | 7 |
| 31 | 19CV022 | Keerthan B.S | | Ab | 1 | 2 | 3 | Ab | 4 | 5 | 6 | 7 | 8 |
| 32 | 19CV023 | Keerthan Prabhu | | Ab | Ab | 1 | 2 | 3 | 4 | 5 | 6 | Ab | 7 |
| 33 | 19CV024 | Kushal. D | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| 34 | 19CV025 | Lakshmi Priya | | 1 | Ab | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
| 35 | 19CV026 | Likith K Gowda | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| 36 | 19CV027 | Likitha. M.M | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| 37 | 19CV028 | Mahadev Prasad | | Ab | Ab | 1 | 2 | 3 | 4 | 5 | Ab | 6 | 7 |
| 38 | 19CV029 | Manish Bopaiah | | 1 | 2 | 3 | 4 | 5 | 6 | Ab | 7 | 8 | 9 |
| 39 | 19CV030 | Manu Prasad | | 1 | 2 | 3 | 4 | 5 | 6 | Ab | 7 | 8 | 9 |
| 40 | 19CV031 | Meghana | | Ab | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
| 41 | 19CV032 | Mithali | | Ab | 1 | 2 | Ab | 3 | 4 | 5 | 6 | 7 | 8 |
| 42 | 19CV033 | Mohammed Arsan Baig | | 1 | 2 | Ab | Ab | Ab | Ab | Ab | 3 | 4 | 5 |
| 43 | 19CV034 | Mohammed Bilal | | Ab | 1 | 2 | 3 | Ab | 4 | 5 | 6 | 7 | 8 |
| 44 | 19CV035 | Nagendra Prasad | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| 45 | 19CV036 | Nandish HD | | 1 | 2 | Ab | Ab | Ab | 3 | 4 | 5 | 6 | 7 |
| 46 | 19CV037 | Naveen. P | | 1 | 2 | 3 | 4 | Ab | 5 | 6 | 7 | 8 | 9 |
| 47 | 19CV038 | Nidhishree M.S | | 1 | 2 | 3 | 4 | 5 | Ab | 6 | 7 | 8 | 9 |
| 48 | 19CV039 | Nisarga V | | 1 | 2 | 3 | Ab | Ab | 4 | 5 | 6 | 7 | 8 |
| 49 | 19CV040 | Nishchitha. J | | 1 | 2 | — | 3 | 4 | 5 | 6 | 7 | 8 | |
| 50 | 19CV041 | Nithin. B. | | 1 | 2 | 3 | 3 | Ab | 4 | 5 | 6 | 7 | Ab |
| | | No. of Abs. | | | | | | | | | | | |
| | | Initials | | | | | | | | | | | |



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|---|---|---|---|---|---|---|---|---|---|---|
| 24 | 26 | 28 | 1 | 5 | 8 | 10 | 12 | 15 | 17 | 19 |
| 11 | 11 | 11 | 13 | 13 | 13 | 13 | 13 | 13 | 13 | 13 |
| 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 |
| 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 |
| 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 |
| 8 | 9 | 10 | 11 | 12 | 13 | 16 | 15 | 16 | 17 | 18 |
| 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 |
| 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 |
| 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 |
| 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 |
| Ab | Ab | Ab | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 |
| 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 |
| 11 | 12 | 13 | 14 | 15 | 16 | 17 | 19 | 19 | 20 | 21 |
| 11 | 12 | 13 | 14 | 15 | 16 | 12 | 19 | 19 | 20 | 21 |
| 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 |
| 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 |
| 10 | 11 | 12 | 13 | 14 | 15 | 16 | Ab | Ab | 17 | 18 |
| 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 |
| 9 | 10 | 11 | Ab | 12 | 13 | 14 | Ab | 15 | 16 | 17 |
| 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 |
| 9 | 10 | 11 | 12 | 13 | Ab | 14 | 15 | 16 | 17 | 18 |
| 11 | 12 | 13 | Ab | 15 | 16 | 17 | 18 | 19 | 20 | 21 |
| 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 |
| 10 | Ab | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 |
| 10 | 11 | 12 | 13 | Ab | 14 | 15 | 16 | 17 | 18 | 19 |
| 9 | 10 | 11 | 12 | 13 | Ab | 14 | Ab | 15 | 16 | 17 |
| Ab | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 |
| 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | → | |

ATME College of Engineering

**ATTENDANCE**

Course Title with Code : ....

Semester & Section : .....

| Sl. No. | USN | Student Name | Date / Month | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | 22 | 24 | 26 | 31 | 2 | 5 | 7 | 9 | 12 | 14 | 16 |
| | | | | 12 | 12 | 12 | 12 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| | | | | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 | 31 | 32 |
| 26 | 4ND19CV017 | Harshitha. B | | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 |
| 27 | 19CV018 | Harshitha N | | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 |
| 28 | 19CV019 | Hrithik. R. | | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 |
| 29 | 19CV020 | Shankar. G. | | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 |
| 30 | 19CV021 | Junaid Ahmed | | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 |
| 31 | 19CV022 | Keerthan B S | | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 |
| 32 | 19CV023 | Keerthan Prabhu | | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 |
| 33 | 19CV024 | Kushal. D | | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 |
| 34 | 19CV025 | Lakshmi Priya | | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 | 31 |
| 35 | 19CV026 | Likith K Gowda | | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 | AB | AB |
| 36 | 19CV027 | Likitha. M.M | | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 | 31 | 32 |
| 37 | 19CV028 | Mahadev Prasad | | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 |
| 38 | 19CV029 | Manish Bopaiah | | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 | 31 |
| 39 | 19CV030 | Manu Prasad | | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 |
| 40 | 19CV031 | Meghana | | 21 | 22 | 23 | 24 | 25 | 26 | 29 | 28 | 29 | 30 | 31 |
| 41 | 19CV032 | Mithali | | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 |
| 42 | 19CV033 | Mohammed Arans Baig | | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 |
| 43 | 19CV034 | Mohammed Bilal | | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 |
| 44 | 19CV035 | Nagendra Prasad | | 22 | 23 | 24 | 25 | 26 | 27 | AB | AB | 28 | AB | 29 |
| 45 | 19CV036 | Nahidha HD | | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 |
| 46 | 19CV037 | Naha. P | | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | AB | 28 | 29 |
| 47 | 19CV038 | Nidhishree H-S | | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 |
| 48 | 19CV039 | Nisarga V | | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 |
| 49 | 19CV040 | Nishchitha. J | | 18 | 19 | 20 | 19 | 21 | 22 | 23 | 24 | 25 | 26 | 27 |
| 50 | 19CV041 | Nithin. B. | | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 |
| | | No. of Abs. | | | | | | | | | | | | |
| | | Initials | | | | | | | | | | | | |

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|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 19 | 21 | 23 | 26 | 28 | 30 | 2 | 4 | | | | | | | |
| 1 | 1 | 1 | 1 | 1 | 1 | 2 | 2 | | | | | | | |
| 33 | 34 | 35 | 36 | 37 | 38 | 39 | 40 | 41 | 42 | | | | | |
| 28 | 29 | 30 | 31 | 32 | 33 | 34 | 35 | | | | | | | |
| 28 | 29 | 30 | 31 | 32 | 33 | 34 | 35 | | | | | | | |
| 30 | 31 | 32 | 33 | 36 | 35 | 36 | 37 | | | | | | | |
| 30 | 31 | 32 | 33 | 34 | 35 | 36 | 37 | | | | | | | |
| 30 | 31 | 32 | 33 | 34 | 35 | 36 | 37 | | | | | | | |
| 31 | 32 | 33 | 34 | 35 | 36 | 37 | 38 | | | | | | | |
| 30 | 31 | 32 | 33 | 34 | 35 | 36 | 37 | | | | | | | |
| 30 | 31 | 32 | 33 | 34 | 35 | 36 | 37 | | | | | | | |
| 32 | 33 | 34 | 35 | 36 | 37 | 38 | 39 | | | | | | | |
| 31 | 32 | 33 | AB | AB | AB | AB | AB | | | | | | | |
| 33 | 34 | 35 | 36 | AB | AB | 37 | 38 | | | | | | | |
| 30 | 31 | AB | 32 | 33 | 34 | AB | 35 | | | | | | | |
| 32 | 33 | 34 | 35 | AB | 36 | 37 | AB | | | | | | | |
| 30 | 31 | 32 | 33 | 34 | 35 | 36 | AB | | | | | | | |
| 33 | 33 | 34 | 35 | 36 | AB | AB | 37 | | | | | | | |
| 29 | 30 | 31 | 32 | 33 | 34 | 35 | 36 | | | | | | | |
| 28 | 29 | 30 | 31 | 32 | 33 | 34 | 35 | | | | | | | |
| 30 | 31 | 32 | 33 | 34 | 35 | 36 | 37 | | | | | | | |
| 30 | 31 | AB | 38 | 39 | 34 | 35 | 36 | | | | | | | |
| 30 | 31 | 32 | 33 | AB | 34 | AB | 35 | | | | | | | |
| 30 | 31 | 32 | AB | 33 | 34 | AB | 35 | | | | | | | |
| 31 | 32 | 33 | 34 | AB | 35 | 36 | AB | | | | | | | |
| 29 | 30 | 31 | 32 | 33 | 34 | AB | AB | | | | | | | |
| 28 | 29 | 30 | 31 | 32 | 33 | 34 | 35 | | | | | | | |
| 28 | 29 | 30 | 31 | 32 | 33 | 34 | 35 | | | | | | | |

ATME College of Engineering

## ATTENDANCE

Course Title with Code

Semester & Section

| Sl. No. | USN | Student Name | Date / Month | 3 / 11 | 4 / 11 | 5 / 11 | 6 / 11 | 7 / 11 | 10 / 11 | 18 / 11 | 19 / 11 | 20 / 11 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| 51 | 1MD19CV042 | Pawan Kumar B.S | | 1 | 2 | 3 | 4 | 5 | 6 | A | 7 | 8 | 9 |
| 52 | 19CV043 | Poornesh .M | | 1 | 2 | A | A | 3 | 4 | A | 5 | 6 | |
| 53 | 19CV044 | Prajwal .N | | 1 | 2 | 3 | 4 | 5 | 6 | A | 7 | A | 8 |
| 54 | 19CV045 | Prashanth .P | | 1 | 2 | A | A | 3 | 4 | A | 5 | 6 | 7 |
| 55 | 19CV046 | Rehaman .N | | A | A | A | A | A | 1 | 2 | 3 | 4 | 5 |
| 56 | 19CV047 | Sagar S | | A | A | A | - | - | - | 1 | 2 | 3 | 4 |
| 57 | 19CV048 | Sahiya. M | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| 58 | 19CV049 | Sanjana Shetty | | 1 | 2 | 3 | 4 | A | A | 5 | 6 | 7 | 8 |
| 59 | 19CV050 | Shoaib .N | | 1 | 2 | 3 | A | 4 | A | A | 5 | 6 | 7 |
| 60 | 19CV051 | Shashank .K | | 1 | 2 | 3 | 4 | A | A | 5 | 6 | 7 | 8 |
| 61 | 19CV052 | Srivathsa .H.R | | 1 | 2 | A | A | 3 | A | A | 4 | A | 5 |
| 62 | 19CV053 | Suhab P | | 1 | A | 2 | 3 | 4 | A | A | 5 | 6 | 7 |
| 63 | 19CV054 | Syed Imad mehdi | | - | - | - | - | A | A | A | 1 | 2 | |
| 64 | 19CV055 | Syed mustaqueem | | 1 | 2 | A | A | 3 | 4 | A | 5 | 6 | 7 |
| 65 | 19CV056 | Tabuniya anjum | | 1 | 2 | A | A | 3 | 4 | 5 | 6 | 7 | 8 |
| 66 | 19CV057 | Vasanthha .R | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| 67 | 19CV058 | Varun M | | 1 | 2 | A | A | 3 | 4 | A | 5 | A | 6 |
| 68 | 19CV059 | Varun. M | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| | | | | | | | | | | | | | |
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| | No. of Abs. | | | | | | | | | | | | |
| | Initials | | | | | | | | | | | | |



ASSE

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|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 24 | 24 | 25 | 1 | 5 | 8 | 10 | 12 | 15 | 17 | 19 | | | | | | | | | | | | | | |
| 11 | 11 | 11 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | 12 | | | | | | | | | | | | | | |
| 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | AT | A1 | | | | | | | | | | | | |
| 11 | 12 | 11 | 12 | 13 | A | 14 | 15 | 16 | 17 | 18 | | | | | | | | | | | | | | |
| 7 | 8 | 9 | 10 | 11 | A | 12 | 13 | 14 | 15 | 16 | | | | | | | | | | | | | | |
| 18 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | | | | | | | | | | | | | | |
| 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | | | | | | | | | | | | | | |
| 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | | | | | | | | | | | | | | |
| 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | A | 14 | | | | | | | | | | | | | | |
| 11 | 13 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | | | | | | | | | | | | | | |
| 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | A | 18 | | | | | | | | | | | | | | |
| 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | | | | | | | | | | | | | | |
| 9 | A | 11 | 12 | 13 | A | 15 | 16 | 17 | 18 | 19 | | | | | | | | | | | | | | |
| 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | A | 15 | | | | | | | | | | | | | | |
| 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | | | | | | | | | | | | | | |
| 3 | 4 | 5 | 6 | 7 | A | 8 | 9 | 10 | 11 | 12 | | | | | | | | | | | | | | |
| 8 | 9 | 10 | 11 | 12 | A | 13 | 14 | 15 | A | 19 | | | | | | | | | | | | | | |
| 9 | 10 | 11 | A | 13 | 15 | 14 | 15 | 16 | 17 | 18 | | | | | | | | | | | | | | |
| 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | | | | | | | | | | | | | | |
| A | 7 | 8 | 9 | 10 | 11 | 12 | A | 13 | 14 | 15 | | | | | | | | | | | | | | |
| 11 | 13 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | A | 21 | | | | | | | | | | | | | | |

ATME College of Engineering

**ATTENDANCE**

Course Title with Code : ...

Semester & Section : .....

| Sl. No. | USN | Student Name | Date / Month |
|---|---|---|---|
| 51 | 1AD19CV052 | Pawan Kumar B.S | 22 24 26 31 2 5 7 9 12 14 16 |
| 52 | 19CV053 | Poornesh .M | 12 13 19 12 1 1 1 1 1 1 1 |
| 53 | 19CV054 | Prajwal N | 22 23 24 25 26 27 28 29 30 31 32 |
| 54 | 19CV055 | Prashanth .P | 19 20 21 22 23 24 25 26 27 28 29 |
| 55 | 19CV056 | Pruthvin N | 17 18 19 20 Ab 21 22 23 24 25 26 |
| 56 | 19CV057 | Sagar S | 18 19 20 21 22 23 24 25 26 27 |
| 57 | 19CV058 | Sahiya. M | 19 Ab 19 20 21 22 23 24 25 26 27 |
| 58 | 19CV059 | Sanjana Shetty | 17 18 19 20 Ab 21 22 23 24 25 26 |
| 59 | 19CV060 | Sharath .N | 15 16 19 18 Ab 19 20 21 22 23 24 |
| 60 | 19CV061 | Shashank .K | 22 23 24 25 26 27 28 29 30 31 32 |
| 61 | 19CV062 | Srivathsa .H.R | 19 20 21 22 23 Ab 24 25 Ab 26 27 |
| 62 | 19CV063 | Suhas P | 20 21 22 23 24 25 26 27 28 29 30 |
| 63 | 19CV064 | Syed imad mehdi | 1 17 18 19 Ab 20 21 22 23 24 25 |
| 64 | 19CV065 | Syed mustaqueem | 19 20 21 22 Ab 23 24 25 26 27 28 |
| 65 | 19CV066 | Tabsuiya anjum | 13 14 15 16 17 18 19 20 21 22 23 |
| 66 | 19CV067 | Vanmithra .R | 18 19 20 21 22 23 24 25 26 27 28 |
| 67 | 19CV068 | Varun M | 19 20 21 22 23 24 25 26 27 28 29 |
| 68 | 19CV069 | Varun. M | 22 23 24 25 26 27 28 29 30 31 32 |
| 69 | 19CV070 | Vasanth .M | 16 17 18 19 20 21 22 23 24 25 26 |
| 70 | 19CV071 | Vinay .M | 22 23 24 25 Ab 26 27 28 29 30 31 |

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|---|---|---|---|---|---|---|---|---|---|---|
| 19 | 21 | 23 | 26 | 28 | 30 | 2 | 4 | | | |
| 1 | 1 | 1 | 1 | 1 | 1 | 2 | 2 | | | |
| 33 | 34 | 35 | 36 | 37 | 38 | 39 | 40 | 41 | 42 | |
| 30 | 31 | 32 | 33 | 34 | 35 | 36 | Ab | | | |
| 27 | 28 | 29 | 30 | 31 | 32 | 33 | 34 | | | |
| 29 | 30 | 31 | 32 | 33 | 34 | 35 | 36 | | | |
| 28 | 27 | 30 | 31 | 32 | 33 | 34 | 35 | | | |
| 27 | 29 | 29 | 30 | 31 | 32 | 33 | 34 | | | |
| 25 | 26 | 27 | 28 | 29 | 30 | 31 | 32 | | | |
| 33 | 34 | 31 | 36 | 37 | 38 | 39 | 40 | | | |
| 30 | 31 | 32 | 33 | 34 | 35 | 36 | 37 | | | |
| 28 | 29 | Ab | 30 | 31 | 32 | 33 | 34 | | | |
| 31 | 32 | 33 | 34 | 35 | 36 | 37 | 38 | | | |
| 26 | 27 | 28 | 29 | 30 | 31 | 32 | 33 | | | |
| 29 | 30 | 31 | 32 | 33 | 34 | 35 | 36 | | | |
| 24 | 25 | 26 | 27 | 28 | 29 | 30 | 31 | | | |
| 29 | 30 | 31 | 32 | 33 | 34 | 35 | 36 | | | |
| 30 | 31 | 32 | 33 | 34 | 35 | 36 | Ab | | | |
| 33 | 34 | 35 | 36 | 37 | 38 | Ab | Ab | | | |
| 27 | 28 | 29 | 30 | 31 | 32 | 33 | Ab | | | |
| 32 | 33 | 34 | 35 | 36 | 37 | 38 | 38 | | | |

ATME College of Engineering

**ATME COLLEGE OF ENGINEERING**

**DEPARTMENT OF CIVIL ENGINEERING**

**OFFLINE TIME TABLE FOR THIRD SEMESTER from 12-08-2021 to 19-08-2021**

**A & B SEC** — Room No:- C V-106

| DAY TIME | 9.00 - 10.00 | 10.00 -11.00 | 11.00-11.15 | 11.15 -12.15 | 12.15 - 1.15 | 01.15 - 02.00 | 2.00 - 3.00 | 3.00 - 4.00 |
|---|---|---|---|---|---|---|---|---|
| Monday | | | 18MAT31 | | 18CV32 | Lunch Break | | |
| Tuesday | 18CV33 | | Tea Break | | 18CV32 | | 18MAT31 | |
| Wednesday | 18CV32 | | Tea Break | | 18CV33 | | 18MAT31 | |
| Thursday | | | 18MAT31 | | 18CV35 | | | |
| Friday | 18CV35 | | Tea Break | | 18MAT31 | | | |
| Saturday | | 18CV33 | Tea Break | | 18CV35 | | 18MAT31 | |

| Subject Code | Subject Title | Faculty In – charge | Initials |
|---|---|---|---|
| 18MAT31 | Engineering Mathematics-III | Madhusudhan K V | KVM |
| 18CV32 | Strength of Materials | Shashank P | PS |
| 18CV33 | Fluid Mechanics | Akshaya B J | ABJ |
| 18CV35 | Basic Surveying | Rudresh A N | RG |

HOD

DEPARTMENT OF CIVIL ENGINEERING
ATME COLLEGE OF ENGINEERING
MYSORE-570028

09/8/21

Dean Academics

7/8/21

Principal

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ATME College of Engineering
#13 KM, Mysuru-Kanakapura-Bangalore Road
Mellahalli, Mysuru-570028

ATME College of Engineering

# ATME COLLEGE OF ENGINEERING

## DEPARTMENT OF CIVIL ENGINEERING

## OFFLINE TIME TABLE FOR FIFTH SEMESTER- 2020-2021 from 12-08-2021 to 19-08-2021

**A SEC** Room No:- CV-107

| DAY TIME | 9.00 - 10.00 | 10.00 -11.00 | 11.00-11.15 | 11.15 -12.15 | 12.15 - 1.15 | 01.15 - 02.00 | 2.00 - 3.00 | 3.00 - 4.00 |
|---|---|---|---|---|---|---|---|---|
| Monday | 18CV52 | | Tea Break | 18CV53 | | Lunch Break | | |
| Tuesday | 18CV53 | | | 18CV52 | | | | |
| Wednesday | 18CV54 | | | 18CV53 | | | | |
| Thursday | 18CV56 | | | 18CV54 | | | | |
| Friday | 18CV54 | | | 18CV56 | | | | |
| Saturday | 18CV52 | | | 18CV56 | | | | |

| Subject Code | Subject Title | Faculty In – charge | Initials |
|---|---|---|---|
| 18CV52 | Anaylsis of Indeterminate Structures | Manu Vijay | MV |
| 18CV53 | Design of RC Structural Elements | Shruthi H G | SHG |
| 18CV54 | Basic Geo-Technical Engineering | Puneeth K | KP |
| 18CV56 | Highway Engineering | Bharathi B | BB |

HOD

HOD
DEPARTMENT OF CIVIL ENGINEERING
ATME COLLEGE OF ENGINEERING
MYSORE-570028

09/8/21

Dean Academics

9/8/21

Principal

PRINCIPAL
ATME College of Engineering
#13, KM, Mysuru-Kanakapura-Bangalore
Mellahalli, Mysuru - 570028

ATME College of Engineering

| | |
|---|---|
| **Semester** | **3** |
| **Department** | **CIVIL** |

**Arrear Exam held during Aug/Sep 2021**

| SL | Course name with code | Name of the faculty engaged special class | No of students appeared (Failed during regular exam) | No. of students passed | No. of fails | Pass % | Overall Pass % |
|---|---|---|---|---|---|---|---|
| 1 | ENGINEERING MATHEMATICS 18MAT31 | Dr. MADHUSUDHAN | 38 | 28 | 12 | 74 | 86 |
| 2 | STRENGTH OF MATERIALS 18CV32 | SHASHANK P | 48 | 30 | 18 | 63 | 75 |
| 3 | FLUID MECHANICS 18CV33 | Dr.AKSHAYA B J<br>PUNEETH K | 22 | 5 | 17 | 23 | 77 |
| 4 | BUILDING MATERIAL & CONSTRUCTION 18CV34 | SRIVATHSA H U | 11 | 5 | 6 | 45 | 92 |
| 5 | BASIC SURVEYING 18CV35 | RUDRESH A N<br>MANDEEP G | 31 | 14 | 17 | 45 | 75 |
| 6 | ENGINEERING GEOLOGY 18CV36 | NAMITHA A P | 3 | 3 | 0 | 100 | 100 |

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ATME COLLEGE OF ENGINEERING
MYSORE-570028

A T M E
College of Engineering

| | |
|---|---|
| **Semester** | **5** |
| **Department** | **CIVIL** |

**Arrear Exam held during Aug/Sep 2021**

| SL | Course name with code | Name of the faculty engaged special class | No of students appeared (Failed during regular exam) | No. of students passed | No. of fails | Pass % | Overall Pass % |
|---|---|---|---|---|---|---|---|
| 1 | Construction Management and Enterpeneruship 18CV51 | Mandeep G | - | - | - | - | **100** |
| 2 | Analysis of Indeterminate strctures 18CV52 | Manu Vijay | **7** | **4** | **3** | **57** | **95** |
| 3 | Design of RCC Elements 18CV53 | shruthi H G | **5** | **1** | **4** | **20** | **93** |
| 4 | Basic geotechnical Engineering 18CV54 | Puneeth K | **10** | **4** | **6** | **40** | **89** |
| 5 | Muncipal waste water Engineering 18CV55 | Suneeth Kumar S M | **3** | **1** | **2** | **33** | **97** |
| 6 | Highway Engineering 18CV56 | Bharathi B | **10** | **8** | **2** | **80** | **97** |

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## Module-3

5 Analyze the continuous beam shown in Fig.Q5 by using Kani's method. The support C sinks by 20 mm. Take E = 200 kN/mm$^2$, I = 170 × 10$^6$ mm$^4$. Draw BMD, SFD and EC.

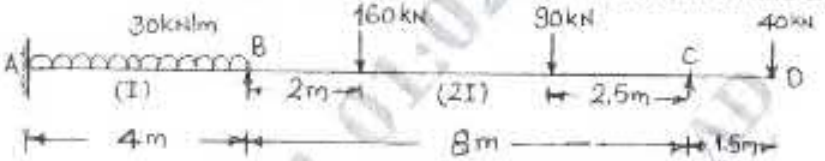



Fig.Q5

**(20 Marks)**

**OR**

6 Analyze the portal frame shown in Fig.Q6 by using Kani's method. Assume EI is constant throughout. Draw BMD and elastic curve.

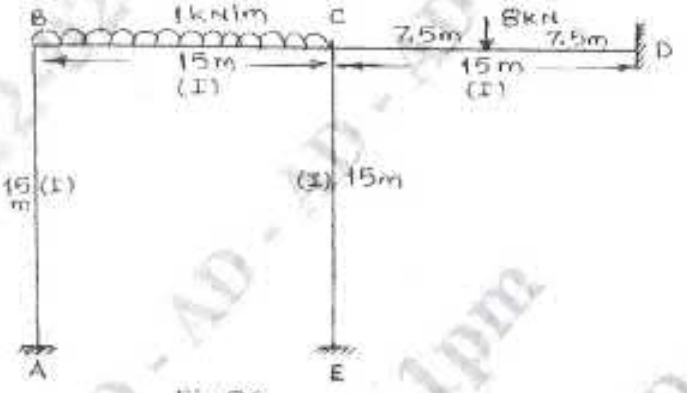



Fig.Q6

**(20 Marks)**

## Module-4

7 Analyze the continuous beam by using flexibility matrix method. Draw BMD, SFD and elastic curve. Refer Fig.Q7.

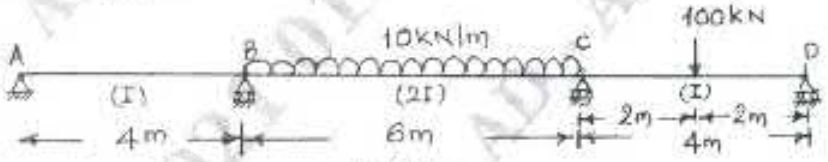



Fig.Q7

**(20 Marks)**

**OR**

8 Analyze the truss shown in Fig.Q8 by flexibility matrix method choosing force in the member AD as redundant. Assume constant EI for all the members.

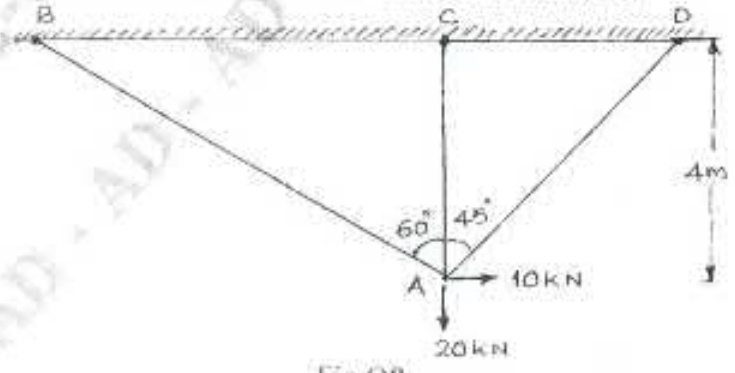



Fig.Q8

**(20 Marks)**

## Module-5

9 Analyze the continuous beam shown in Fig.Q9 by using stiffness matrix method. Draw BMD, SFD and elastic curve.

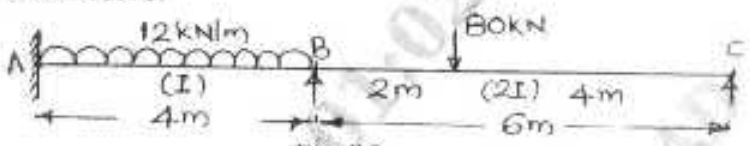



Fig.Q9

(20 Marks)

**OR**

10 Analyze the portal frame shown in Fig.Q10 by stiffness matrix method. Draw BMD and elastic curve.

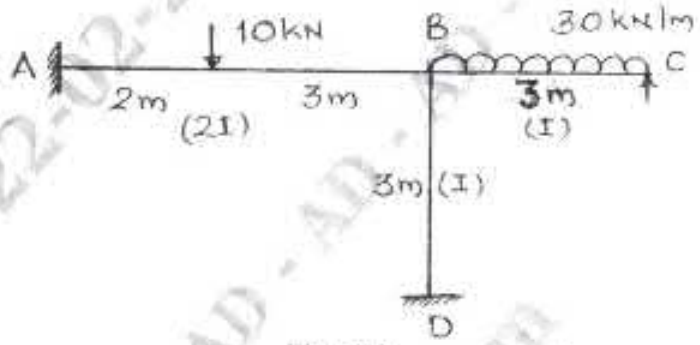



Fig.Q10

(20 Marks)

* * * * *

AD - AD - AD -

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# DEPARTMENT OF CIVIL ENGINEERING

## Academic Year 2020-21

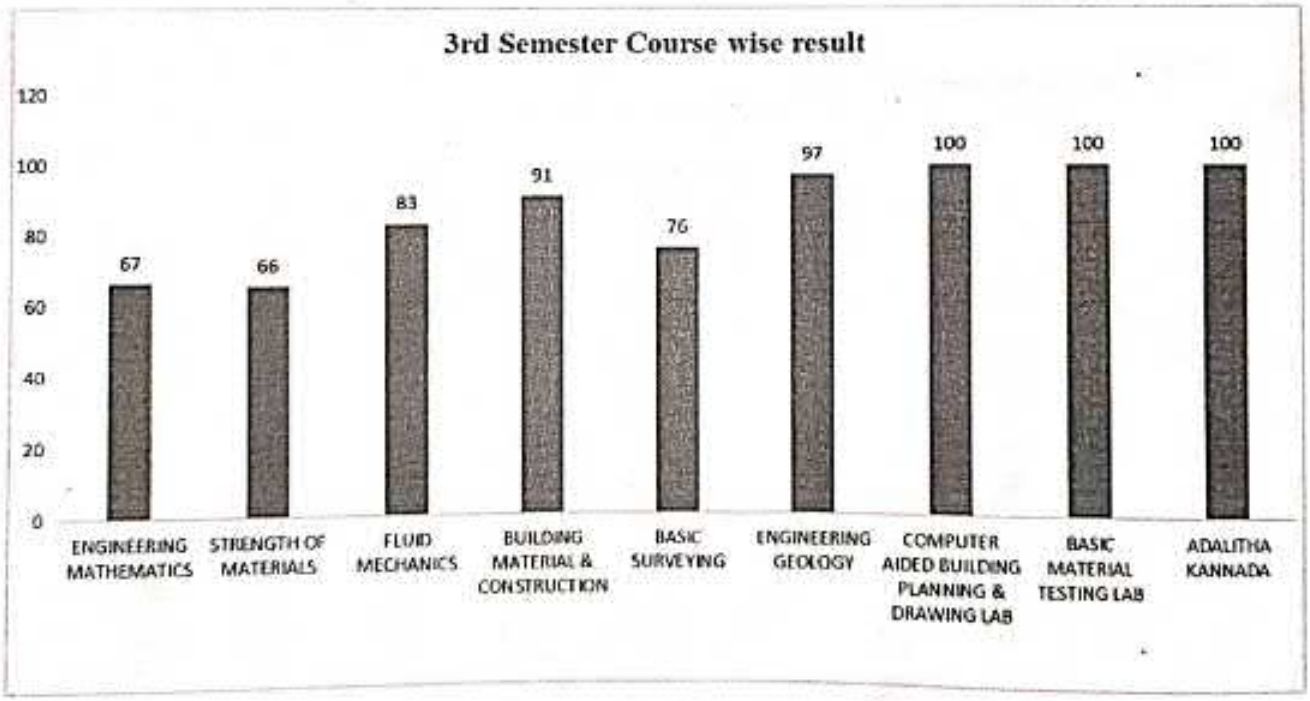
| Sl. No | Event Description | Event Date | Resource Person with Designation |
|---|---|---|---|
| 01 | Technical Talk on "Precast structures " | 22/10/2020 | Dr M N Hedge ,Ret. Dean Academics AIT Bangalore |
| 02 | Webinar from E construct company for final year students (12 weeks Webinar ) | Oct 2020 –Aug 2021 | Mr. Sandeep Pingale, Founder & MD of E-Construct |
| 03 | Webinar on "Steel Structures" | November 2020 | Satish Jeetwani, Director & Training Head EZ Engineers Pvt Ltd., Mumbai |
| 04 | Five Day webinar series on "Design, Construction Practice & its Management" | 14th to 18th July 2020 | Mr. Kushal S, Structural Engineer VISDA |
| 05 | Four Day Webinar on "Advances in Transportation Engineering" | 3rd to 6th Aug 2020 | Prof M N Sree Hari, Advisor to Govt. of Karnataka for Traffic, Transportation and Infrastructure |
| 06 | "Structural and Geotechnical Advances in Civil Engineering" | 20th and 21st of July 2020 | Dr. H S Prasanna, Professor, NIE Mysuru |
| 07 | Technical Talk on "Tekla Structures" | 6th June 2021 | Mrs. Kusuma Sri, Tekla Designer & Trainer |
| 08 | "Earthquake & its Effects on Built Structures" | 14th June 2021 | Mr. Bushan Mohan Raisanghani, Structural Consultant |
| 09 | Talk on "Career Guidance for Civil Engineers" | 18th June 2021 | Ms. Megha Jawale, Career Growth Mentor |
| 10 | "Methods of Building Construction from A to Z" | 12th July 2021 | Er. Mushtaq Ameen, Structural Engineer, Ameen Corps Structural Consultancy |
| 11 | "Soft Computing Technique For Sustainable Development" | 19th June 2021 | Dr. Surendra H J, Associate Professor |
| 12 | Short Term Training Program on "Hands on training on current Civil Engineering Practices" | 15th to 31st March 2021 | Er. Subramanya Bhat Pangla Proprietor Ambruni Architecture & Structural Consultants, Udupi |
| 13 | Virtual Tour on " Ultra Tech Cement Pvt Ltd | 17th Oct 2020 | - |

## Department of Civil Engineering

### Result analysis of Odd Semester- Academic Year- 2020-21

| Class | No. of Students | No. of Pass | FCD | FC | SC | Pass % |
|---|---|---|---|---|---|---|
| 3rd semester | | | | | | |
| Regular | 66 | 13 | 9 | 3 | 1 | 20 |
| Lateral | 9 | 3 | 2 | 1 | 0 | 33 |
| Overall | 75 | 16 | 11 | 4 | 1 | 27 |
| 5th semester | 63 | 42 | 28 | 13 | 1 | 67 |
| 7th semester | 65 | 58 | 52 | 6 | 0 | 89 |

**3rd Semester Course wise result**

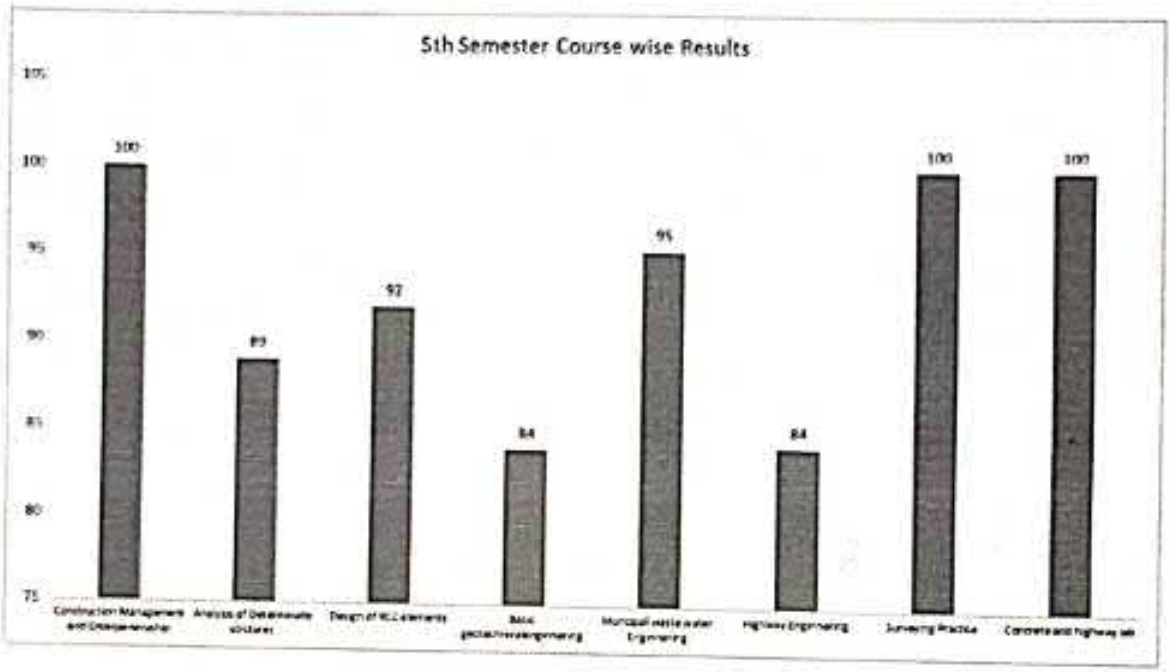



Result Analysis Coordinator

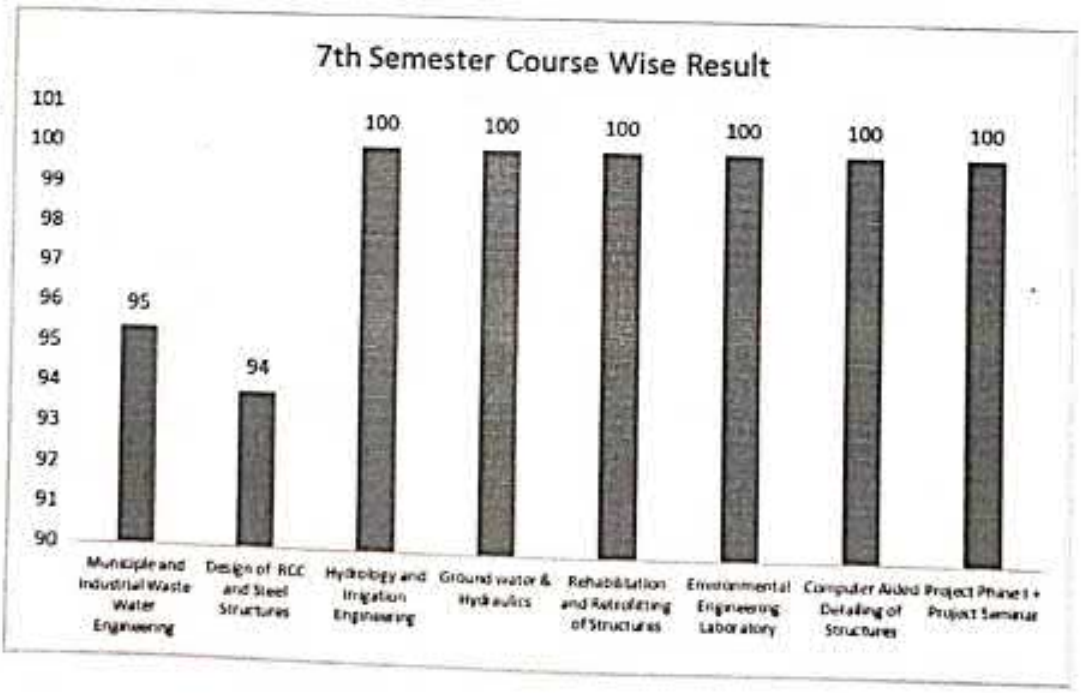
HoD

## Department of Civil Engineering

### 5th Semester Course-wise Result




### 7th Semester Course-wise Result




Result Analysis Coordinator

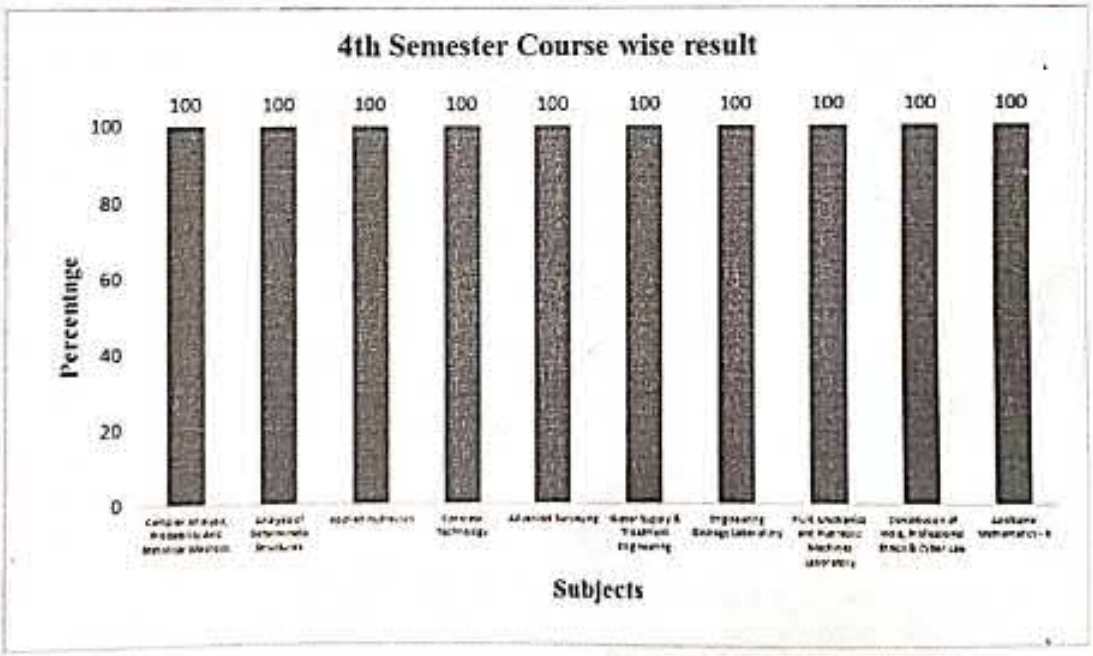
HoD

## Department of Civil Engineering

### Result analysis of Even Semester- Academic Year- 2020-21

| Class | No. of Students | No. of Pass | FCD | FC | SC | Pass % |
|---|---|---|---|---|---|---|
| **4th semester** | | | | | | |
| Regular | 65 | 65 | 37 | 27 | 1 | 100 |
| Lateral | 9 | 9 | 8 | 1 | 0 | 100 |
| Overall | 74 | 74 | 45 | 28 | 1 | 100 |
| 6th semester | 68 | 68 | 60 | 7 | 1 | 100 |
| 8th semester | 65 | 65 | 65 | 0 | 0 | 100 |

**4th Semester Course wise result**

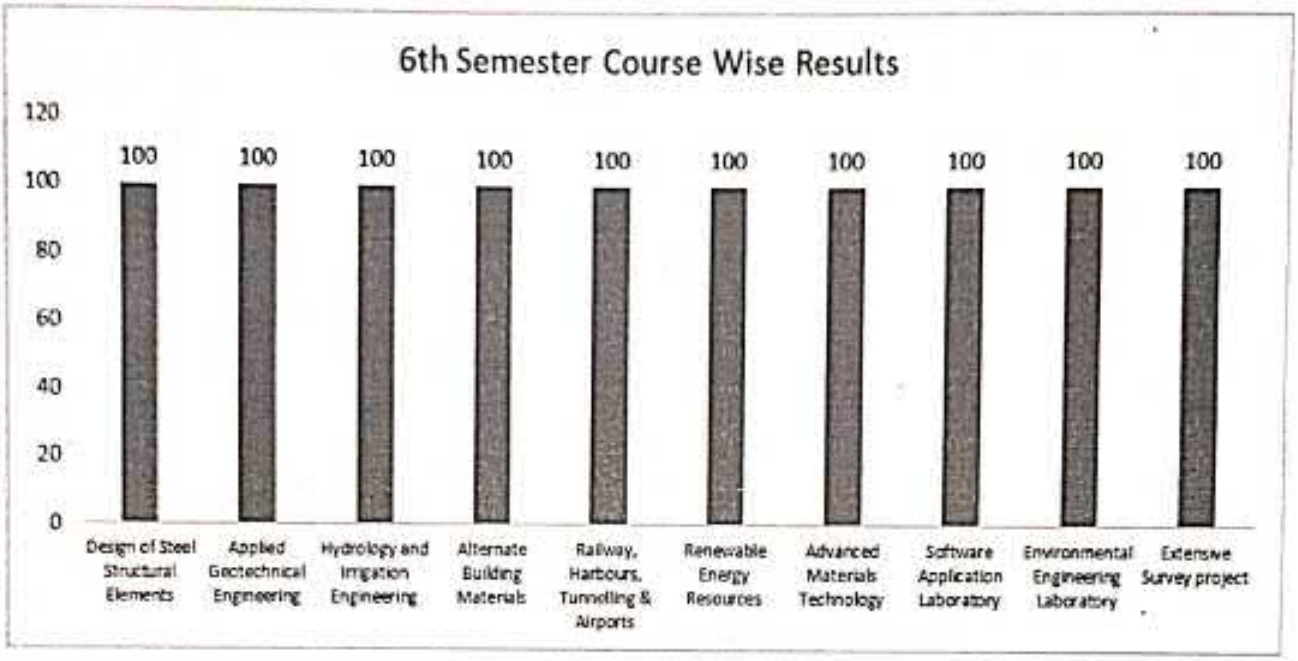



Result Analysis Coordinator

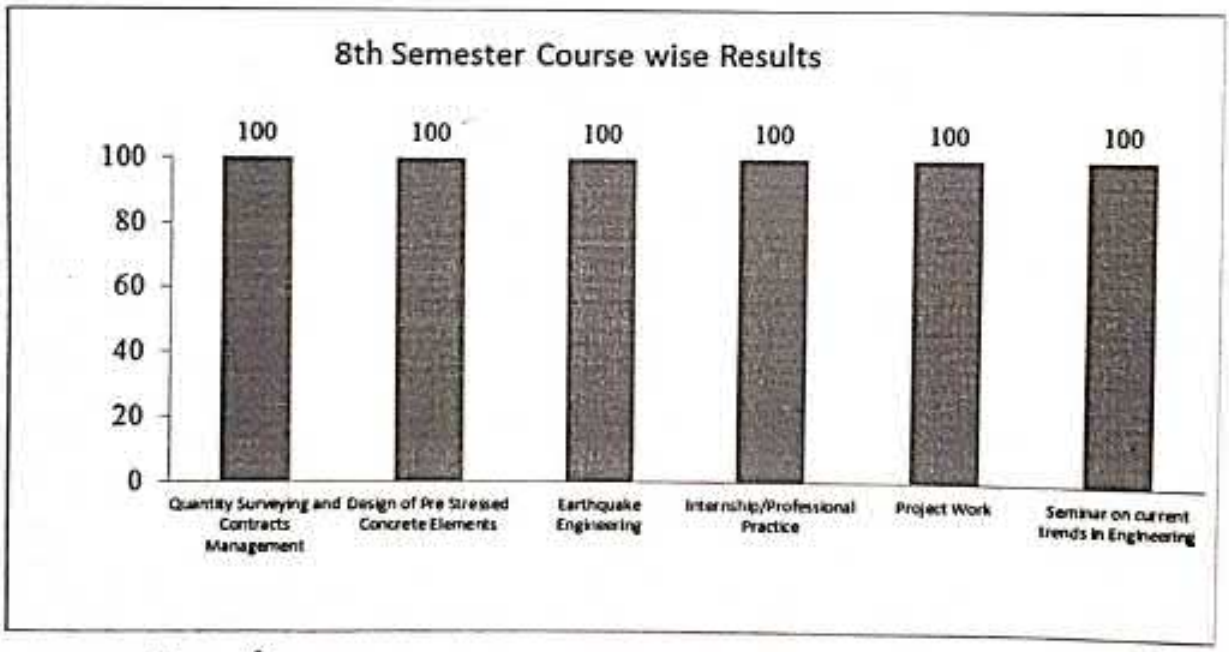
HoD

## Department of Civil Engineering

### 6th Semester Course-wise Result




### 7th Semester Course-wise Result




Result Analysis Coordinator

HoD

ATME College of Engineering

## WORK DONE DIARY

| WEEK 10 | MONDAY DATE | TUESDAY DATE | WEDNESDAY DATE |
|---|---|---|---|
| ACTIVITY – Class Hours | | 3/11/20<br>18CV36 - Introduction to Engineering geology | 4/11<br>Ecosystem. |
| ACTIVITY – Others | | | 18CV36 - Special class as to be taken. (Quartz) |
| **WEEK 11** | **MONDAY DATE** | **TUESDAY DATE** | **WEDNESDAY DATE** |
| ACTIVITY – Class Hours | 9/11<br>No class, FDP on NAAC Webinar | 10/11<br>18CV36 - types, classification, significance of igneous rock. | 11/11<br>18CV59 – Module-1 Ecosystem. |
| ACTIVITY – Others | | FDP on NAAC | AIDA Workshop, Preparation of LP for SA-1 |
| **WEEK 12** | **MONDAY DATE** | **TUESDAY DATE** | **WEDNESDAY DATE** |
| ACTIVITY – Class Hours | 15/11/20<br>Holiday | 16/11/20<br>Holiday | 17/11<br>No class to be taken as of SA-2 |
| ACTIVITY – Others | | | Invigilation work done for 3rd Sem |



## WORK DONE DIARY

ATME College of Engineering

| WEEK 10 | THURSDAY DATE | FRIDAY DATE | SATURDAY DATE |
|---|---|---|---|
| ACTIVITY – Class Hours | 5/11<br>18CV36 - Feldspar group of minerals. | 6/11<br>No class as per timetable. | 7/11<br>18CV36 - Ore group of minerals. |
| ACTIVITY – Others | Special class as to be taken. 18CV36 (Kaolin) | 18CV36 Special class as to be taken - completed Mondays lesson plan. | Preparation for class, completed lesson plan. |
| **WEEK 11** | **THURSDAY DATE** | **FRIDAY DATE** | **SATURDAY DATE** |
| ACTIVITY – Class Hours | 12/11/20<br>Internal Assessment Duty.<br>No class to be taken as of SA-2 | 13/11/20<br>No class SA-2 | 14/11/20<br>Holiday |
| ACTIVITY – Others | Invigilation Carried out for 3rd Sem. | Preparation of Answer Script. | |
| **WEEK 12** | **THURSDAY DATE** | **FRIDAY DATE** | **SATURDAY DATE** |
| ACTIVITY – Class Hours | 18/11<br>18CV36 - Module-2 Specimen based on Metamorphic Rocks<br>18CV59 - Module-1 Conservation of Biodiversity | 19/11<br>18CV36 - Module-2 Metamorphic Rocks | 20/11<br>No class as per the time table |
| ACTIVITY – Others | Extra class was taken for 3 Sem. | SA-2 papers evaluation. | Attended webinar on QPR & its role in research impact -tion |

ATME College of Engineering

## WORK DONE DIARY

| WEEK 13 | | MONDAY DATE | TUESDAY DATE | WEDNESDAY DATE |
|---|---|---|---|---|
| ACTIVITY | Class Hours | 21/11 18CV36 - Weathering of rocks - Agents & types and effects on civil engineering Projects. | 22/11 Sunday | 23/11 No - class as per the time table |
| | Others | Completion of IA-2 evaluation | | PPT preparation. Completed 100 today |
| WEEK 14 | | MONDAY DATE | TUESDAY DATE | WEDNESDAY DATE |
| ACTIVITY | Class Hours | 27/11 18CV59 - EVS. EVS - module-1 - Ecosystem. | 28/11 18CV36 - Soil formation. Soil profile & types 18CV59 - Evs module - 1 - Ecosystem for Ec. | 29/11 Sunday |
| | Others | Preparation of ppt and class | Completion of work done. | |
| WEEK 15 | | MONDAY DATE | TUESDAY DATE | WEDNESDAY DATE |
| ACTIVITY | Class Hours | 3/12/20 Holiday | 4/12/20 18CV59 - EVS Module-1 - Causes - Value of Bio-div - ersity. | 5/12/20 18CV36 - Selection of rocks as building materials 18CV59 - EC Conservation of Bio-diversity. |
| | Others | | Updations of lesson plan and 15 days work report | Preparation of EVS module - 2 notes |



ATME College of Engineering

WORK DONE DIARY

| WEEK 13 | | THURSDAY DATE | FRIDAY DATE | SATURDAY DATE |
|---|---|---|---|---|
| ACTIVITY | Class Hours | 24/11 18CV36 - Geomorp - hology - Landform (Aeolian & fluvial) | 25/11 18CV59 - CV - Module Relevance in energy systems. | 26/11 18CV36 - Coastal landforms - drainage Pattern for 3rd Sem. 18CV59 - ES - Module |
| | Others | Preparation of ques - tions for Quiz. Completed two exp today | Course modules exp sheets of EVS. Preparation for class | Notes preparation, Quiz for 3rd sem. Attend Quiz on courses S Kannaiya |
| WEEK 14 | | THURSDAY DATE | FRIDAY DATE | SATURDAY DATE |
| ACTIVITY | Class Hours | 30/11 18CV59 - EVS - module-1 - Ecosystem for Mech department | 1/12/20 18CV36 - CV Module-2 - Natural energy resource for civil engineering properties of rocks | 2/12/20 18CV59 EVS - module - 2 Natural energy resource - |
| | Others | class and ppt Preparation. | notes preparation and ppt. | preparation of notes. |
| WEEK 15 | | THURSDAY DATE | FRIDAY DATE | SATURDAY DATE |
| ACTIVITY | Class Hours | 6/12/20 Sunday | 7-12-20 18CV59 - Mech Module-1 Conservation of Bio diversity | 8/12/20 18CV36 - Module-2 Structural Geology - Structural - soil classification of rocks. |
| | Others | | Admission duty, Preparation of PPT and for class | Preparation of module-2 notes and ppt. |

ATME College of Engineering

## WORK DONE DIARY

| WEEK 16 | MONDAY DATE | TUESDAY DATE | WEDNESDAY DATE |
|---|---|---|---|
| ACTIVITY – Class Hours | 9/10/20<br>18CIV59 - CV<br>Module - 3 - Emerging environmental pollution | 10-10-20<br>18CV36 - Module - 3<br>fields, famila.<br>18CIV59 - CS<br>Module - 2 - Natural Energy Resource. | 11-10-20<br>18CV59 - EEE<br>Module - 2 - Natural energy resource. |
| ACTIVITY – Others | Conducted quiz & Preparation of ppt and notes. | Updation of course file. | Updation of personal file and course module - conducted quiz. |

| WEEK 17 | MONDAY DATE | TUESDAY DATE | WEDNESDAY DATE |
|---|---|---|---|
| ACTIVITY – Class Hours | 15/10/20<br>18CV36 - Module - 3 Selection of site for construction of dam and reservoirs. | 16/10/20<br>18CIV59 - CV - Module - 3 - Air and Noise Pollution. | 17/10/20<br>18CV36 - Module - 3 Tunnels<br>18CIV59 - CS - Module - 2 - Natural Energy Resource. |
| ACTIVITY – Others | Offline class was engaged to parallel course students. PPT Preparation. | class preparation. ppt preparation. offline class was engaged to parallel course. | Prepared notes. |

| WEEK 18 | MONDAY DATE | TUESDAY DATE | WEDNESDAY DATE |
|---|---|---|---|
| ACTIVITY – Class Hours | 21/10/20<br>No online class according to the time table. | 22/10/20<br>18CV36 - Module - 4 Hydrogeology (Aquifers) | 23/10/20<br>18CIV59 - CV Module - 4 Global environmental Concern. |
| ACTIVITY – Others | Offline class was engaged to parallel course | Preparation for class and ppt. | Updation of course file, ppt and Notes preparation of 18CIV59 |



WORK DONE DIARY

ATME College of Engineering

| WEEK 16 | THURSDAY DATE | FRIDAY DATE | SATURDAY DATE |
|---|---|---|---|
| ACTIVITY – Class Hours | 11/10/20<br>18CV36 - Module - 3 Structural aspects of dams.<br>18CIV59 - EC - Module 2 Natural energy resources | 18/10<br>Sunday. | 17/10/20<br>18CIV59 - Mech - Module - 2 - Natural energy resource. |
| ACTIVITY – Others | Noha done report and Course file updated. | | ppt preparation, offline class was engaged to parallel course |

| WEEK 17 | THURSDAY DATE | FRIDAY DATE | SATURDAY DATE |
|---|---|---|---|
| ACTIVITY – Class Hours | 18/10/20<br>18CIV59 - EEE Module - 2 - Natural energy resource | 19/10/20<br>18CV36 - Module - 4 Hydrogeology.<br>18CIV59 EC - Module - 2 - Natural energy resource. | 20/10/20<br>Sunday. |
| ACTIVITY – Others | Offline class was engaged to parallel course. | Updated work done report, ppt preparation. | |

| WEEK 18 | THURSDAY DATE | FRIDAY DATE | SATURDAY DATE |
|---|---|---|---|
| ACTIVITY – Class Hours | 25/10/20<br>18CV36 - Module - 4 Hydrogeology - Ground water occurrence and rain water harvesting. | 24/10/20<br>Holiday | 24/10/20<br>18CV36 - Module - 4 Ground water pollution.<br>18CIV59 - EC - Module - 3 Environmental pollution. |
| ACTIVITY – Others | Q.P preparation for IA 3 | | Updated work done report, completed question set of IA paper. |

# ATME College of Engineering

## C1.1.1 - The Institution ensures effective curriculum delivery through a well-planned and documented process

## Supporting Documents

### Index

| Sl. No. | Academic Year | Particulars |
|---|---|---|
| 1 | **2020-21** | Academic Calendar- College & Department |
| 2 | | Teaching Plan |
| 3 | | Department Meeting – Sample MoM |
| 4 | | Learning Outcome- Course Module |
| 5 | | Time Table |
| 6 | | Teaching – Learning resources |
| 7 | | Attendance Record |
| 8 | | Bridge & Remedial Classes |
| 9 | | Question Bank-VTU Previous Year QP |
| 10 | | Academic Activity and its Planning |
| 11 | | Result Analysis |
| 12 | | Teachers Diary |

# Department of Computer Science and Engineering

**ATME COLLEGE OF ENGINEERING**
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Email: info@atme.in, Web : www.atme.in

# ATME COLLEGE OF ENGINEERING, MYSURU

## Revised Academic Calendar (ODD SEMESTER, 2020-21)

| WEEK | MONTH | SUN | MON | TUE | WED | THU | FRI | SAT | HOLIDAY (H) | COLLEGE EVENTS |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | SEPTEMBER | | | 1 | 2 | 3 | 4 | 5 | | 3rd , 5th & 7th Semster : commencement of Online Classes |
| 2 | | 6 | 7 | 8 | 9 | 10 | 11 | 12 | | |
| 3 | | 13 | 14 | 15 | 16 | 17 | 18 | 19 | Mahalaya Amavasya | |
| 4 | | 20 | 21 | 22 | 23 | 24 | 25 | 26 | | |
| 5 | | 27 | 28 | 29 | 30 | | | | | |
| 5 | OCTOBER | | | | | 1 | 2 | 3 | Gandhi Jayanthi | |
| 6 | | 4 | 5 | 6 | 7 | 8 | 9 | 10 | | First I A for 3rd , 5th and 7th Semester |
| 7 | | 11 | 12 | 13 | 14 | 15 | 16 | 17 | | |
| 8 | | 18 | 19 | 20 | 21 | 22 | 23 | 24 | | |
| 9 | | 25 | 26 | 27 | 28 | 29 | 30 | 31 | Ayudha Pooja, Vijaya Dashami, Eid-Milad , Valmiki Jayanthi | |
| 10 | NOVEMBER | 1 | 2 | 3 | 4 | 5 | 6 | 7 | Kannada Rajyotsava | |
| 11 | | 8 | 9 | 10 | 11 | 12 | 13 | 14 | Naraka Chaturdashi | Second IA for 3rd , 5th and 7th Semester |
| 12 | | 15 | 16 | 17 | 18 | 19 | 20 | 21 | Balipadyami | Commencement of On-Campus Classes for Semseter 7. |
| 13 | | 22 | 23 | 24 | 25 | 26 | 27 | 28 | | |
| 14 | | 29 | 30 | | | | | | | |

Non Working Saturdays

# ATME COLLEGE OF ENGINEERING, MYSURU

**Revised Academic Calendar (ODD SEMESTER, 2020-21)**

| WEEK | MONTH | SUN | MON | TUE | WED | THU | FRI | SAT | HOLIDAY (H) | COLLEGE EVENTS |
|---|---|---|---|---|---|---|---|---|---|---|
| 14 | DECEMBER | | | 1 | 2 | 3 | 4 | 5 | Kanakadasa Jayanthi | |
| 15 | | 6 | 7 | 8 | 9 | 10 | 11 | 12 | | |
| 16 | | 13 | 14 | 15 | 16 | 17 | 18 | 19 | | |
| 17 | | 20 | 21 | 22 | 23 | 24 | 25 | 26 | Christmas | |
| 18 | | 27 | 28 | 29 | 30 | 31 | | | | Third IA for Semesters 3, 5 and 7 |
| 18 | JANUARY | | | | | | 1 | 2 | | |
| 19 | | 3 | 4 | 5 | 6 | 7 | 8 | 9 | | LAB Interenals for Semesters 3,5 and 7 |
| 20 | | 10 | 11 | 12 | 13 | 14 | 15 | 16 | Makra Sankranthi | Improvement IA for Semesters 3,5 and 7, LAST working day for ODD Sem 2020-21 |
| 21 | | 17 | 18 | 19 | 20 | 21 | 22 | 23 | | Comencement of Odd Semester Practical Exams |
| 22 | | 24 | 25 | 26 | 27 | 28 | 29 | 30 | Republic Day | |
| 23 | | 31 | | | | | | | | |
| 23 | FEBRUARY | | 1 | 2 | 3 | 4 | 5 | 6 | | End of Odd Semester Practical Exams |
| 24 | | 7 | 8 | 9 | 10 | 11 | 12 | 13 | | Commencement of Odd Semester Theory Exams |
| 25 | | 14 | 15 | 16 | 17 | 18 | 19 | 20 | | |
| 26 | | 21 | 22 | 23 | 24 | 25 | 26 | 27 | | |
| 27 | | 28 | | | | | | | | |

Non Working Saturdays

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| No. Of Working Days | 17 | 20 | 20 | 17 | 17 | 9 | Total No. Of Working Days | 100 |

# ATME COLLEGE OF ENGINEERING, MYSURU

## Revised Academic Calendar (ODD SEMESTER, 2020-21)

| WEEK | MONTH | SUN | MON | TUE | WED | THU | FRI | SAT | HOLIDAY (H) | COLLEGE EVENTS |
|---|---|---|---|---|---|---|---|---|---|---|
| 14 | MARCH | | 1 | 2 | 3 | 4 | 5 | 6 | | |
| 15 | | 7 | 8 | 9 | 10 | 11 | 12 | 13 | Mahashivaratri | |
| 16 | | 14 | 15 | 16 | 17 | 18 | 19 | 20 | | |
| 17 | | 21 | 22 | 23 | 24 | 25 | 26 | 27 | | 25th End of odd semester Theory exams, 26th Mar 2021 Commencement of Even Semester |
| 18 | | 28 | 29 | 30 | 31 | | | | | |
| 18 | APRIL | | | | | 1 | 2 | 3 | Good Friday | |
| 19 | | 4 | 5 | 6 | 7 | 8 | 9 | 10 | | |
| 20 | | 11 | 12 | 13 | 14 | 15 | 16 | 17 | Chadramana Yugadi, Ambedkar Jayanthi | |
| 21 | | 18 | 19 | 20 | 21 | 22 | 23 | 24 | | |
| 22 | | 25 | 26 | 27 | 28 | 29 | 30 | | Mahavir Jayanthi | |
| 23 | MAY | | | | | | | 1 | May Day (Labour Day) | |
| 23 | | 2 | 3 | 4 | 5 | 6 | 7 | 8 | | |
| 24 | | 9 | 10 | 11 | 12 | 13 | 14 | 15 | Idul-Fitr, Basava Jayathi | |
| 25 | | 16 | 17 | 18 | 19 | 20 | 21 | 22 | | |
| 26 | | 23 | 24 | 25 | 26 | 27 | 28 | 29 | | |
| 27 | | 30 | 31 | | | | | | | |

Non Working Saturdays

Sd-
Dr. L Basavaraj
Principal

# ATME COLLEGE OF ENGINEERING, MYSURU

**Revised Academic Calendar (EVEN SEMESTER, 2020-21)**

| WEEK | MONTH | SUN | MON | TUE | WED | THU | FRI | SAT | HOLIDAY (H) | COLLEGE EVENTS |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | APRIL | | | | | 1 | 2 | 3 | | |
| 2 | | 4 | 5 | 6 | 7 | 8 | 9 | 10 | | |
| 3 | | 11 | 12 | 13 | 14 | 15 | 16 | 17 | | |
| 4 | | 18 | 19 | 20 | 21 | 22 | 23 | 24 | | Commencement of 4th, 6th and 8th Semester Classes |
| 5 | | 25 | 26 | 27 | 28 | 29 | 30 | | | |
| 5 | MAY | | | | | | | 1 | May Day | |
| 6 | | 2 | 3 | 4 | 5 | 6 | 7 | 8 | | |
| 7 | | 9 | 10 | 11 | 12 | 13 | 14 | 15 | Basava Jayanthi, Ramzan | |
| 8 | | 16 | 17 | 18 | 19 | 20 | 21 | 22 | | |
| 9 | | 23 | 24 | 25 | 26 | 27 | 28 | 29 | | FIRST IA 4TH AND 6TH SEM |
| | | 30 | 31 | | | | | | | |
| 10 | JUNE | | | 1 | 2 | 3 | 4 | 5 | | |
| 11 | | 6 | 7 | 8 | 9 | 10 | 11 | 12 | | |
| 12 | | 13 | 14 | 15 | 16 | 17 | 18 | 19 | | |
| 13 | | 20 | 21 | 22 | 23 | 24 | 25 | 26 | | |
| 14 | | 27 | 28 | 29 | 30 | | | | | |

**Non Working Saturdays**

# ATME COLLEGE OF ENGINEERING, MYSURU

## Revised Academic Calendar (EVEN SEMESTER, 2020-21)

| WEEK | MONTH | SUN | MON | TUE | WED | THU | FRI | SAT | HOLIDAY (H) | COLLEGE EVENTS |
|---|---|---|---|---|---|---|---|---|---|---|
| 14 | JULY | | | | | 1 | 2 | 3 | | SECOND IA 4TH AND 6TH SEM |
| 15 | | 4 | 5 | 6 | 7 | 8 | 9 | 10 | | |
| 16 | | 11 | 12 | 13 | 14 | 15 | 16 | 17 | | |
| 17 | | 18 | 19 | 20 | 21 | 22 | 23 | 24 | Bakrid | 8th Sem Last Working Day, 8th Sem Theory Exam Begins |
| 18 | | 25 | 26 | 27 | 28 | 29 | 30 | 31 | | 8th Sem Theory Exam Ends, THIRD IA 4th AND 6th SEM |
| 18 | AUGUST | 1 | 2 | 3 | 4 | 5 | 6 | 7 | | 4th and 6th Sem Last Working Day, 8th Sem Internship Viva Voce. LAB IA 4th and 6th Sem. |
| 19 | | 8 | 9 | 10 | 11 | 12 | 13 | 14 | | Practical Exams Starts for 4th and 6th Sem |
| 20 | | 15 | 16 | 17 | 18 | 19 | 20 | 21 | Muharram | Practical Exams Ends for 4th and 6th Sem |
| 21 | | 22 | 23 | 24 | 25 | 26 | 27 | 28 | | Theory Exams Starts for 4th and 8th Sem |
| 22 | | 29 | 30 | 31 | | | | | | |
| 23 | SEPTEMBER | | | | 1 | 2 | 3 | 4 | | |
| 24 | | 5 | 6 | 7 | 8 | 9 | 10 | 11 | Ganesha Chathurthi | Theory Exams Starts for 4th and 8th Sem |
| 25 | | 12 | 13 | 14 | 15 | 16 | 17 | 18 | | |
| 26 | | 19 | 20 | 21 | 22 | 23 | 24 | 25 | Non Working Saturdays | |
| 27 | | 26 | 27 | 28 | 29 | 30 | 31 | 32 | | |
| WORKING DAYS (8th Sem) | | | 14 | 14 | 13 | 13 | 13 | 6 | 73 | |
| WORKING DAYS(4th & 6th) | | | 16 | 16 | 15 | 16 | 16 | 7 | 86 | Inclusive of IA tests and other activities |

DEAN ACADEMICS
DR. M S GOVINDE GOWDA

PRINCIPAL
DR. L BASAVARAJ

ATME College of Engineering

# Department of Computer Science & Engineering

## Academic Calendar (ODD SEMESTER, 2020-21)

| WEEK | MONTH | SUN | MON | TUE | WED | THU | FRI | SAT | HOLIDAY (H) | | COLLEGE EVENTS |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | SEPTEMBER | | | 1 | 2 | 3 | 4 | 5 | | 3rd, 5th & 7th Sem: commencement of Online Classes , Induction Program for 3rd, 5th and 7th Semester | Aptitude Test |
| 2 | | 6 | 7 | 8 | 9 | 10 | 11 | 12 | | Aptitude Test | |
| 3 | | 13 | 14 | 15 | 16 | 17 | 18 | 19 | Mahalaya Amavasya | Aptitude Test | |
| 4 | | 20 | 21 | 22 | 23 | 24 | 25 | 26 | | CSI State Level Event( Quiz Competition) | Placement Activity (Mock Interview for 7th Semester) |
| 5 | | 27 | 28 | 29 | 30 | | | | | Technical Talk | Synopsis Review for 7th Semester |
| 5 | OCTOBER | | | | | 1 | 2 | 3 | Gandhi Jayanthi | Commencement of Offline Classes for 3,5 & 7 Sem | |
| 6 | | 4 | 5 | 6 | 7 | 8 | 9 | 10 | | First I A for 3rd , 5th and 7th Semester | |
| 7 | | 11 | 12 | 13 | 14 | 15 | 16 | 17 | | | |
| 8 | | 18 | 19 | 20 | 21 | 22 | 23 | 24 | | CSI Event (Webinar) | Workshop on Android |
| 9 | | 25 | 26 | 27 | 28 | 29 | 30 | 31 | Ayudha Pooja, Vijaya Dashami, Eid-Milad , Valmiki Jayanthi | | |
| 10 | NOVEMBER | 1 | 2 | 3 | 4 | 5 | 6 | 7 | Kannada Rajyotsava | | |
| 11 | | 8 | 9 | 10 | 11 | 12 | 13 | 14 | Naraka Chaturdashi | Second IA for 3rd , 5th and 7th Semester | |
| 12 | | 15 | 16 | 17 | 18 | 19 | 20 | 21 | Balipadyami | Workshop on Amazon Web Services | Technical Talk |
| 13 | | 22 | 23 | 24 | 25 | 26 | 27 | 28 | | Project Phase-I, Review-1 | |
| 14 | | 29 | 30 | | | | | | | CSI National Event( Code Relay) | |

ATME College of Engineering

# Department of Computer Science & Engineering

| WEEK | MONTH | SUN | MON | TUE | WED | THU | FRI | SAT | | | COLLEGE EVENTS |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 14 | DECEMBER | | | 1 | 2 | 3 | 4 | 5 | Kanakadasa Jayanthi | | |
| 15 | | 6 | 7 | 8 | 9 | 10 | 11 | 12 | | Lab I A | |
| 16 | | 13 | 14 | 15 | 16 | 17 | 18 | 19 | | Lab IA | Last working day for Semesters 3, 5 and 7 |
| 17 | | 20 | 21 | 22 | 23 | 24 | 25 | 26 | Christmas | Semster Practical Exmainations | |
| 18 | | 27 | 28 | 29 | 30 | 31 | | | | Third IA for Semesters 3, 5 and 7 | |
| 18 | JANUARY | | | | | | 1 | 2 | | | |
| 19 | | 3 | 4 | 5 | 6 | 7 | 8 | 9 | | LAB Interenals for Semesters 3,5 and 7 | |
| 20 | | 10 | 11 | 12 | 13 | 14 | 15 | 16 | Makra Sankranthi | Improvement IA for Semesters 3,5 and 7 | Last working day for ODD Sem 2020-21 |
| 21 | | 17 | 18 | 19 | 20 | 21 | 22 | 23 | | Comencement of Odd Semester Practical Exams | |
| 22 | | 24 | 25 | 26 | 27 | 28 | 29 | 30 | Republic Day | | |
| 23 | | 31 | | | | | | | | | |
| 23 | FEBRUARY | | 1 | 2 | 3 | 4 | 5 | 6 | | End of Odd Semester Practical Exams | |
| 24 | | 7 | 8 | 9 | 10 | 11 | 12 | 13 | | Commencement of Odd Semester Theory Exams | |
| 25 | | 14 | 15 | 16 | 17 | 18 | 19 | 20 | | | |
| 26 | | 21 | 22 | 23 | 24 | 25 | 26 | 27 | | | |
| 27 | | 28 | | | | | | | | | |

HOD

ATME College of Engineering

# Department of Computer Science & Engineering

## Lesson Plan & Work-done Diary for AY: 2020-21, ODD Semester

| Course with Code: Computer Organization-18CS34 | | | | Faculty: Nasreen Fathima | | | Semester & Section: 3 A | |
|---|---|---|---|---|---|---|---|---|
| Class No. | Date planned (DD/MM) | Topics to be covered | TLP Planned | Class No. | Date of Conduction (DD/MM) | Topics Covered | TLP Executed | Remarks if any deviation |
| MODULE-1 | | | | | | | | |
| 1 | 02-09-2020 | **Basic Structure of Computers:** Basic Operational Concepts | PPT | 1 | 2-9-20 | Introduction to subject & syllabus discussion | PPT | Introduction class |
| 2 | 04-09-2020 | Bus Structures, Performance – Processor Clock, Basic Performance equation | PPT | 2 | 4-9-20 | Basic Operational Concepts | PPT | |
| 3 | 07-09-2020 | Clock Rate, Performance Measurement | PPT | 3 | 7-9-20 | Bus structure, performance processor clock, Equations | PPT | |
| 4 | 09-09-2020 | **Machine Instructions and Programs:** Memory Location and Addresses, | PPT | 4 | 9-9-20 | Performance equation clock rate, Measurement, MM loc" & addresses | PPT | |
| 5 | 11-09-2020 | Memory Operations, Instructions and Instruction Sequencing, | PPT | 5 | 11-9-20 | Memory loc" addresses and Operation | PPT | |
| 6 | 14-09-2020 | Addressing Modes | PPT | 6 | 14-9-20 | Instruction and Instruction sequencing | PPT | |
| 7 | 16-09-2020 | Assembly Language, | PPT | 7 | 16-9-20 | Instruction and Instruction sequencing continued | PPT | complex topic took extra class |
| 8 | 18-09-2020 | Basic Input and Output Operations, | PPT | 8 | 18-9-20 | Addressing modes | PPT | |
| 9 | 21-09-2020 | Stacks and Queues | PPT | 9 | 21-9-20 | Assembly language | PPT | |
| 10 | 23-09-2020 | Subroutines, Additional Instructions | PPT | 10 | 23-9-20 | Basic Input output, Stacks | PPT | |
| 11 | 25-09-2020 | Encoding of Machine Instructions | PPT | 11 | 25-9-20 | stacks Queues, subroutines | PPT | |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | | 12 | 28-9-20 | subRoutines continued, Additional instructions | PPT | |
| | | | | 13 | 30-9-20 | Additional instruct" contd Encoding of m/c instruct" | PPT | |
| | | | | | | | | |

| Course with Code: Computer Organization-18CS34 | | | | Faculty: Nasreen Fathima | | | Semester & Section: 3 A | |
|---|---|---|---|---|---|---|---|---|
| Class No. | Date planned (DD/MM) | Topics to be covered | TLP Planned | Class No. | Date of Conduction (DD/MM) | Topics Covered | TLP Executed | Remarks if any deviation |
| | | | | MODULE-2 | | | | |
| 12 | 28-09-2020 | **Input / Output Organization:** Accessing I/O Devices | PPT | 14 | 5-10-20 | Accessing input output devices, interrupts | PPT | |
| 13 | 30-09-2020 | Interrupts – Interrupt Hardware | PPT | 15 | 7-10-20 | Interrupts continued | PPT | |
| 14 | 05-10-2020 | Interrupts – Interrupt Hardware | PPT | 16 | 13-10-20 | Direct memory Access | PPT | compensatory class for 12-10-20 |
| 15 | 07-10-2020 | Direct Memory Access | PPT | 17 | 14-10-20 | Buses | PPT | |
| 16 | 12-10-2020 | Direct Memory Access | PPT | 18 | 16-10-20 | Buses contd, Interface circuits | PPT | |
| 17 | 14-10-2020 | Buses | PPT | 19 | 19-10-20 | Interface circuits, standard interface ckts | PPT | |
| 18 | 16-10-2020 | Interface Circuits | PPT | 20 | 21-10-20 | std interface ckts contd.. | PPT | |
| 19 | 19-10-2020 | Standard I/O Interfaces – PCI Bus | PPT | 21 | 23-10-20 | std interface CKTs contd.. | PPT | |
| 20 | 21-10-2020, | SCSI Bus, USB | PPT | 22 | 28-10-20 | std interface CKTs contd, USB | PPT | |
| | | | | | | | | |
| | | | | | | | | |

| Course with Code: Computer Organization-18CS34 | | | | Faculty: Nasreen Fathima | | | Semester & Section: 3 A | |
|---|---|---|---|---|---|---|---|---|
| Class No. | Date planned (DD/MM) | Topics to be covered | TLP Planned | Class No. | Date of Conduction (DD/MM) | Topics Covered | TLP Executed | Remarks if any deviation |
| MODULE-3 | | | | | | | | |
| 21 | 23-10-2020 | **Memory System:** Basic Concepts, | PPT | 23 | 2-11-20 | Basic concepts, Semiconductor RAM | PPT | |
| 22 | 28-10-2020 | Semiconductor RAM Memories | PPT | 24 | 4-11-20 | semiconductor RAM contd | PPT | |
| 23 | 02-11-2020 | Read Only Memories | PPT | 25 | 6-11-20 | ROM, Speed, Size, cost cache memories | PPT | |
| 24 | 04-11-2020 | Speed, Size, and Cost, Cache Memories – Mapping Functions | PPT | 26 | 9-11-20 | Cache memories | PPT | |
| 25 | 06-11-2020 | Replacement Algorithms, Performance Considerations | PPT | 27 | 11-11-20 | performance considerations | PPT | |
| 26 | 09-11-2020 | Performance Considerations | PPT | 28 | 18-11-20 | performance considerations contd | PPT | |
| | | | | | | | | |
| | | | | | | | | |

| Course with Code: Computer Organization-18CS34 | | | | Faculty: Nasreen Fathima | | | Semester & Section: 3 A | |
|---|---|---|---|---|---|---|---|---|
| Class No. | Date planned (DD/MM) | Topics to be covered | TLP Planned | Class No. | Date of Conduction (DD/MM) | Topics Covered | TLP Executed | Remarks if any deviation |
| MODULE-4 | | | | | | | | |
| 27 | 02-12-2020 | **Arithmetic:** Numbers Arithmetic Operations, and Characters Addition and Subtraction of | PPT | 37 | 9-12-20 | Arithmetic operations, Numbers, Operations, Addition Subtraction | PPT | |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | Signed Numbers | | | | | | |
| 28 | 04-12-2020 | Design of Fast Adders | PPT | 38 | 11-12-20 | Design of fast adders | PPT | |
| 29 | 09-12-2020 | Design of Fast Adders | PPT | 39 | 14-12-20 | Fast adders contd.., Multiplication of positive nos | PPT | |
| 30 | 11-12-2020 | Multiplication of Positive Numbers | PPT | 40 | 16-12-20 | Multiplication of Signed numbers | PPT | |
| 31 | 14-12-2020 | Signed Operand Multiplication | PPT | 41 | 18-12-20 | contd.., Fast Multiplication | PPT | |
| 32 | 16-12-2020 | Fast Multiplication | PPT | 42 | 21-12-20 | Fast multiplicatn contd | PPT | |
| 33 | 18-12-2020 | Integer Division | PPT | 43 | 23-12-20 | Integer division | PPT | |
| | | | | | | | | |

| Course with Code: Computer Organization-18CS34 | | | | Faculty: Nasreen Fathima | | | Semester & Section: 3 A | |
|---|---|---|---|---|---|---|---|---|
| **Class No.** | **Date planned (DD/MM)** | **Topics to be covered** | **TLP Planned** | **Class No.** | **Date of Conduction (DD/MM)** | **Topics Covered** | **TLP Executed** | **Remarks if any deviation** |
| **MODULE-5** | | | | | | | | |
| 34 | 11-11-2020 | **Basic Processing Unit:** Some Fundamental Concepts, | PPT | 29 | 20-11-20 | Fundamental concepts | PPT | |
| 35 | 18-11-2020 | Execution of a Complete Instruction | PPT | 30 | 23-11-20 | Execution of complete instruction | PPT | |
| 36 | 20-11-2020 | Multiple Bus Organization | PPT | 31 | 25-11-20 | Multiple bus organization, Hardwired control | PPT | |
| 37 | 23-12-2020 | Hard-wired Control | PPT | 32 | 27-11-20 | Hardwired continued, Microprogrammed control | PPT | |
| 38 | 25-11-2020 | Micro programmed Control | PPT | 33 | 30-11-20 | Microprogrammed control | PPT | |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 39 | 27-11-2020 | Micro programmed Control | PPT | 34 | 2-12-20 | Microprogrammed control contd. | PPT | |
| 40 | 31-11-2020 | **Pipelining**: Basic Concepts of Pipelining | PPT | 35 | 4-12-20 | Pipelining | PPT | |
| | | | | 36 | 7-12-20 | Pipelining contd | PPT | |
| | | | | | | | | |

| | Activity | Planned | Actual | Remarks |
|---|---|---|---|---|
| **1** | Theory Classes | 40 | 43 | Extra classes taken to revise some content |
| **2** | Assignments/ Quizzes/ Self-study | 3 | 3 | |
| **3** | Tutorials/ Extra classes | | 03 | |
| **4** | Internal Assessments | 4 | 4 | |
| **5** | ICT based Teaching (% of usage in Curriculum) | 100% | 100% | |

| **Planning** | **Execution** |
|---|---|
| **Faculty Signature:** | **Faculty Signature:** |
| **HoD Signature:** | **HoD Signature:** |

Dept. of Computer Science & Engg
ATME College of Engineering
Mysuru-570028

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# Department of Computer Science & Engineering

**Minutes of the meeting with Faculty members held on 08-12-2020, in the department Chaired by HOD.**

**Members Present**

| | | | |
|---|---|---|---|
| 1. | Dr.Putte Gowda D | - | Professor & Head |
| 2. | Dr.Gorabal J V | - | Professor |
| 3. | Mr.Anil Kumar C J | - | Associate Professor |
| 4. | Mrs.Impana Apaji | - | Assistant Professor |
| 5. | Mr.Raghuram A S | - | Assistant Professor |
| 6. | Mr.Kiran B | - | Assistant Professor |
| 7. | Ms.Keerthana M M | - | Assistant Professor (On Leave) |
| 8. | Mrs.Nasreen Fathima | - | Assistant Professor |
| 9. | Mrs.Sunitha Patel M S | - | Assistant Professor |
| 10. | Mr.Anil kumar B H | - | Assistant Professor |
| 11. | Mrs.Sneha N P | - | Assistant Professor |
| 12. | Mr.Mohanesh B M | - | Assistant Professor |
| 13. | Mrs.Sushma V | - | Assistant Professor |
| 14. | Mrs.Kavyashree E D | - | Assistant Professor |
| 15. | Mrs.Jyothi M Patil | - | Assistant Professor |
| 16. | Mrs.Vibha U | - | Assistant Professor |
| 17. | Ms.Lavanya N | - | Assistant Professor |
| 18. | Mrs.Rashmi K | - | Assistant Professor |
| 19. | Mrs.Akshatha A | - | Assistant Professor |

**Agenda**

Academics and Placement

**Proceedings**

**Previous meeting points are discussed and following action plan report.**

| Sl. | Discussion | Action Taken |
|---|---|---|
| 1 | HoD enquired about Usage of Microsoft Team form to conduct the Quiz. Mrs Jyothi M P informed that she has used the form for the conduction of Quiz. HoD informed all the faculties use this feature in classes so that faculty can monitor that student is attentive in the online classes. | Mr Anil Kumar B H and Mrs. Sunitha Patel M S exploring the polly quiz and my quiz-Tools and asked them give the demo in next meeting. |
| 2 | HoD informed about concept of | As per the suggestion from Chairman sir, |

| | | |
|---|---|---|
| | Microlearning. A committee has been framed comprising of Rashmi K, Anil Kumar B H, Jyothi M Patil and Dr. Gorabal to identify and prepare the content for 6 to 8 courses in consultation with industry experts. | course content of Microlearning is revised. The revised new courses and its syllabus has been mailed to the Chairman sir and principal. |
| 3 | HoD informed to add two new column in WFC. Any deviation from lesson plan and reason for deviation has be to mentioned in WFC report and report has to be sent every Saturday by 6 PM. | Faculties are following the modifications in WFC as specified in the meeting. |
| 4 | ERP Admin, Mr. Kiran informed that Mentoring Module is working properly. In connection to this, HoD informed all the faculties updates the mentoring data in ERP by 30-11-2020 | CERP Admin Mr Kiran B, informed that first part of the mentoring data is not retrieving in the CERP report tab and will be addressed at the earlist. |
| 5 | Placement Coordinator, Mrs. Jyothi M Patil informed that 09 ( Nine) students for TCS company and 11(eleven) students for JARO company are shortlisted for 2nd round. HoD informed all the placement mentors to motivate and guide the students so that these students can clear the all the placement rounds. | **TCS:** Students underwent second round of virtual face to face interview on 02-12-2020 and results will be announced by two to three weeks.<br><br>**JARO:** Two students are shortlisted final round. One student is selected this company in the 3rd round and another student 3rd round interview is scheduled on 10th Dec 2020. |
| 6 | Regarding the College fee due by the students, HoD informed all the mentors must speak with students as well with their parents about the College Fee due and inform them about VTU registration process will not be completed if any fee due is present. | Mentors are following up students and parents regarding college fee. |

1. HoD informed that IA marks has to updated in CERP within a week after the test. Mrs. Keerthana M M, Mrs. Jyothi M Patil, Vibha U and Mohanesh B M has not updated marks in CERP. Before mentoring marks must be updated in CERP. Without IA marks it is difficult to Mentor students.
2. R files verification has to be done by NBA coordinator. Few faculties are not following the given timeline for the verification. Mrs Nasreen Fathima informed that if R files are assigned to new faculties, its their responsibility to take care of present and previous data. Also informed all faculties to verify both hardcopy and softcopy of their R files with NBA coordinators.

3. HoD has informed that faculties have to give reason for deviation in WFC report. All faculties are instructed to verify videos and video links in WFC before sending and also informed that, few faculties are not giving permission to view the video.
4. HoD discussed on Microlearning courses content. The content should be other than technical training content & VTU courses told by Dr J V Gorabal. Course like DevOps, Hadoop, Cybersecurity, testing tools, Blockchain can be done based on students interest. This should strengthen student before leaving the institution. Adds on must be implemented through microlearning. This help in placements and also to explore job opportunities. The faculties are expressed that these type Add on courses should be focused for 2nd and 3rd Year students rather than final year students, as they will be engaged with internship, placement, seminar etc.
5. Attendance status for final year placement training initially it was 85%, now it is scaled down to 65%. Placement Co-ordinators asked to monitor the attendance.
6. HoD informed Placement coordinator should Communicate with CERP coordinator and inform the CERP Co-ordinator to block time table in CERP as event if any placement event takes place.
7. EMS co-ordinators are informed that Five students from 3rd sem and Three students from 5th sem have not paid any college fee(Zero payment). HoD asked the mentors to talk to students as well as parents about college fee due. EMS co-ordinator, Sushma V has informed that 71 students Fee data is mismatching and asked the respective mentors to give receipt/transaction details of their students to cross verify the fee data.
8. HoD informed, faculties to update student's attendance shortage list less than 75% by 09 Dec 2020 in the Staff Meeting report. Faculties are also instructed to use MS Teams to send email with resources instead of CERP. The mail has to be sent one day prior to class.
9. HoD informed that few faculties are not engaging class in time and also as per time table and instructed all the faculties follow the timetable.
10. Status of Lab programs are discussed

| Sl. No. | Faculty Name | Sem | Laboratory | Total No. of Programs | Programs Completed |
|---|---|---|---|---|---|
| 1. | Sushma V | 3B | Data Structure Laboratory | 12 | 8 |
| 2. | Impana Appaji | 3A | Data Structure Laboratory | 12 | 7 |
| 3. | Nasreen Fathima | 5B | Network Laboratory | 12 | 8 |
| 4. | Sneha N P | 5A | Network Laboratory | 12 | 7 |
| 5. | Kiran B | 5B | Data Base Management Laboratory | 5 | 4 |
| 6. | Jyothi N | 5A | Data Base Management Laboratory | 5 | 4 |
| 7. | Raghuram A S | 7A | Web Laboratory with Mini Project | 10 | 10 |
| 8. | Kavyashree E D | 7B | Web Laboratory with Mini Project | 10 | 10 |
| 9 | Sunitha Patel M S | | Machine Learning Lab | 10 | 7 |
| 10 | Mohanesh B M | | Machine Learning Lab | 10 | 9 |

## Department of Computer Science & Engineering

11. HoD informed that plan for the Revision if the syllabus is covered by faculties and discuss the model question papers and previous question papers.
12. Decennial Celebration list has been mailed to all and plan events accordingly and execute it on mentioned date. Additional events can also be planned in addition to Decennial celebration events.
13. All the faculties are informed that stick on to points when approaching/tele calling students / parents.
14. MS Teams Demo is presented by Mr Anil Kumar B H how to of transfer previous video in one channel. All the Assignment and IA scripts must be loaded to CS Server. All the faculties are informed that collect the hardcopy of all the 3 IA script when the students turned into college.
15. HoD informed that all the faculties are instructed to give the presentation on Criteria -3: Attainment process from 11-12-2020 to 16-12-2020.

**Copy to Principal**

**HOD**

MSSP -

SNP -

NF -

KB -

JVH -

ABH -

ACJ -

SV -

RAS -

JMP -

## COURSE MODULES FOR THE SESSION 2020-2021 (ODD SEM)

**Academic Year**: 2020 – 2021

**Department**: Computer Science and Engineering

| Course Code | Course Title | Core/Elective | Prerequisite | Contact Hours | | | Total Hrs/ Sessions |
|---|---|---|---|---|---|---|---|
| | | | | L | T | P | |
| 18CS34 | COMPUTER ORGANIZATION | Core | 1. Fundamentals of Computer 2.Digital Logic Circuits | 3 | 0 | 0 | 40 |

**Objectives**

- Explain the basic sub systems of a computer, their organization, structure and operation.
- Illustrate the concept of programs as sequences of machine instructions.
- Demonstrate different ways of communicating with I/O devices and standard I/O interfaces.
- Describe memory hierarchy and concept of virtual memory.
- Describe arithmetic and logical operations with integer and floating-point operands.
- Illustrate organization of a simple processor, pipelined processor and other computing systems.

**Topics Covered as per Syllabus**

**Module -1:** Basic Structure of Computers: Basic Operational Concepts, Bus Structures, Performance– Processor Clock, Basic Performance Equation, Clock Rate, Performance Measurement. **Machine Instructions and Programs**: Memory Location and Addresses, Memory Operations, Instructions and Instruction Sequencing, Addressing Modes, Assembly Language, Basic Input and Output Operations, Stacks and Queues, Subroutines, Additional Instructions, Encoding of Machine Instructions

**Module -2: Input/output Organization:** Accessing I/O Devices, Interrupts – Interrupt Hardware, Direct Memory Access, Buses, Interface Circuits, Standard I/O Interfaces – PCI Bus, SCSI Bus, USB.

**Module – 3**: **Memory System**: Basic Concepts, Semiconductor RAM Memories, Read Only Memories, Speed, Size, and Cost, Cache Memories – Mapping Functions, Replacement Algorithms, Performance Considerations

**Module-4:Arithmetic:**Numbers, Arithmetic Operations and Characters, Addition and Subtraction of Signed Numbers, Design of Fast Adders, Multiplication of Positive Numbers, Signed Operand Multiplication, Fast Multiplication, Integer Division

**Module-5: Basic Processing Unit**: Some Fundamental Concepts, Execution of a Complete Instruction, Multiple Bus Organization, Hard-wired Control, Micro programmed Control.
Pipelining: Basic concepts of pipelining

**List of Text Books**

1. Carl Hamacher, Zvonko Vranesic, Safwat Zaky: Computer Organization, 5th Edition, Tata

McGraw Hill, 2002. (Listed topics only from Chapters 1, 2, 4, 5, 6, 7)

**List of Reference Books**

1. William Stallings: Computer Organization & Architecture, 7th Edition, PHI, 2006.

**List of URLs, Text Books, Notes, Multimedia Content, etc**

1. https://www.tutorialspoint.com/computer_organization/index.asp
2. http://coe.uok.edu.in/Portals/0/basics%20of%20co.pdf
3. http://www.cse.iitm.ac.in/~vplab/courses/comp_org.html

| | |
|---|---|
| **Course Outcomes** | 1. Explain the basic organization of a computer system.<br>2. Demonstrate functioning of different sub systems, such as processor, Input/output, and memory.<br>3. Illustrate hardwired control and micro programmed control, pipelining, embedded and other computing systems.<br>4. Design and analyse simple arithmetic and logical units. |

**Internal Assessment Marks: 40 (3 Session Tests are conducted during the semester and marks allotted based on average of best performances).**

**The Correlation of Course Outcomes (CO's) and Program Outcomes (PO's)**

| **Subject Code:** | 18CS34 | | | **TITLE:** COMPUTER ORGANIZATION | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **List of Course Outcomes** | **Program Outcomes** | | | | | | | | | | | |
| | PO-1 | PO-2 | PO-3 | PO-4 | PO-5 | PO-6 | PO-7 | PO-8 | PO-9 | PO-10 | PO-11 | PO-12 |
| CO-1 | 2 | - | - | - | - | - | - | - | - | - | - | - |
| CO-2 | 2 | 3 | 1 | - | - | - | - | - | - | - | - | - |
| CO-3 | 1 | 1 | 1 | 1 | - | - | - | - | - | - | - | 2 |
| CO-4 | 1 | - | 2 | - | - | - | - | - | - | - | - | - |

**Note:** 3 = Strong Contribution 2 = Average Contribution 1 = Weak Contribution 0 = No Contribution

**The Correlation of Program Specific Outcome's (PSO's) and Program Outcomes (PO's)**

| **Subject Code:** | 18CS34 | **TITLE:** COMPUTER ORGANIZATION |
|---|---|---|
| **List of Course Outcomes** | **Program Specific Outcomes** | |
| | **PSO1** | **PSO2** |
| CO-1 | - | - |
| CO-2 | - | - |
| CO-3 | - | - |
| CO-4 | - | - |

**Note:** 3 = Strong Contribution 2 = Average Contribution 1 = Weak Contribution 0 = No Contribution

# Department of Computer Science and Engineering

| STAFF NAME:Nasreen Fathima | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| DAY | 9.00 - 10.00 | 10.00 - 11.00 | 11:00-11:15 | 11.15-12.15 | 12:15-1:15 | 1:15 - 2:00 | 2:00-2:55 | 2:55-3:50 | 3:50-4:45 |
| MON | | | TEA BREAK | CO (3A) | | LUNCH BREAK | | | |
| TUE | | | | CNS (5B) | | | | | |
| WED | | CO (3A) | | | | | | | |
| THU | | | | CNS (5B) | | | | | |
| FRI | | CO (3A) | | | CN LAB (5B) | | | | |
| SAT | | | | | CNS (5B) | | | | |

| Curricular | | Units | Co-curricular | Units |
|---|---|---|---|---|
| Lecture | 6h*2units | 12 | NBA Dept Coordinator(2) | 2 |
| Lab | 1h*1unit | 1 | Lab Exam Time Table Coordinator (1) | 1 |
| Project | 2G*2 units | 4 | Student Counsellor(1) | 1 |
| Total | | 17 | | 4 |

Coordinator

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ATME College of Engineering
Mysuru-570028

| STAFF NAME: M S Sunitha Patel | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| DAY | 9.00 - 10.00 | 10.00 - 11.00 | 11:00-11:15 | 11.15-12.15 | 12:15-1:15 | 1:15 - 2:00 | 2:00-2:55 | 2:55-3:50 | 3:50-4:45 |
| MON | | | TEA BREAK | | | LUNCH BREAK | ML (7B) | | |
| TUE | | | | | CCA (7A) | | | | |
| WED | | ML (7B) | | | CCA (7A) | | | PROJECT | |
| THU | | ML (7B) | | | | | CCA (7A) | | |
| FRI | | | | | ML (7B) | | | | |
| SAT | | ML LAB (7B) | | | | | | | |

| Curricular | | Units | Co-curricular | Units |
|---|---|---|---|---|
| Lecture | 7h*2units | 14 | NBA Dept Coordinator(2), | 2 |
| Lab | 2h*1unit | 2 | Project Coordinator(2) | 2 |
| Project | 2G*2 units | 4 | IQAC coordinator, Calendar of events (1), Student Counsellor(1) | 2 |
| Total | | 20 | | 6 |

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# COMPUTER ORGANIZATION (18CS34)

## MODULE 1: BASIC STRUCTURE OF COMPUTERS

### 1.1 Introduction

**BASIC CONCEPTS**

• **Computer Architecture (CA)** is concerned with the structure and behaviour of the computer.

• CA includes the information formats, the instruction set and techniques for addressing memory.

• In general covers, CA covers 3 aspects of computer-design namely: 1) Computer Hardware, 2) Instruction set Architecture and 3) Computer Organization.

**1. Computer Hardware**

➢ It consists of electronic circuits, displays, magnetic and optical storage media and communication facilities.

**2. Instruction Set Architecture**

➢ It is programmer visible machine interface such as instruction set, registers, memory organization and exception handling.

➢ Two main approaches are 1) CISC and 2)RISC.

(CISC□□Complex Instruction Set Computer, RISC□□Reduced Instruction Set Computer)

**3. Computer Organization**

➢ It includes the high level aspects of a design, such as

→ memory-system

→ bus-structure &

→ design of the internal CPU.

➢ It refers to the operational units and their interconnections that realize the architectural specifications.

➢ It describes the function of and design of the various units of digital computer that store and process information.

### 1.3 Basic Operational Concepts

**FUNCTIONAL UNITS**

• A computer consists of 5 functionally independent main parts:

1) Input
2) Memory
3) ALU
4) Output&
5) Control units.

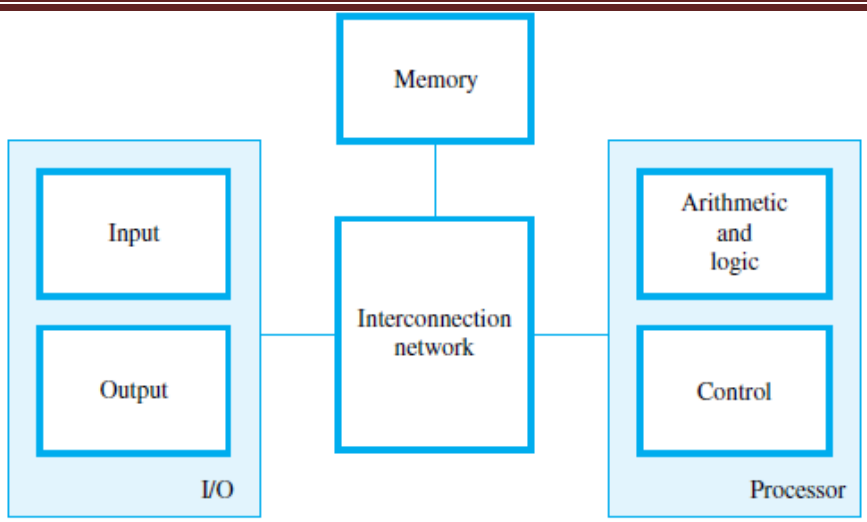



**Figure 1.1** Basic functional units of a computer.

## 1.4 BASIC OPERATIONAL CONCEPTS

- An Instruction consists of 2 parts, 1) Operation code (Opcode) and 2)Operands.

| OPCODE | OPERANDS |
|---|---|

- The data/operands are stored in memory.
- The individual instruction are brought from the memory to the processor.
- Then, the processor performs the specified operation.
- Let us see a typical instruction

  **ADD LOCA, R0**

- This instruction is an addition operation. The following are the steps to execute the instruction:

  Step 1: Fetch the instruction from main-memory into the processor.

  Step 2: Fetch the operand at location LOCA from main-memory into the processor.

  Step 3: Add the memory operand (i.e. fetched contents of LOCA) to the contents of register R0.

  Step 4: Store the result (sum) in R0.

- The same instruction can be realized using 2 instructions as:

  **Load**
  **LOCA, R1**
  **Add R1, R0**

- The following are the steps to execute the instruction:

  Step 1: Fetch the instruction from main-memory into the processor.

  Step 2: Fetch the operand at location LOCA from main-memory into the register R1.

  Step 3: Add the content of Register R1 and the contents of register R0.

  Step 4: Store the result (sum) in R0.

**MAIN PARTS OF PROCESSOR**

- The **processor** contains ALU, control-circuitry and many registers.
- The processor contains 'n' general-purpose registers **R0** through **Rn-1**.
- The **IR** holds the instruction that is currently being executed.
- The **control-unit** generates the timing-signals that determine when a given action is to take place.
- The **PC** contains the memory-address of the next-instruction to be fetched &executed.
- During the execution of an instruction, the contents of PC are updated to point to next instruction.
- The **MAR** holds the address of the memory-location to be accessed.
- The **MDR** contains the data to be written into or read out of the addressed location.
- MAR and MDR facilitates the communication with memory. (IR □Instruction-Register, PC □Program Counter)
  (MAR □Memory Address Register, MDR□ □Memory Data Register)

**STEPS TO EXECUTE AN INSTRUCTION**

1) The address of first instruction (to be executed) gets loaded into PC.

2) The contents of PC (i.e. address) are transferred to the MAR & control-unit issues Read signal to memory.

3) After certain amount of elapsed time, the first instruction is read out of memory and placed into MDR.

4) Next, the contents of MDR are transferred to IR. At this point, the instruction can be decoded & executed.

5) To fetch an operand, it's address is placed into MAR & control-unit issues Read signal. As a result, the operand is transferred from memory into MDR, and then it is transferred from MDR to ALU.

6) Likewise required number of operands is fetched into processor.

7) Finally, ALU performs the desired operation.

8) If the result of this operation is to be stored in the memory, then the result is sent to the MDR.

9) The address of the location where the result is to be stored is sent to the MAR and a Write cycle is initiated.

10) At some point during execution, contents of PC are incremented to point to next instruction in the program.

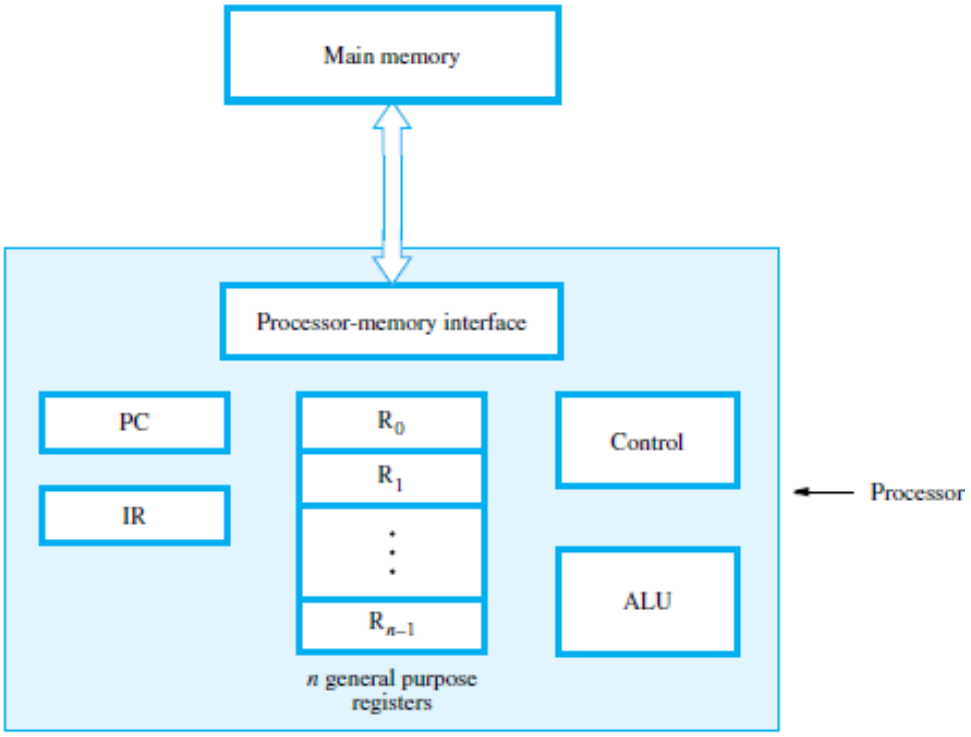



**Figure 1.2** Connection between the processor and the main memory.

### 1.5 BUS STRUCTURE

- A bus is a group of lines that serves as a connecting path for several devices.
- A bus may be lines or wires.
- The lines carry data or address or control signal.
- There are 2 types of Bus structures: 1) Single Bus Structure and 2) Multiple Bus Structure.

**1) Single Bus Structure**

- Because the bus can be used for only one transfer at a time, only 2 units can actively use the bus at any given time.
- Bus control lines are used to arbitrate multiple requests for use of the bus.
- **Advantages:**
  1. Low cost&
  2. Flexibility for attaching peripheral devices.

**2) Multiple Bus Structure**

- Systems that contain multiple buses achieve more concurrency in operations.
- Two or more transfers can be carried out at the same time.
- **Advantage:** Better performance.
- **Disadvantage:** Increased cost.

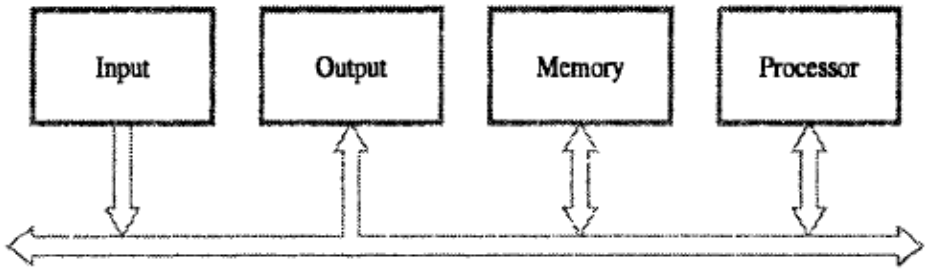



**Figure 1.3** Single-bus structure.

- The devices connected to a bus vary widely in their speed of operation.
- To synchronize their operational-speed, buffer-registers can be used.
- **Buffer Registers**
  - → are included with the devices to hold the information during transfers.
  - → prevent a high-speed processor from being locked to a slow I/O device during data transfers.

**PERFORMANCE**

- The most important measure of performance of a computer is how quickly it can execute programs.
- The speed of a computer is affected by the design of
  1) Instruction-set.
  2) Hardware & the technology in which the hardware is implemented.
  3) Software including the operating system.
- Because programs are usually written in a HLL, performance is also affected by the compiler that translates programs into machine language. (HLL□□High Level Language).
- For best performance, it is necessary to design the compiler, machine instruction set and hardware in a co-ordinated way.

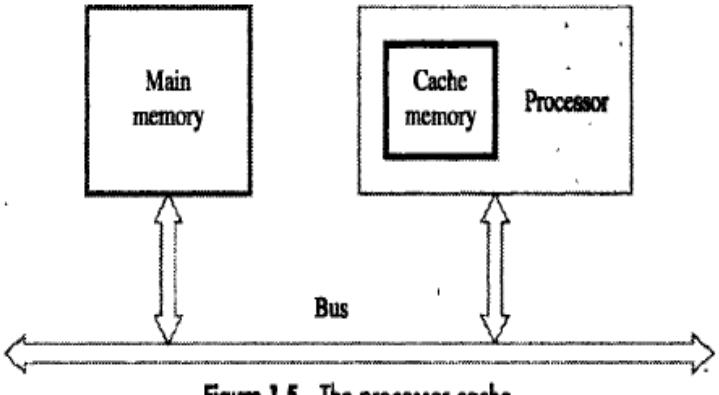



**Figure 1.5** The processor cache.

- Let us examine the flow of program instructions and data between the memory & the processor.
- At the start of execution, all program instructions are stored in the main-memory.
- As execution proceeds, instructions are fetched into the processor, and a copy is placed in the cache.
- Later, if the same instruction is needed a second time, it is read directly from the cache.
- A program will be executed faster

  if movement of instruction/data between the main-memory and the processor is minimized

  which is achieved by using the cache.

**PROCESSOR CLOCK**

- Processor circuits are controlled by a timing signal called a **Clock**.
- The clock defines regular time intervals called **Clock Cycles**.
- To execute a machine instruction, the processor divides the action to be performed into a sequence of basic steps such that each step can be completed in one clock cycle.
- Let P = Length of one clock cycle R = Clock rate.
- Relation between P and R is given by

$$R = \frac{1}{P}$$

- R is measured in cycles per second.
- Cycles per second is also called Hertz(Hz)

**BASIC PERFORMANCE EQUATION**

- Let T = Processor time required to executed a program.
- N = Actual number of instruction executions.

  S = Average number of basic steps needed to execute one machine instruction.

  R = Clock rate in cycles per second.
- The program execution time is given by

$$T = \frac{N \times S}{R} \quad \text{------(1)}$$

- Equ1 is referred to as the basic performance equation.
- To achieve high performance, the computer designer must reduce the value of T, which means reducing N and S, and increasing R.
  - The value of N is reduced if source program is compiled into fewer machine instructions.
  - The value of S is reduced if instructions have a smaller number of basic steps to perform.
  - The value of R can be increased by using a higher frequency clock.
- Care has to be taken while modifying values since changes in one parameter may affect the other.

**1.6 CLOCK RATE**

- There are 2 possibilities for increasing the clock rate R:

  1) Improving the IC technology makes logic-circuits faster.

  This reduces the time needed to compute a basic step. (IC □integrated circuits).

This allows the clock period P to be reduced and the clock rate R to be increased.

2) Reducing the amount of processing done in one basic step also reduces the clock period P.

• In presence of a cache, the percentage of accesses to the main-memory is small.

Hence, much of performance-gain expected from the use of faster technology can be realized.

The value of T will be reduced by same factor as R is increased '.' S & N are not affected.

**PIPELINING & SUPERSCALAR OPERATION**

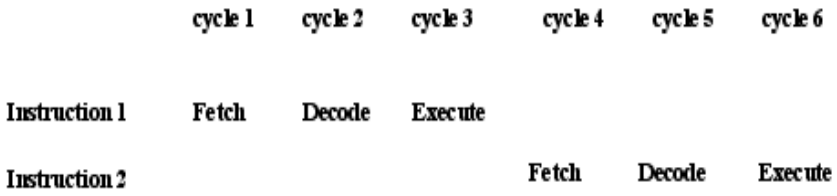
• Normally, the computer executes the instruction in sequence one by one.

• An improvement in performance can be achieved by overlapping the execution of successive instructions using a technique called **Pipelining**.

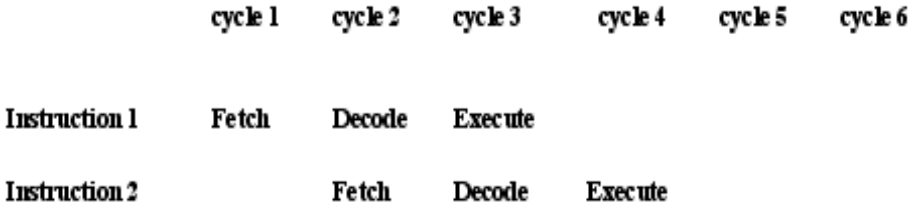
• Consider the instruction

**Add R1,R2,R3 ; instruction1**
**Move R4,R5 ; instruction1**

Let us assume that both operations take 3 clock cycles each for completion.




• As shown in above figure, 6 clock cycles are required to complete two operations.




• As shown in above figure, if we use pipelining & pre-fetching, only 4 cycles are required to complete same two operations.

• While executing the Add instruction, the processor can read the Move instruction from memory.

• In the ideal case, if all instructions are overlapped to the maximum degree possible, execution proceeds at the rate of one instruction completed in each clock cycle.

• A higher degree of concurrency can be achieved if multiple instruction pipelines are implemented in the processor i.e. multiple functional units can be used to execute different instructions parallely. This mode of operation is known as **Superscalar Execution**.

• With Superscalar arrangement, it is possible to complete the execution of more than one instruction in every clock cycle.

**1.7 PERFORMANCE MEASUREMENT**

• Benchmark refers to standard task used to measure how well a processor operates.

• The Performance Measure is the time taken by a computer to execute a given benchmark.

• SPEC selects & publishes the standard programs along with their test results for different application domains. (SPEC □System Performance Evaluation Corporation).

- SPEC Rating is given by

$$\text{SPEC rating} = \frac{\text{Running time on the reference computer}}{\text{Running time on the computer under test}}$$

- SPEC rating = 50 The computer under test is 50 times as fast as reference-computer.
- The test is repeated for all the programs in the SPEC suite.

  Then, the geometric mean of the results is computed.
- Let $SPEC_i$ = Rating for program 'i' in the suite.

  Overall SPEC rating for the computer is given by

$$\text{SPEC rating} = \left(\prod_{i=1}^{n} SPEC_i\right)^{\frac{1}{n}}$$

where n = no. of programs in the suite.

**INSTRUCTION SET: CISC AND RISC**

| No | RISC | CISC |
|---|---|---|
| 1 | Simple instructions taking one cycle | Complex instructions taking multiple cycles |
| 2 | Instructions are executed by hardwired control unit | Instructions are executed by microprogramed control unit |
| 3 | Few instructions | Many instructions |
| 4 | Fixed format instructions | Variable format instructions |
| 5 | Few addressing mode, and most instructions have register to register addressing mode | Many addressing modes |
| 6 | Multiple register set | Single register set |
| 7 | Highly pipelined | Not pipelined or less pipelined |

**Problem 1:**

List the steps needed to execute the machine instruction:

*Load R2, LOC*

in terms of transfers between the components of processor and some simple control commands. Assume that the address of the memory-location containing this instruction is initially in register PC. **Solution:**

1. Transfer the contents of register PC to register MAR.
2. Issue a Read command to memory.

   And, then wait until it has transferred the requested word into register MDR.
3. Transfer the instruction from MDR into IR and decode it.

4. Transfer the address LOCA from IR to MAR.
5. Issue a Read command and wait until MDR is loaded.
6. Transfer contents of MDR to the ALU.
7. Transfer contents of R0 to the ALU.
8. Perform addition of the two operands in the ALU and transfer result intoR0.
9. Transfer contents of PC to ALU.
10. Add 1 to operand in ALU and transfer incremented address to PC.

**Problem 2:**

List the steps needed to execute the machine instruction:

*Add R4, R2, R3*

in terms of transfers between the components of processor and some simple control commands. Assume that the address of the memory-location containing this instruction is initially in register PC. **Solution:**

1. Transfer the contents of register PC to register MAR.
2. Issue a Read command to memory.
   And, then wait until it has transferred the requested word into register MDR.
3. Transfer the instruction from MDR into IR and decode it.
4. Transfer contents of R1 and R2 to the ALU.
5. Perform addition of two operands in the ALU and transfer answer into R3.
6. Transfer contents of PC to ALU.
7. Add 1 to operand in ALU and transfer incremented address to PC.

**Problem 3:**

(a) Give a short sequence of machine instructions for the task "Add the contents of memory-location A to those of location B, and place the answer in location C". Instructions:

Load R*i*,
LOC
and
Store R*i*, LOC

are the only instructions available to transfer data between memory and the general purpose registers. Add instructions are described in Section 1.3. Do not change contents of either location A or B.

(b) Suppose that Move and Add instructions are available with the formats:

Move Location1,
Location2 and
Add Location1, Location2

These instructions move or add a copy of the operand at the second location to the first location, overwriting the original operand at the first location. Either or both of the operands can be in the memory or the general-purpose registers. Is it possible to use fewer instructions of these types to accomplish the task in part (a)? If yes, give the sequence.

**Solution:**

(a)

Load A,
R0
Load B,

R1 Add
R0, R1
Store R1, C

(b) Yes;

Move
B, C
Add A,
C

**Problem 4:**

(a) Program execution time T is to be examined for a certain high-level language program. The program can be run on a RISC or a CISC computer. Both computers use pipelined instruction execution, but pipelining in the RISC machine is more effective than in the CISC machine. Specifically, the effective value of S in the T expression for the RISC machine is 1.2, bit it is only 1.5 for the CISC machine. Both machines have the same clock rate R. What is the largest allowable value for N, the number of instructions executed on the CISC machine, expressed as a percentage of the N value for the RISC machine, if time for execution on the CISC machine is to be longer than on the RISC machine?

(b) Repeat Part (a) if the clock rate R for the RISC machine is 15 percent higher than that for the CISC machine.

**Solution:**

(a) Let $T_R = (N_R \times S_R)/R_R$ & $T_C = (N_C \times S_C)/R_C$ be execution times on RISC and CISC processors. Equating execution times and clock rates, we have

$$1.2N_R = 1.5N_C$$

Then

$$N_C/N_R = 1.2/1.5 = 0.8$$

Therefore, the largest allowable value for $N_C$ is 80% of $N_R$.

(b) In this case,

$$1.2N_R/1.15 = 1.5N_C/1.00$$

Then

$$N_C/N_R = 1.2/(1.15 \times 1.5) = 0.696$$

Therefore, the largest allowable value for $N_C$ is 69.6% of $N_R$.

**Problem 5:**

(a) Suppose that execution time for a program is proportional to instruction fetch time. Assume that fetching an instruction from the cache takes 1 time unit, but fetching it from the main-memory takes 10 time units. Also, assume that a requested instruction is found in the cache with probability 0.96. Finally, assume that if an instruction is not found in the cache it must first be fetched from the main- memory into the cache and then fetched from the cache to be executed. Compute the ratio of program execution time without the cache to program execution time with the cache. This ratio is called the speedup resulting from the presence of the cache.

(b) If the size of the cache is doubled, assume that the probability of not finding a requested instruction there is cut in half. Repeat part (a) for a doubled cache size.

**Solution:**

(a) Let cache access time be 1 and main-memory access time be 20. Every instruction that is executed must be fetched from the cache, and an additional fetch from the main-memory must be performed for 4% of these cache accesses.

Therefore,

$$\text{Speedup factor} = \frac{1.0 \times 20}{(1.0 \times 1) + (0.04 \times 20)} = 11.1$$

(b)

$$\text{Speedup factor} = \frac{1.0 \times 20}{(1.0 \times 1) + (0.02 \times 20)} = 16.7$$

**Problem 6:**

A program contains 1000 instructions. Out of that 25% instructions requires 4 clock cycles,40% instructions requires 5 clock cycles and remaining require 3 clock cycles for execution. Find the total time required to execute the program running in a 1 GHz machine.

**Solution:**

N = 1000

25% of N= 250 instructions require 4 clock cycles.

40% of N =400 instructions require 5 clock cycles. 35% of N=350 instructions require 3 clock cycles.

T = (N*S)/R= (250*4+400*5+350*3)/1X$10^9$ =(1000+2000+1050)/1*$10^9$= 4.05 μs.

**Problem 7:**

For the following processor, obtain the performance.

Clock rate = 800 MHz

No. of instructions executed = 1000

Average no of steps needed / machine instruction = 20

**Solution:**

$$T = \frac{N \times S}{R} = (1000*20)/800 * 10^6 = 25 \text{ micro sec or } 25*10^{-6} \text{ sec}$$

## MODULE 1 (CONT.): MACHINE INSTRUCTIONS & PROGRAMS

### 1.8 MEMORY-LOCATIONS & ADDRESSES

- The memory consists of many millions of storage cells(flip-flops).
- Each cell can store a bit of information i.e. 0 or 1 (Figure2.1).
- Each group of n bits is referred to as a **word** of information, and n is called the **word length**.
- The word length can vary from 8 to 64bits.
- A unit of 8 bits is called a byte.
- Accessing the memory to store or retrieve a single item of information (word/byte) requires distinct addresses for each item location. (It is customary to use numbers from 0 through $2^k$-1 as the addresses of successive-locations in the memory).
- If $2^k$ = no. of addressable locations

  then $2^k$ addresses constitute the address-space of the computer.

  For example, a 24-bit address generates an address-space of $2^{24}$ locations (16 MB).

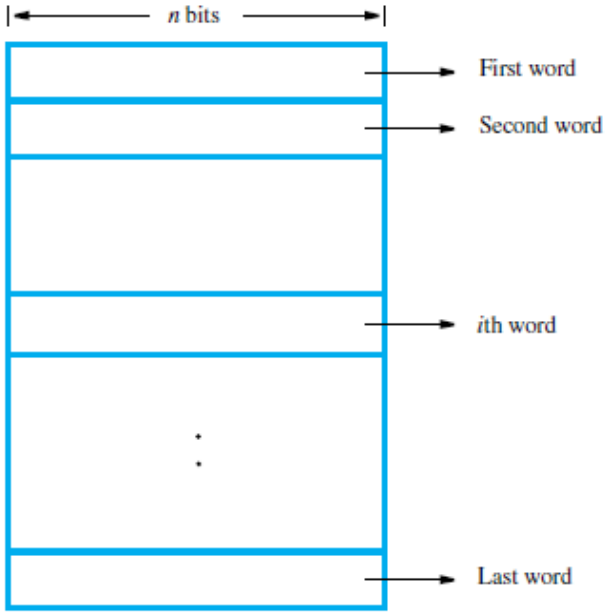



**Figure 2.1** Memory words.

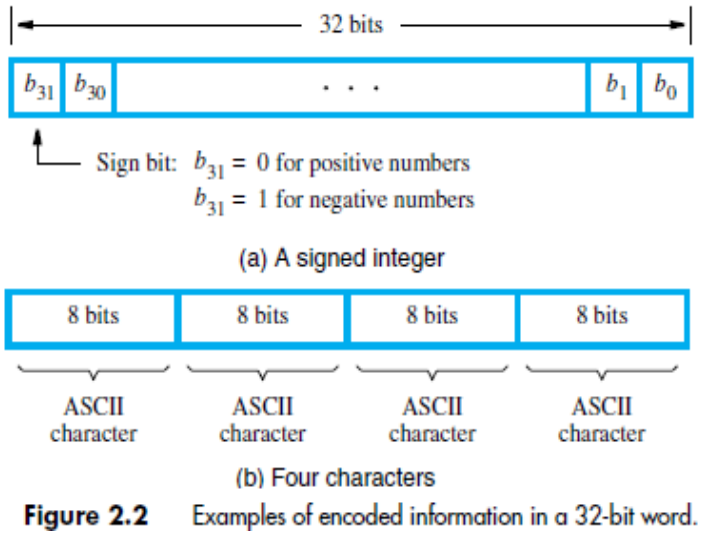



**Figure 2.2** Examples of encoded information in a 32-bit word.

**BYTE-ADDRESSABILITY**

- In byte-addressable memory, successive addresses refer to successive byte locations in the memory.
- Byte locations have addresses 0, 1, 2. . . ..
- If the word-length is 32 bits, successive words are located at addresses 0, 4, 8. . with each word having 4bytes.

**BIG-ENDIAN & LITTLE-ENDIAN ASSIGNMENTS**

- There are two ways in which byte-addresses are arranged (Figure2.3).
  1) **Big-Endian:** Lower byte-addresses are used for the more significant bytes of the word.
  2) **Little-Endian:** Lower byte-addresses are used for the less significant bytes of the word
- In both cases, byte-addresses 0, 4, 8. . . . . are taken as the addresses of successive words in the memory.

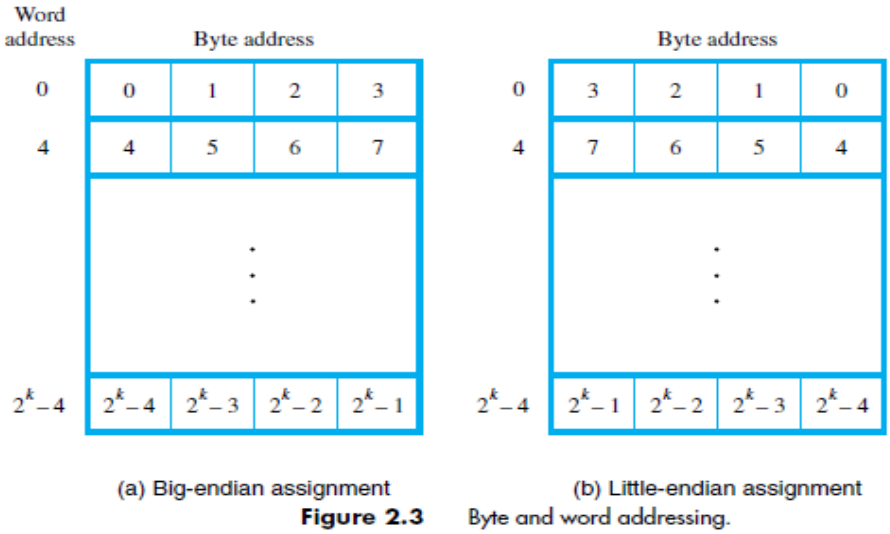



**Figure 2.3** Byte and word addressing.

- Consider a 32-bit integer (in hex): 0**x**12345678 which consists of 4 bytes: 12, 34, 56, and78.
  - Hence this integer will occupy 4 bytes in memory.
  - Assume, we store it at memory address starting1000.

- On little-endian, memory will look like

| Address | Value |
|---|---|
| 1000 | 78 |
| 1001 | 56 |
| 1002 | 34 |
| 1003 | 12 |

- On big-endian, memory will look like

| Address | Value |
|---|---|
| 1000 | 12 |
| 1001 | 34 |
| 1002 | 56 |
| 1003 | 78 |

**WORD ALIGNMENT**

• Words are said to be **Aligned** in memory if they begin at a byte-address that is a multiple of the number of bytes in a word.

• For example,
  - If the word length is 16(2 bytes), aligned words begin at byte-addresses 0, 2, 4 . . . ..
  - If the word length is 64(2 bytes), aligned words begin at byte-addresses 0, 8, 16 . . . ..

• Words are said to have **Unaligned Addresses**, if they begin at an arbitrary byte-address.

**ACCESSING NUMBERS, CHARACTERS & CHARACTERS STRINGS**

• A number usually occupies one word. It can be accessed in the memory by specifying its word address. Similarly, individual characters can be accessed by their byte-address.

• There are two ways to indicate the length of the string:

1) A special control character with the meaning "end of string" can be used as the last character in the string.

2) A separate memory word location or register can contain a number indicating the length of the string in byte.

1.9 MEMORY OPERATIONS

• Two memory operations are:
  1) Load (Read/Fetch)&
  2) Store(Write).

• The **Load** operation transfers a copy of the contents of a specific memory-location to the processor. The memory contents remain unchanged.

• Steps for Load operation:
  1) Processor sends the address of the desired location to the memory.
  2) Processor issues ‘read’ signal to memory to fetch the data.
  3) Memory reads the data stored at that address.
  4) Memory sends the read data to the processor.

- The **Store** operation transfers the information from the register to the specified memory-location. This will destroy the original contents of that memory-location.
- Steps for Store operation are:
  1) Processor sends the address of the memory-location where it wants to store data.
  2) Processor issues 'write' signal to memory to store the data.
  3) Content of register(MDR) is written into the specified memory-location.

**INSTRUCTIONS & INSTRUCTION SEQUENCING**

- A computer must have instructions capable of performing 4 types of operations:
  1) Data transfers between the memory and the registers (MOV, PUSH, POP,XCHG).
  2) Arithmetic and logic operations on data (ADD, SUB, MUL, DIV, AND, OR,NOT).
  3) Program sequencing and control (CALL.RET, LOOP,INT).
  4) I/0 transfers (IN,OUT).

**REGISTER TRANSFER NOTATION (RTN)**

- The possible locations in which transfer of information occurs are: 1) Memory-location 2) Processor register & 3) Registers in I/O device.

| Location | Hardware Binary Address | Example | Description |
|---|---|---|---|
| Memory | LOC, PLACE, NUM | R1 <-[LOC] | Contents of memory-location LOC are transferred into register R1. |
| Processor | R0, R1 ,R2 | [R3] <-[R1]+[R2] | Add the contents of register R1 &R2 and places their sum into R3. |
| I/O Registers | DATAIN, DATAOUT | R1 <-DATAIN | Contents of I/O register DATAIN are transferred into register R1. |

**ASSEMBLY LANGUAGE NOTATION**

- To represent machine instructions and programs, assembly language format is used.

| Assembly Language Format | Description |
|---|---|
| Move LOC, R1 | Transfer data from memory-location LOC to register R1. The contents of LOC are unchanged by the execution of this instruction, but the old contents of register R1 are overwritten. |
| Add R1, R2, R3 | Add the contents of registers R1 and R2, and places their sum into register R3. |

**BASIC INSTRUCTION TYPES**

| Instruction Type | Syntax | Example | Description | Instructions for Operation |
|---|---|---|---|---|
| Three Address | Opcode Source1,Source2,Destination | Add A,B,C | Add the contents of memory-locations A & B. Then, place the result into location C. | |
| Two Address | Opcode Source, Destination | Add A,B | Add the contents of memory-locations A & B. Then, place the result into location B, replacing the original contents of this location. Operand B is both a source and a destination. | Move B, C<br>Add A, C |
| One Address | Opcode Source/Destination | Load A | Copy contents of memory-location A into accumulator. | Load A<br>Add B<br>Store C |
| | | Add B | Add contents of memory-location B to contents of accumulator register & place sum back into accumulator. | |
| | | Store C | Copy the contents of the accumulator into location C. | |
| Zero Address | Opcode [no Source/Destination] | Push | Locations of all operands are defined implicitly. The operands are stored in a pushdown stack. | Not possible |

- Access to data in the registers is much faster than to data stored in memory-locations.
- Let Ri represent a general-purpose register. The instructions:

*Load A,Ri*

Store Ri,A

Add *A,Ri*

are generalizations of the Load, Store and Add Instructions for the single-accumulator case, in which register Ri performs the function of the accumulator.

- In processors, where arithmetic operations as allowed only on operands that are in registers, the task C<-[A]+[B] can be performed by the instruction sequence:

Move A,Ri
Move B,Rj
Add Ri,Rj
Move Rj,C

## 1.10 INSTRUCTION EXECUTION & STRAIGHT LINE SEQUENCING

- The program is executed as follows:

  1) Initially, the address of the first instruction is loaded into PC (Figure2.8).

  **2)** Then, the processor control circuits use the information in the PC to fetch and execute instructions, one at a time, in the order of increasing addresses. This is called **Straight-Line sequencing.**

  3) During the execution of each instruction, PC is incremented by 4 to point to next instruction.

- There are 2 phases for Instruction Execution:

  **1) Fetch Phase:** The instruction is fetched from the memory-location and placed in the IR.

  **2) Execute Phase:** The contents of IR is examined to determine which operation is to be performed. The specified-operation is then performed by the processor.

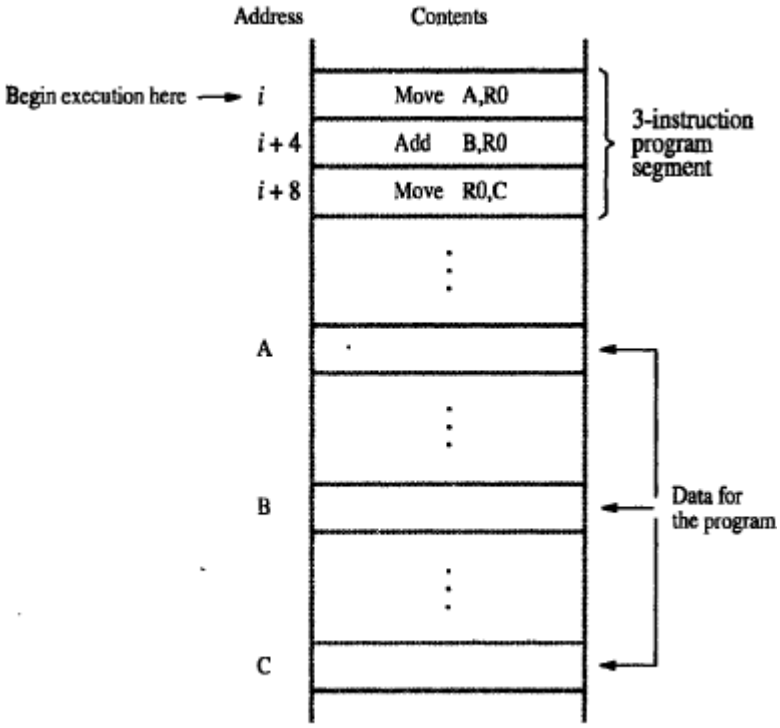



Figure 2.8 A program for C ← [A] + [B].

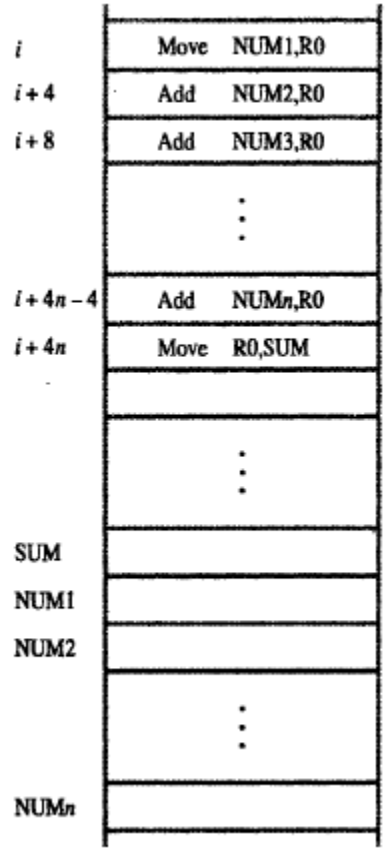



Figure 2.9 A straight-line program for adding *n* numbers.

### Program Explanation

- Consider the program for adding a list of n numbers (Figure2.9).
- The Address of the memory-locations containing the n numbers are symbolically given as NUM1, NUM2…..NUMn.
- Separate Add instruction is used to add each number to the contents of registerR0.
- After all the numbers have been added, the result is placed in memory-location SUM.

### BRANCHING

- Consider the task of adding a list of 'n' numbers (Figure2.10).
- Number of entries in the list 'n' is stored in memory-location **N**.

- Register **R1** is used as a counter to determine the number of times the loop is executed.
- Content-location N is loaded into register R1 at the beginning of the program.

  The **Loop** is a straight line sequence of instructions executed as many times as needed. The loop starts at location LOOP and ends at the instruction Branch>0.
- During each pass,

  → address of the next list entry is determined and

  → that entry is fetched and added to R0.
- The instruction *Decrement R1* reduces the contents of R1 by 1 each time through the loop.
- Then **Branch Instruction** loads a new value into the program counter. As a result, the processor fetches and executes the instruction at this new address called the **Branch Target**.
- A **Conditional Branch Instruction** causes a branch only if a specified condition is satisfied. If the condition is not satisfied, the PC is incremented in the normal way, and the next instruction in sequential address order is fetched and executed.

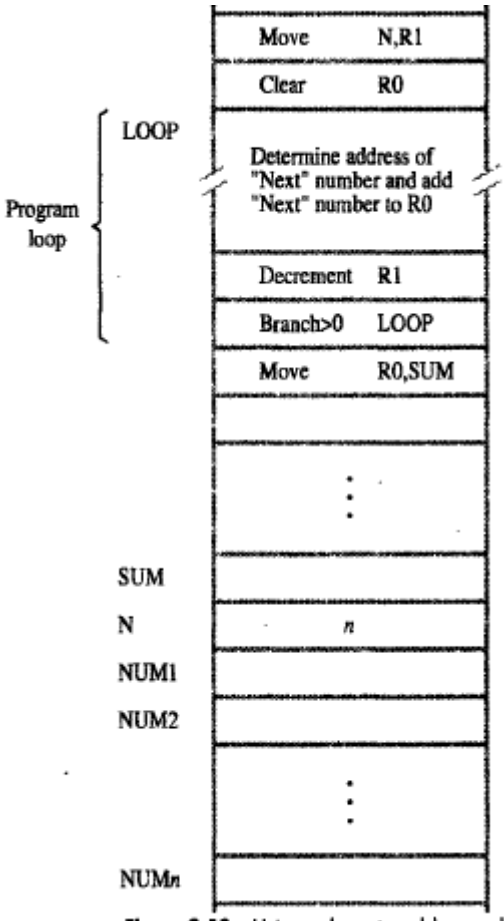



**Figure 2.10** Using a loop to add *n* numbers.

**CONDITION CODES**

- The processor keeps track of information about the results of various operations. This is accomplished by recording the required information in individual bits, called **condition code flags**.
- These flags are grouped together in a special processor-register called the condition code register (or statue register).
- Four commonly used flags are:

1) N (negative) set to 1 if the result is negative, otherwise cleared to0.
2) Z (zero) set to 1 if the result is 0; otherwise, cleared to0.
3) V (overflow) set to 1 if arithmetic overflow occurs; otherwise, cleared to0.
4) C (carry) set to 1 if a carry-out results from the operation; otherwise cleared to0.

## 1.11 ADDRESSING MODES

• The different ways in which the location of an operand is specified in an instruction are referred to as **Addressing Modes** (Table 2.1).

**Table 2.1** Generic addressing modes

| Name | Assembler syntax | Addressing function |
|---|---|---|
| Immediate | #Value | Operand = Value |
| Register | R*i* | EA = R*i* |
| Absolute (Direct) | LOC | EA = LOC |
| Indirect | (R*i*)<br>(LOC) | EA = [R*i*]<br>EA = [LOC] |
| Index | X(R*i*) | EA = [R*i*] + X |
| Base with index | (R*i*,R*j*) | EA = [R*i*] + [R*j*] |
| Base with index and offset | X(R*i*,R*j*) | EA = [R*i*] + [R*j*] + X |
| Relative | X(PC) | EA = [PC] + X |
| Autoincrement | (R*i*)+ | EA = [R*i*];<br>Increment R*i* |
| Autodecrement | –(R*i*) | Decrement R*i*;<br>EA = [R*i*] |

EA = effective address
Value = a signed number

### IMPLEMENTATION OF VARIABLE AND CONSTANTS

• A **variable** is represented by allocating a memory-location to hold its value.
• Thus, the value can be changed as needed using appropriate instructions.
• There are 2 accessing modes to access the variables:
1) Register Mode
2) Absolute Mode

### 1. Register Mode

• The operand is the contents of a register.
• The name (or address) of the register is given in the instruction.
• Registers are used as temporary storage locations where the data in a register are accessed.
• For example, the instruction
*MoveR1,R2* ;Copy content of register R1 into register R2

**2. Absolute (Direct) Mode**

- The operand is in a memory-location.
- The address of memory-location is given explicitly in the instruction.
- The absolute mode can represent global variables in the program.
- For example, the instruction

*MoveLOC,R2* ;Copy content of memory-location LOC into registerR2.

**3. Immediate Mode**

- The operand is given explicitly in the instruction.
- For example, the instruction

*Move#200,R0* ;Place the value 200 in registerR0.

- Clearly, the immediate mode is only used to specify the value of a source-operand.

**4. INDIRECTION AND POINTERS**

- Instruction does not give the operand or its address explicitly.
- Instead, the instruction provides information from which the new address of the operand can be determined.
- This address is called **Effective Address (EA)** of the operand.

**Indirect Mode**

- The EA of the operand is the contents of a register(or memory-location).
- The register (or memory-location) that contains the address of an operand is called a **Pointer**.
- We denote the indirection by
  - → name of the register or
  - → new address given in the instruction.

E.g: *Add (R1),R0*;The operand is in memory. Register R1 gives the effective-address (B) of the operand. The data is read from location B and added to contents of registerR0.

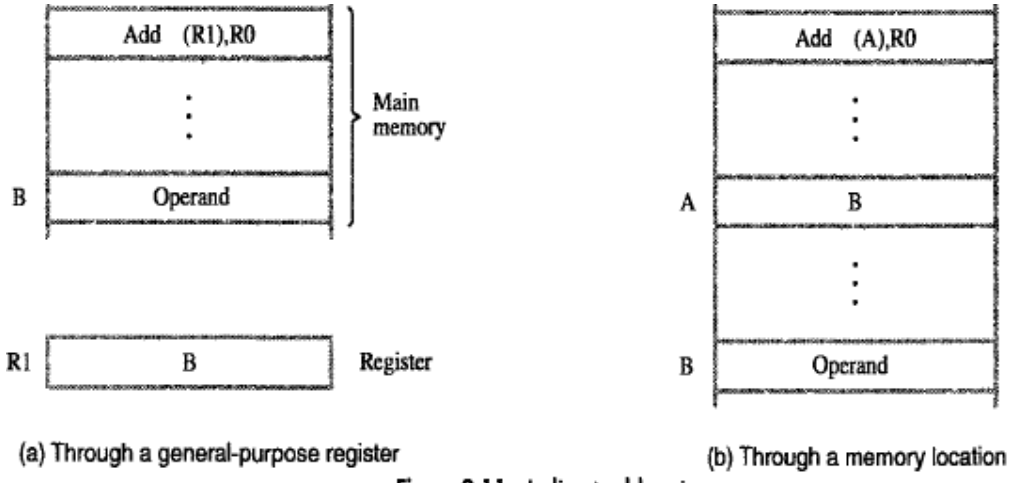



**Figure 2.11** Indirect addressing.

• To execute the Add instruction in fig 2.11 (a), the processor uses the value which is in register R1, as the EA of the operand.
• It requests a read operation from the memory to read the contents of location B. The value read is the desired operand, which the processor adds to the contents of registerR0.
• Indirect addressing through a memory-location is also possible as shown in fig 2.11(b). In this case, the processor first reads the contents of memory-location A, then requests a second read operation using the value B as an address to obtain the operand.

| Address | Contents | | |
|---|---|---|---|
| | Move | N,R1 | Initialization |
| | Move | #NUM1,R2 | |
| | Clear | R0 | |
| LOOP | Add | (R2),R0 | |
| | Add | #4,R2 | |
| | Decrement | R1 | |
| | Branch>0 | LOOP | |
| | Move | R0,SUM | |

**Figure 2.12** Use of indirect addressing in the program of Figure 2.10.

**Program Explanation**

• In above program, Register R2 is used as a pointer to the numbers in the list, and the operands are accessed indirectly throughR2.
• The initialization-section of the program loads the counter-value n from memory-location N into R1 and uses the immediate addressing-mode to place the address value NUM1, which is the address of the first number in the list, into R2. Then it clears R0 to0.
• ThefirsttwoinstructionsintheloopimplementtheunspecifiedinstructionblockstartingatLOOP.
• The first time through the loop, the instruction Add (R2), R0 fetches the operand at location NUM1 and adds it to R0.
• The second Add instruction adds 4 to the contents of the pointer R2, so that it will contain the address value NUM2 when the above instruction is executed in the second pass through the loop.

## 5. INDEXING AND ARRAYS

• A different kind of flexibility for accessing operands is useful in dealing with lists and arrays.

**Index mode**

• The operation is indicated as X(Ri)
where X=the constant value which defines an offset(also called a displacement).
Ri=the name of the index register which contains address of a new location.
• The effective-address of the operand is given by EA=X+[Ri]
• The contents of the index-register are not changed in the process of generating the effective- address.
• The constant X may be given either
→ as an explicit number or
→ as a symbolic-name representing a numerical value.

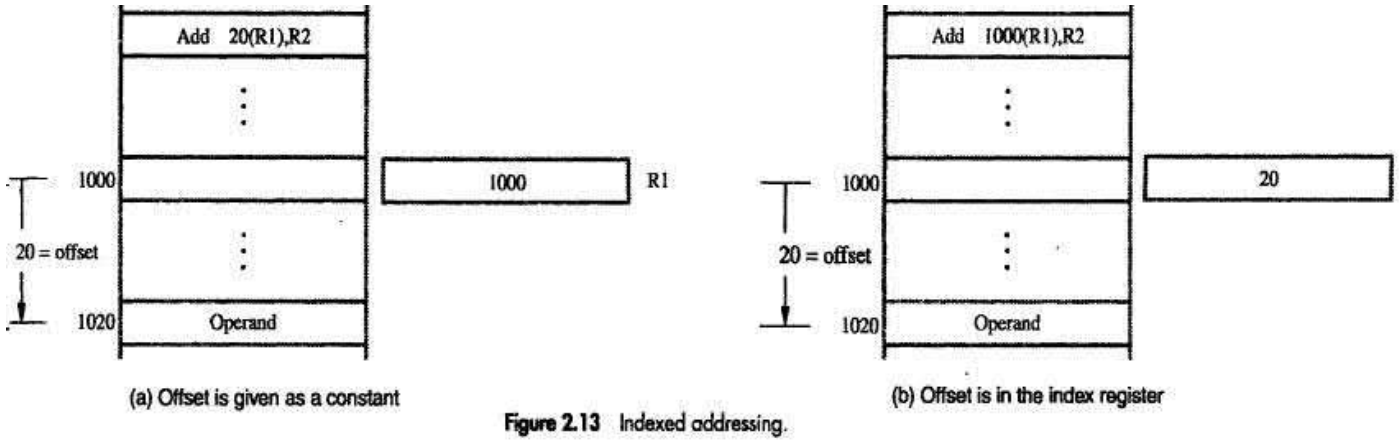



**Figure 2.13** Indexed addressing.

• Fig(a) illustrates two ways of using the Index mode. In fig(a), the index register, R1, contains the address of a memory-location, and the value X defines an offset(also called a displacement) from this address to the location where the operand is found.

• To find EA of operand: Eg:

Add 20(R1),R2

EA=>1000+20=1020

• An alternative use is illustrated in fig(b). Here, the constant X corresponds to a memory address, and the contents of the index register define the offset to the operand. In either case, the effective-address is the sum of two values; one is given explicitly in the instruction, and the other is stored in a register.

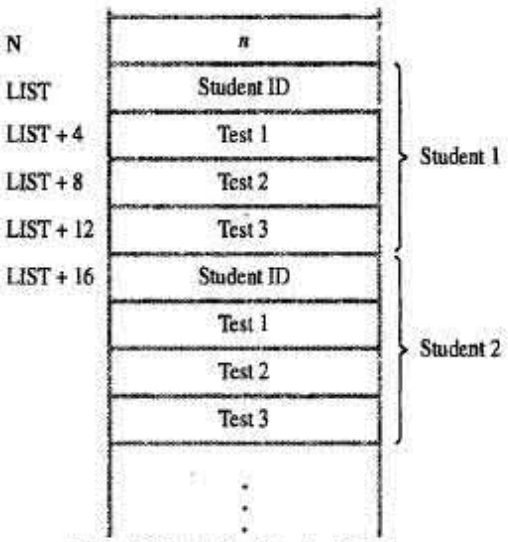



**Figure 2.14** A list of students' marks.

```
                Move      #LIST,R0
                Clear     R1
                Clear     R2
                Clear     R3
                Move      N,R4
LOOP            Add       4(R0),R1
                Add       8(R0),R2
                Add       12(R0),R3
                Add       #16,R0
                Decrement R4
                Branch>0  LOOP
                Move      R1,SUM1
                Move      R2,SUM2
                Move      R3,SUM3
```

**Figure 2.15** Indexed addressing used in accessing test scores in the list in Figure 2.14.

**Base with Index Mode**

- Another version of the Index mode uses 2 registers which can be denoted as
  (Ri,Rj)
- Here, a second register may be used to contain the offset X.
- The second register is usually called the *base register*.
- The effective-address of the operand is given by EA=[Ri]+[Rj]
- This form of indexed addressing provides more flexibility in accessing operands because both components of the effective-address can be changed.

**Base with Index & Offset Mode**

- Another version of the Index mode uses 2 registers plus a constant, which can be denoted as
  X(Ri,Rj)
- The effective-address of the operand is given by EA=X+[Ri]+[Rj]
- This added flexibility is useful in accessing multiple components inside each item in a record, where the beginning of an item is specified by the (Ri, Rj) part of the addressing-mode. In other words, this mode implements a 3-dimensionalarray.

## 6. RELATIVE MODE

- This is similar to index-mode with one difference:
  The effective-address is determined using the PC in place of the general purpose register Ri.
- The operation is indicated as X(PC).
- X(PC) denotes an effective-address of the operand which is X locations above or below the current contents of PC.
- Since the addressed-location is identified "relative" to the PC, the name Relative mode is associated with this type of addressing.
- This mode is used commonly in conditional branch instructions.
- An instruction such as

  *Branch >0 LOOP* ;Causes program execution to go to the branch target location identified by name LOOP if branch condition is satisfied.

## 7. ADDITIONAL ADDRESSING MODES

### 1) Auto Increment Mode

- Effective-address of operand is contents of a register specified in the instruction (Fig:2.16).
- After accessing the operand, the contents of this register are automatically incremented to point to the next item in a list.
- Implicitly, the increment amount is1.
- This mode is denoted as

  (Ri)+ ;where Ri=pointer-register.

### 2) Auto Decrement Mode

- The contents of a register specified in the instruction are first automatically decremented and are then used as the effective-address of the operand.
- This mode is denoted as

  -(Ri) ;where Ri=pointer-register.
- These 2 modes can be used together to implement an important data structure called a stack.

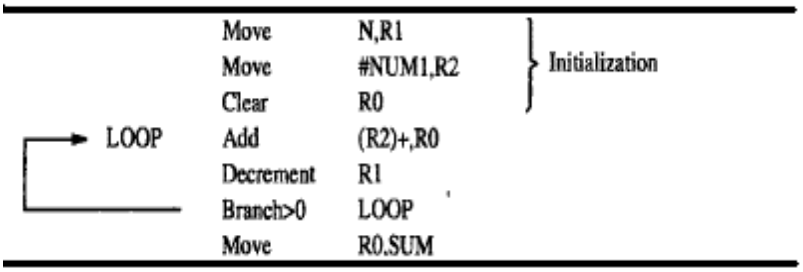



**Figure 2.16** The Autoincrement addressing mode used in the program of Figure 2.12.

## 1.12 ASSEMBLY LANGUAGE

- We generally use symbolic-names to write a program.
- A complete set of symbolic-names and rules for their use constitute an **Assembly Language**.
- The set of rules for using the mnemonics in the specification of complete instructions and programs is called the **Syntax** of the language.
- Programs written in an assembly language can be automatically translated into a sequence of machine instructions by a program called an **Assembler.**
- The user program in its original alphanumeric text formal is called a **Source Program**, and the assembled machine language program is called an **Object Program**.

For example:

*MOVE R0,SUM*;The term MOVE represents OP code for operation performed by instruction.
*ADD#5,R3* ;Adds number 5 to contents of register R3 & puts the result back intoregisterR3.

### ASSEMBLER DIRECTIVES

- **Directives** are the assembler commands to the assembler concerning the program being assembled.
- These commands are not translated into machine opcode in the object-program.

| | Memory address label | Operation | Addressing or data information |
|---|---|---|---|
| Assembler directives | SUM | EQU | 200 |
| | | ORIGIN | 204 |
| | N | DATAWORD | 100 |
| | NUM1 | RESERVE | 400 |
| | | ORIGIN | 100 |
| Statements that | START | MOVE | N,R1 |
| generate | | MOVE | #NUM1,R2 |
| machine | | CLR | R0 |
| instructions | LOOP | ADD | (R2),R0 |
| | | ADD | #4,R2 |
| | | DEC | R1 |
| | | BGTZ | LOOP |
| | | MOVE | R0,SUM |
| Assembler directives | | RETURN | |
| | | END | START |

**Figure 2.18** Assembly language representation for the program in Figure 2.17.

- **EQU** informs the assembler about the value of an identifier (Figure:2.18).
  Ex*: SUM EQU 200* ;Informs assembler that the name SUM should be replaced by the value 200.
- **ORIGIN** tells the assembler about the starting-address of memory-area to place the data block.
  Ex*:* ORIGIN 204 ;Instructs assembler to initiate data-block at memory-locations starting from 204.
- **DATAWORD** directive tells the assembler to load a value into the location.
  Ex: *N DATAWORD 100 ;*Informs the assembler to load data 100 into the memory-location N(204).
- **RESERVE** directive is used to reserve a block of memory.
  Ex: *NUM1 RESERVE 400 ;*declares a memory-block of 400 bytes is to be reserved for data.
- **END** directive tells the assembler that this is the end of the source-program text.
- **RETURN** directive identifies the point at which execution of the program should be terminated.
- Anystatementthatmakesinstructionsordatabeingplacedinamemory-locationmaybegivena **label**. The label(say N or NUM1) is assigned a value equal to the address of that location.

**GENERAL FORMAT OF A STATEMENT**

- Most assembly languages require statements in a source program to be written in the form:

| Label | Operation | Operands | Comment |
|---|---|---|---|

**1) Label** is an optional name associated with the memory-address where the machine language instruction produced from the statement will be loaded.

**2) Operation Field** contains the OP-code mnemonic of the desired instruction or assembler.

**3) Operand Field** contains addressing information for accessing one or more operands, depending on the type of instruction.

**4) Comment Field** is used for documentation purposes to make program easier to understand.

**ASSEMBLY AND EXECUTION OF PRGRAMS**

- Programs written in an assembly language are automatically translated into a sequence of machine instructions by the **Assembler**.
- **Assembler Program**
  → replaces all symbols denoting operations & addressing-modes with binary-codes used in machine instructions.

→ replaces all names and labels with their actual values.
→ assigns addresses to instructions & data blocks, starting at address given in ORIGIN directive
→ inserts constants that may be given in DATAWORD directives.
→ reserves memory-space as requested by RESERVE directives.

- **Two Pass Assembler** has 2passes:

**1. First Pass:** Work out all the addresses of labels.

➢ As the assembler scans through a source-program, it keeps track of all names of numerical-values that correspond to them in a symbol-table.

**2. Second Pass:** Generate machine code, substituting values for the labels.

➢ When a name appears a second time in the source-program, it is replaced with its value from the table.

- The assembler stores the object-program on a magnetic-disk. The object-program must be loaded into the memory of the computer before it is executed. For this, a **Loader Program** is used.
- **Debugger Program** is used to help the user find the programming errors.
- Debugger program enables the user

→ to stop execution of the object-program at some points of interest &
→ to examine the contents of various processor-registers and memory-location.

## 1.13 BASIC INPUT/OUTPUT OPERATIONS

- Consider the problem of moving a character-code from the keyboard to the processor (Figure:2.19). For this transfer, buffer-register DATAIN & a status control flags(SIN) are used.
- When a key is pressed, the corresponding ASCII code is stored in a **DATAIN** register associated with the keyboard.
  - **SIN=1** When a character is typed in the keyboard. This informs the processor that a valid character is in DATAIN.
  - **SIN=0** When the character is transferred to the processor.
- An analogous process takes place when characters are transferred from the processor to the display. For this transfer, buffer-register DATAOUT & a status control flag SOUT are used.
  - **SOUT=1** When the display is ready to receive a character.
  - **SOUT=0** When the character is being transferred to DATAOUT.
- The buffer registers DATAIN and DATAOUT and the status flags SIN and SOUT are part of circuitry commonly known as a **device interface**.

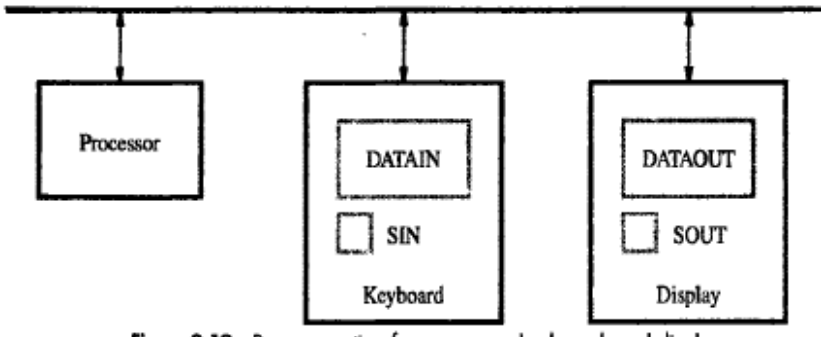



**Figure 2.19** Bus connection for processor, keyboard, and display.

| Program to read a line of characters and display it | | | |
|---|---|---|---|
| | Move | #LOC,R0 | Initialize pointer register R0 to point to the address of the first location in memory where the characters are to be stored. |
| READ | TestBit | #3,INSTATUS | Wait for a character to be entered |
| | Branch=0 | READ | in the keyboard buffer DATAIN. |
| | MoveByte | DATAIN,(R0) | Transfer the character from DATAIN into the memory (this clears SIN to 0). |
| ECHO | TestBit | #3,OUTSTATUS | Wait for the display to become ready. |
| | Branch=0 | ECHO | |
| | MoveByte | (R0),DATAOUT | Move the character just read to the display buffer register (this clears SOUT to 0). |
| | Compare | #CR,(R0)+ | Check if the character just read is CR (carriage return). If it is not CR, then |
| | Branch≠0 | READ | branch back and read another character. Also, increment the pointer to store the next character. |

**Figure 2.20** A program that reads a line of characters and displays it.

**MEMORY-MAPPED I/O**

• Some address values are used to refer to peripheral device buffer-registers such as DATAIN & DATAOUT.

• No special instructions are needed to access the contents of the registers; data can be transferred between these registers and the processor using instructions such as Move, Load or Store.

• For example, contents of the keyboard character buffer DATAIN can be transferred to register R1 in the processor by the instruction

*Move Byte DATAIN,R1*

• The Move Byte operation code signifies that the operand size is a byte.

• The **Testbit** instruction tests the state of one bit in the destination, where the bit position to be tested is indicated by the first operand.

**1.14 STACKS**

• A **stack** is a special type of data structure where elements are inserted from one end and elements are deleted from the same end. This end is called the **top** of the stack (Figure:2.14).

• The various operations performed on stack:

1) Insert: An element is inserted from top end. Insertion operation is called **push** operation.
2) Delete: An element is deleted from top end. Deletion operation is called **pop** operation.

• A processor-register is used to keep track of the address of the element of the stack that is at the top at any given time. This register is called the **Stack Pointer(SP)**.

• If we assume a byte-addressable memory with a 32-bit word length,

1) The push operation can be implemented as

Subtract #4, SP
Move NEWITEM,(SP)

2) The pop operation can be implemented as

Move (SP),

ITEM Add #4, SP

• Routine for a safe pop and push operation as follows:

| | | | |
|---|---|---|---|
| SAFEPOP | Compare<br>Branch>0 | #2000,SP<br>EMPTYERROR | Check to see if the stack pointer contains an address value greater than 2000. If it does, the stack is empty. Branch to the routine EMPTYERROR for appropriate action. |
| | Move | (SP)+,ITEM | Otherwise, pop the top of the stack into memory location ITEM. |

(a) Routine for a safe pop operation

| | | | |
|---|---|---|---|
| SAFEPUSH | Compare<br>Branch≤0 | #1500,SP<br>FULLERROR | Check to see if the stack pointer contains an address value equal to or less than 1500. If it does, the stack is full. Branch to the routine FULLERROR for appropriate action. |
| | Move | NEWITEM,–(SP) | Otherwise, push the element in memory location NEWITEM onto the stack. |

(b) Routine for a safe push operation

**Figure 2.23** Checking for empty and full errors in pop and push operations.

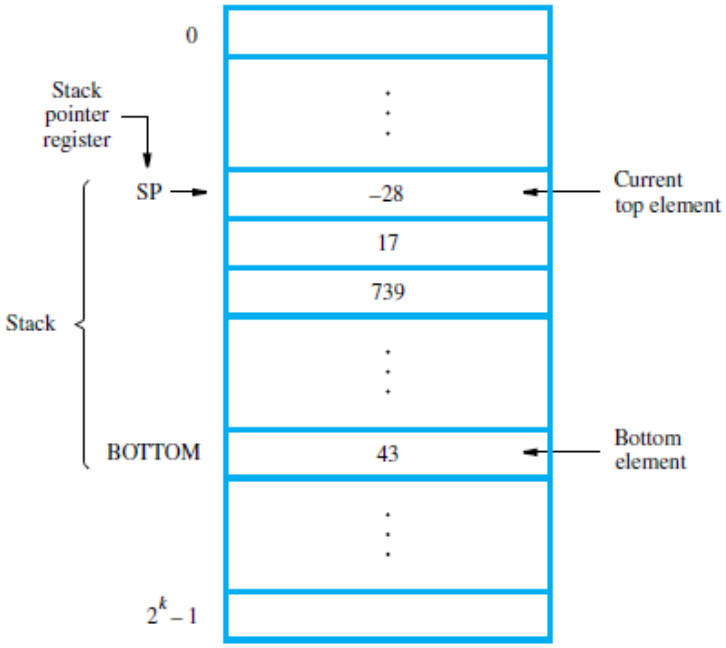



**Figure 2.14** A stack of words in the memory.

**QUEUE**

- Data are stored in and retrieved from a queue on a FIFO basis.
- Difference between stack and queue?

1) One end of the stack is fixed while the other end rises and falls as data are pushed and popped.
2) In stack, a single pointer is needed to keep track of top of the stack at any given time.
In queue, two pointers are needed to keep track of both the front and end for removal and insertion respectively.
3) Without further control, a queue would continuously move through the memory of a computer in the direction of higher addresses. One way to limit the queue to a fixed region in memory is to use a circular buffer.

**1.15 SUBROUTINES**

- A subtask consisting of a set of instructions which is executed many times is called a **Subroutine**.
- A Call instruction causes a branch to the subroutine (Figure:2.16).
- At the end of the subroutine, a return instruction is executed
- Program resumes execution at the instruction immediately following the subroutine call
- The way in which a computer makes it possible to call and return from subroutines is referred to as its **Subroutine Linkage** method.
- The simplest subroutine linkage method is to save the return-address in a specific location, which may be a register dedicated to this function. Such a register is called the **Link Register**.
- When the subroutine completes its task, the Return instruction returns to the calling-program by branching indirectly through the link-register.
- The **Call Instruction** is a special branch instruction that performs the following operations:
  → Store the contents of PC into link-register.
  → Branch to the target-address specified by the instruction.
- The **Return Instruction** is a special branch instruction that performs the operation:
  → Branch to the address contained in the link-register.

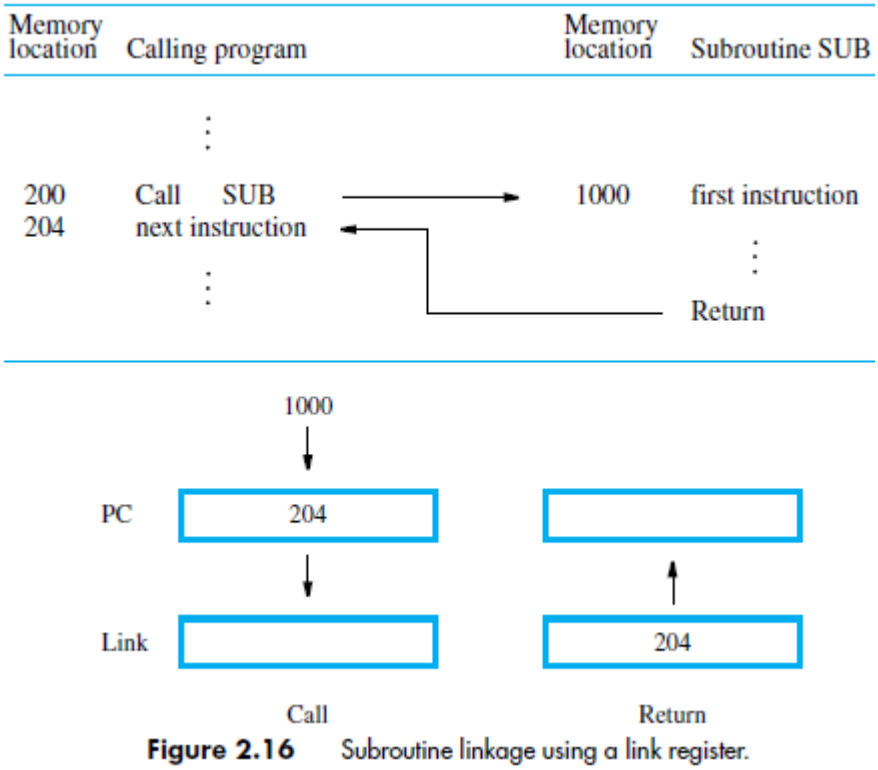



**Figure 2.16** Subroutine linkage using a link register.

**SUBROUTINE NESTING AND THE PROCESSOR STACK**

• **Subroutine Nesting** means one subroutine calls another subroutine.

• In this case, the return-address of the second call is also stored in the link-register, destroying its previous contents.

• Hence, it is essential to save the contents of the link-register in some other location before calling another subroutine. Otherwise, the return-address of the first subroutine will be lost.

• Subroutine nesting can be carried out to any depth. Eventually, the last subroutine called completes its computations and returns to the subroutine that called it.

• The return-address needed for this first return is the last one generated in the nested call sequence. That is, return-addresses are generated and used in a LIFO order.

• This suggests that the return-addresses associated with subroutine calls should be pushed onto a stack. A particular register is designated as the SP(Stack Pointer) to be used in this operation.

• SP is used to point to the processor-stack.

• Call instruction pushes the contents of the PC onto the processor-stack.

Return instruction pops the return-address from the processor-stack into the PC

**PARAMETER PASSING**

• The exchange of information between a calling-program and a subroutine is referred to as **Parameter Passing** (Figure: 2.25).

• The parameters may be placed in registers or in memory-location, where they can be accessed by the subroutine.

• Alternatively, parameters may be placed on the processor-stack used for saving the return-address.

• Following is a program for adding a list of numbers using subroutine with the parameters passed through registers.

**Calling program**

```
            Move      N,R1        R1 serves as a counter.
            Move      #NUM1,R2    R2 points to the list.
            Call      LISTADD     Call subroutine.
            Move      R0,SUM      Save result.
            ⋮
```

**Subroutine**

```
LISTADD     Clear     R0          Initialize sum to 0.
LOOP        Add       (R2)+,R0    Add entry from list.
            Decrement R1
            Branch>0  LOOP
            Return                Return to calling program.
```

**Figure 2.25** Program of Figure 2.16 written as a subroutine; parameters passed through registers.

**STACK FRAME**

• **Stack Frame** refers to locations that constitute a private work-space for the subroutine.

• The work-space is

→ created at the time the subroutine is entered &

→ freed up when the subroutine returns control to the calling-program (Figure: 2.26).

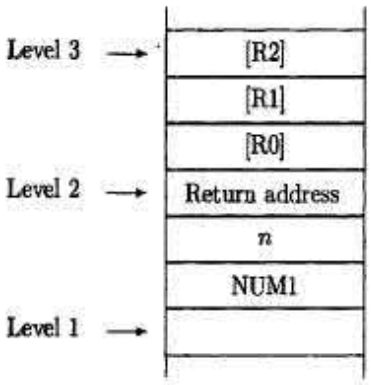
Program for adding a list of numbers using subroutine with the parameters passed to stack.

Assume top of stack is at level 1 below.

```
            Move        #NUM1,-(SP)     Push parameters onto stack.
            Move        N,-(SP)
            Call        LISTADD         Call subroutine
                                          (top of stack at level 2).
            Move        4(SP),SUM       Save result.
            Add         #8,SP           Restore top of stack
                                          (top of stack at level 1).
            :

LISTADD     MoveMultiple R0-R2,-(SP)    Save registers
                                          (top of stack at level 3).
            Move        16(SP),R1       Initialize counter to n.
            Move        20(SP),R2       Initialize pointer to the list.
            Clear       R0              Initialize sum to 0.
LOOP        Add         (R2)+,R0        Add entry from list.
            Decrement   R1
            Branch>0    LOOP
            Move        R0,20(SP)       Put result on the stack.
            MoveMultiple (SP)+,R0-R2    Restore registers.
            Return                      Return to calling program.
```

(a) Calling program and subroutine




(b) Top of stack at various times

**Figure 2.26** Program of Figure 2.16 written as a subroutine; parameters passed on the stack.

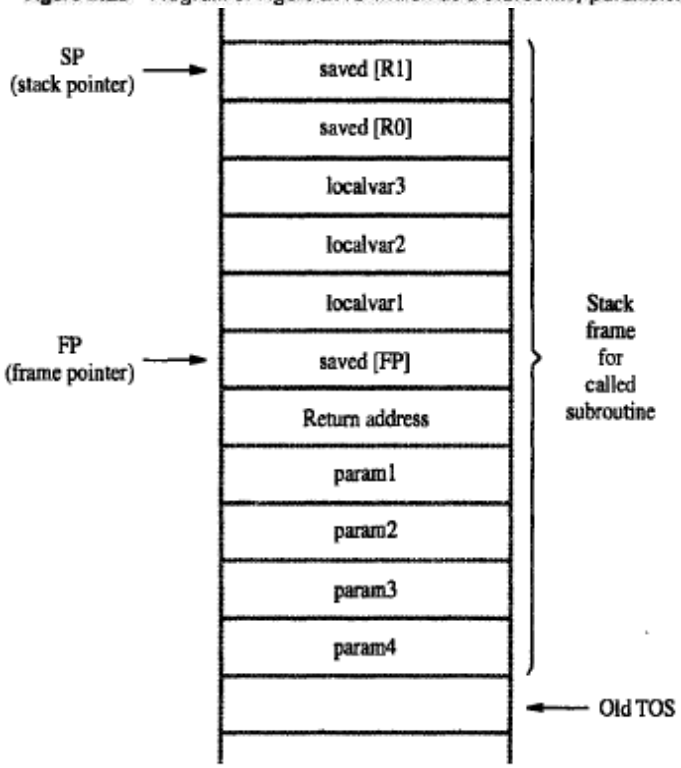



**Figure 2.27** A subroutine stack frame example.

• Fig: 2.27 show an example of a commonly used layout for information in a stack-frame.
• **Frame Pointer (FP)** is used to access the parameters passed
→ to the subroutine &
→ to the local memory-variables.
• The contents of FP remains fixed throughout the execution of the subroutine, unlike stack-pointer SP, which must always point to the current top element in the stack.

**Operation on Stack Frame**

• Initially SP is pointing to the address of old TOS.
• The calling-program saves 4 parameters on the stack (Figure2.27).
• The Call instruction is now executed, pushing the return-address onto the stack.
• Now, SP points to this return-address, and the first instruction of the subroutine is executed.
• Now, FP is to be initialized and its old contents have to be stored. Hence, the first 2 instructions in the subroutine are:

***Move FP,-(SP)***
***Move SP,FP***

• The FP is initialized to the value of SP i.e. both FP and SP point to the saved FP address.
• The 3 local variables may now be pushed onto the stack. Space for local variables is allocated by executing the instruction

***Subtract #12,SP***

• Finally, the contents of processor-registers R0 and R1 are saved in the stack. At this point, the stack-frame has been set up as shown in the fig2.27.
• The subroutine now executes its task. When the task is completed, the subroutine pops the saved values of R1 and R0 back into those registers, removes the local variables from the stack frame by executing the instruction.

***Add #12, SP***

• And subroutine pops saved old value of FP back into FP. At this point, SP points to return-address, so the Return instruction can be executed, transferring control back to the calling-program.

## STACK FRAMES FOR NESTED SUBROUTINES

- Stack is very useful data structure for holding return-addresses when subroutines are nested.
- When nested subroutines are used; the stack-frames are built up in the processor-stack.

**Program to illustrate stack frames for nested subroutines**

| Memory location | | Instructions | | Comments |
|---|---|---|---|---|
| **Main program** | | | | |
| | | ⋮ | | |
| 2000 | | Move | PARAM2,−(SP) | Place parameters on stack. |
| 2004 | | Move | PARAM1,−(SP) | |
| 2008 | | Call | SUB1 | |
| 2012 | | Move | (SP),RESULT | Store result. |
| 2016 | | Add | #8,SP | Restore stack level. |
| 2020 | | next instruction | | |
| | | ⋮ | | |
| **First subroutine** | | | | |
| 2100 | SUB1 | Move | FP,−(SP) | Save frame pointer register. |
| 2104 | | Move | SP,FP | Load the frame pointer. |
| 2108 | | MoveMultiple | R0−R3,−(SP) | Save registers. |
| 2112 | | Move | 8(FP),R0 | Get first parameter. |
| | | Move | 12(FP),R1 | Get second parameter. |
| | | ⋮ | | |
| | | Move | PARAM3,−(SP) | Place a parameter on stack. |
| 2160 | | Call | SUB2 | |
| 2164 | | Move | (SP)+,R2 | Pop SUB2 result into R2. |
| | | ⋮ | | |
| | | Move | R3,8(FP) | Place answer on stack. |
| | | MoveMultiple | (SP)+,R0−R3 | Restore registers. |
| | | Move | (SP)+,FP | Restore frame pointer register. |
| | | Return | | Return to Main program. |
| **Second subroutine** | | | | |
| 3000 | SUB2 | Move | FP,−(SP) | Save frame pointer register. |
| | | Move | SP,FP | Load the frame pointer. |
| | | MoveMultiple | R0−R1,−(SP) | Save registers R0 and R1. |
| | | Move | 8(FP),R0 | Get the parameter. |
| | | ⋮ | | |
| | | Move | R1,8(FP) | Place SUB2 result on stack. |
| | | MoveMultiple | (SP)+,R0−R1 | Restore registers R0 and R1. |
| | | Move | (SP)+,FP | Restore frame pointer register. |
| | | Return | | Return to Subroutine 1. |

Figure 2.28 Nested subroutines.

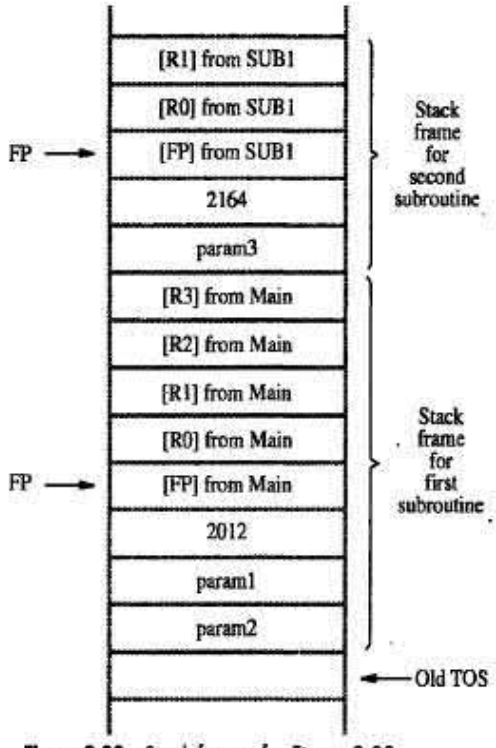



Figure 2.29 Stack frames for Figure 2.28.

**The Flow of Execution is as follows:**

- Main program pushes the 2 parameters param2 and param1 onto the stack and then callsSUB1.
- SUB1 has to perform an operation & send result to the main-program on the stack (Fig:2.28&29).
- During the process, SUB1 calls the second subroutine SUB2 (in order to perform some subtask).

• After SUB2 executes its Return instruction; the result is stored in register R2 bySUB1.
• SUB1thencontinuesitscomputations&eventuallypassesrequiredanswerbacktomain-programonthestack.
• When SUB1 executes return statement, the main-program stores this answers in memory-location RESULT and continues its execution.

**LOGIC INSTRUCTIONS**

• Logic operations such as AND, OR, and NOT applied to individual bits.
• These are the basic building blocks of digital-circuits.
• This is also useful to be able to perform logic operations is software, which is done using instructions that apply these operations to all bits of a word or byte independently and in parallel.
• For example, the instruction

*Not dst*

**SHIFT AND ROTATE INSTRUCTIONS**

• There are many applications that require the bits of an operand to be shifted right or left some specified number of bit positions.
• The details of how the shifts are performed depend on whether the operand is a signed number or some more general binary-coded information.
• For general operands, we use a logical shift.

For a number, we use an arithmetic shift, which preserves the sign of the number.

**LOGICAL SHIFTS**

• Two logical shift instructions are

1) Shifting left (LShiftL)&
2) Shifting right(LShiftR).

• These instructions shift an operand over a number of bit positions specified in a count operand contained in the instruction.

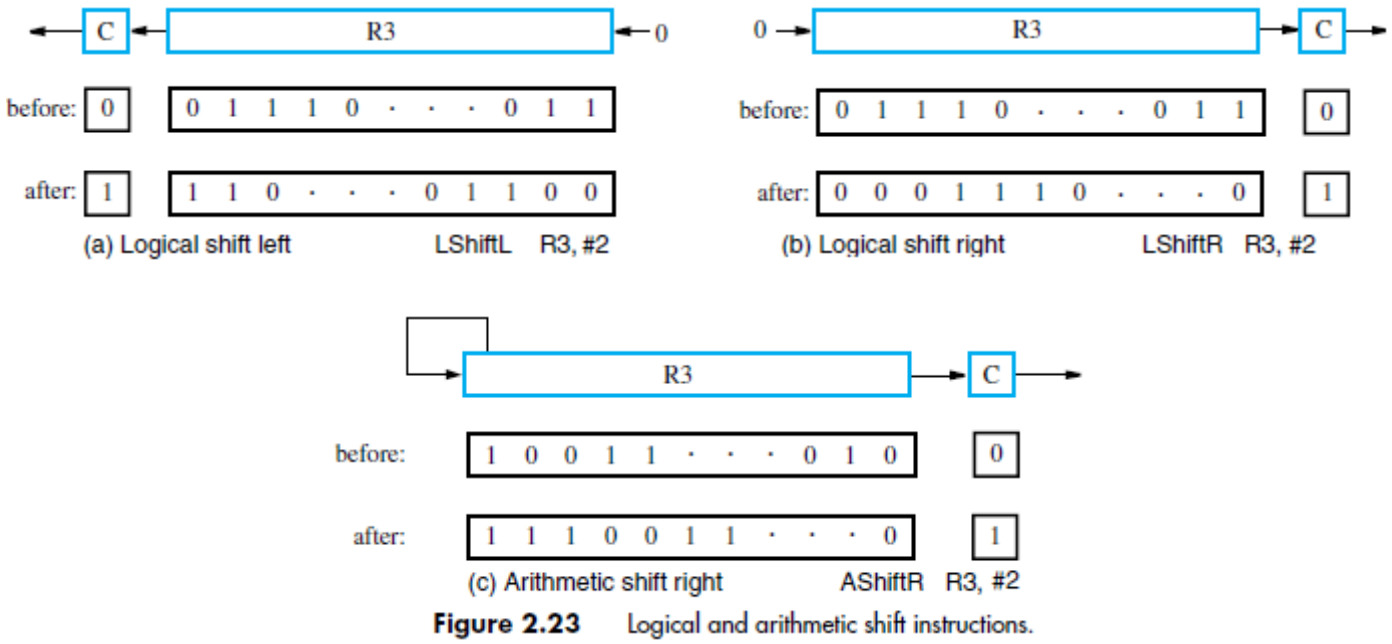



**Figure 2.23** Logical and arithmetic shift instructions.

```
Move        #LOC,R0       R0 points to data.
MoveByte    (R0)+,R1      Load first byte into R1.
LShiftL     #4,R1         Shift left by 4 bit positions.
MoveByte    (R0),R2       Load second byte into R2.
And         #$F,R2        Eliminate high-order bits.
Or          R1,R2         Concatenate the BCD digits.
MoveBvte    R2.PACKED     Store the result.
```

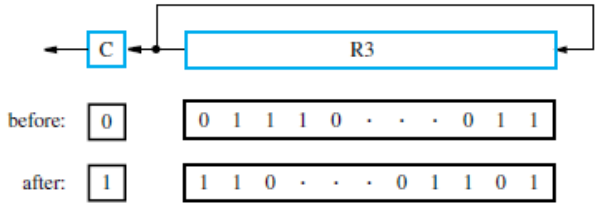
**Figure 2.31** A routine that packs two BCD digits.

**ROTATE OPERATIONS**

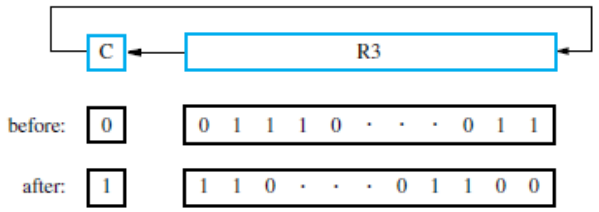
- In shift operations, the bits shifted out of the operand are lost, except for the last bit shifted out which is retained in the Carry-flag C.
- To preserve all bits, a set of rotate instructions can be used.
- They move the bits that are shifted out of one end of the operand back into the other end.
- Two versions of both the left and right rotate instructions are usually provided.

In one version, the bits of the operand is simply rotated.

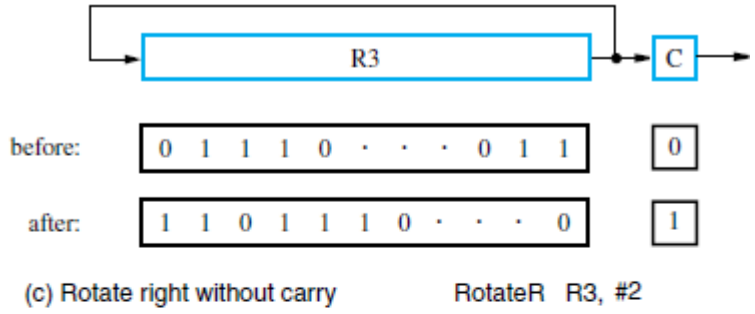
In the other version, the rotation includes the C flag.



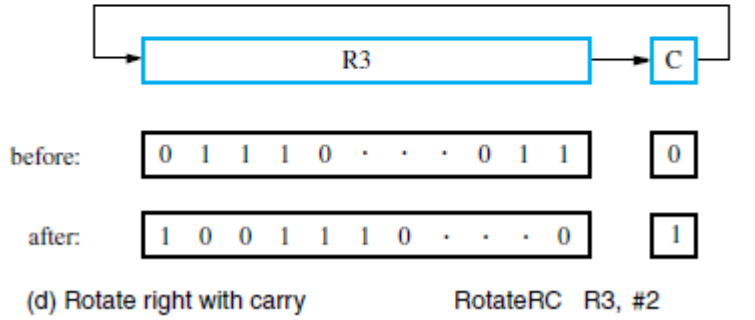

(a) Rotate left without carry RotateL R3, #2




(b) Rotate left with carry RotateLC R3, #2




(c) Rotate right without carry RotateR R3, #2




(d) Rotate right with carry RotateRC R3, #2

**Figure 2.25** Rotate instructions.

## 1.16 ENCODING OF MACHINE INSTRUCTIONS

• To be executed in a processor, an instruction must be encoded in a binary-pattern. Such encoded instructions are referred to as **Machine Instructions**.

• The instructions that use symbolic-names and acronyms are called *assembly language einstructions*.

• We have seen instructions that perform operations such as add, subtract, move, shift, rotate, and branch. These instructions may use operands of different sizes, such as 32-bit and 8-bitnumbers.

• Let us examine some typical cases. The instruction

*Add R1, R2* ;Has to specify the registers R1 and R2, in addition to the OP code. If the processor has 16 registers, then four bits are needed to identify each register. Additional bits are needed to indicate that the Register addressing-mode is used for each operand.

The instruction

*Move24(R0),R5* ;Requires 16 bits to denote the OP code and the two registers, and some bits to express that the source operand uses the Index addressing mode and that the index value is24.

• In all these examples, the instructions can be encoded in a 32-bit word (Fig2.39).

• The OP code for given instruction refers to type of operation that is to be performed.

• Source and destination field refers to source and destination operand respectively.

• The "Other info" field allows us to specify the additional information that may be needed such as an index value or an immediate operand.

• Using multiple words, we can implement complex instructions, closely resembling operations in high-level programming languages. The term complex instruction set computers (CISC) refers to processors that use

• CISC approach results in instructions of variable length, dependent on the number of operands and the type of addressing modes used.
• In RISC (reduced instruction set computers), any instruction occupies only one word.
• The RISC approach introduced other restrictions such as that all manipulation of data must be done on operands that are already in registers.

*Ex: Add R1,R2,R3*

• In RISC type machine, the memory references are limited to only Load/Store operations.

**Problem 1:**

Write a program that can evaluate the expression A*B+C*D In a single-accumulator processor. Assume that the processor has Load, Store, Multiply, and Add instructions and that all values fit in the accumulator

**Solution:**

A program for the expression is:

Load A
Multiply B
Store RESULT
Load C
Multiply D
Add RESULT
Store RESULT

**Problem 2:**

Registers R1 and R2 of a computer contains the decimal values 1200 and 4600. What is the effective-address of the memory operand in each of the following instructions?

(a) Load 20(R1),R5
(b) Move#3000,R5
(c) StoreR5,30(R1,R2)
(d) Add-(R2),R5
(e) Subtract(R1)+,R5

**Solution:**

(a) EA = [R1]+Offset=1200+20 = 1220
(b) EA = 3000
(c) EA = [R1]+[R2]+Offset = 1200+4600+30=5830
(d) EA = [R2]-1 = 4599
(e) EA = [R1] = 1200

**Problem 3:**

Registers R1 and R2 of a computer contains the decimal values 2900 and 3300. What is the effective-address of the memory operand in each of the following instructions?

(a)Load 1,55(R2)
(b)Move #2000,R7
(c) Store95(R1,R2),R5
(d) Add(R1)+,R5
(e) Subtract-(R2),R5

**Solution:**

a) Load R1,55(R2) This is indexed addressing mode. So EA =55+R2=55+3300=3355.
b) Move #2000,R7This is an immediate addressing mode. So, EA =2000
c) Store 95(R1,R2),R5 This is a variation of indexed addressing mode, in which contents of 2 registers are added with the offset or index to generate EA. So, 95+R1+R2=95+2900+3300=6255.
d) Add (R1)+, R5 This is Autoincrement mode. Contents of R1 are the EA so, 2900 is the EA.
e) Subtract -(R2),R5 This is Auto decrement mode. Here, R2 is subtracted by 4 bytes (assuming 32-bt processor) to generate the EA, so, EA=3300-4=3296.

**Problem 5:**

Both of the following statements cause the value 300 to be stored in location 1000, but at different times.

ORIGIN 1000
DATAWORD 300
And

Move #300,1000

Explain the difference.

**Solution:**

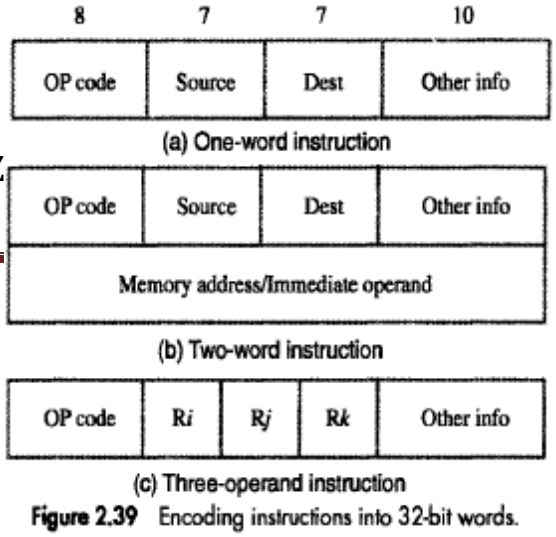


Figure 2.39 Encoding instructions into 32-bit words.

The assembler directive cause the object program memory image constructed by the assembler to indicate that 300 is to be placed at memory word location 1000 at the time the program is loaded into memory prior to execution.

The Move instruction places 300 into memory word location 1000 when the instruction is executed as part of a program.

**Problem 6:**

Register R5 is used in a program to point to the top of a stack. Write a sequence of instructions using the Index, Auto increment, and Auto decrement addressing modes to perform each of the following tasks:

(a) Pop the top two items off the stack, and them, and then push the result onto the stack.

(b) Copy the fifth item from the top into registerR3.

(c) Remove the top ten items from the stack.

**Solution:**

(a) Move(R5)+,R0
Add (R5)+, R0
Move R0, -(R5)

(b) Move 16(R5),R3

(c) Add #40,R5

OR

**Problem 7:**

Consider the following possibilities for saving the return address of a subroutine:

(a) In the processor register.

(b) In a memory-location associated with the call, so that a different location is used when the subroutine is called from different places

(c) On a stack.

Which of these possibilities supports subroutine nesting and which supports subroutine recursion(that is, a subroutine that calls itself)?

**Solution:**

(a) Neither nesting nor recursion is supported.

(b) Nesting is supported, because different Call instructions will save the return address at different memory-locations. Recursion is not supported.

(c) Both nesting and recursion are supported.

# MODULE 2: INPUT/OUTPUT ORGANIZATION

## INTRODUCTION

Input/output architecture is a interface to the outside world that provide systematic means of controlling interaction with outside world. Input device such as keyboard, scanner, digital camera, etc. Output devices such as display, printer etc.Input/output devices cannot directly connect to the system bus because Data transfer rate of input/output devices is slower than (memory & processor) and verse versa. Input/output devices are used different data format and word length.

## 2.1 ACCESSING I/O-DEVICE

- A **single bus-structure** can be used for connecting I/O-devices to a computer (Figure7.1).
- Each I/O device is assigned a unique set ofaddress.
- Bus consists of 3 sets of lines to carry address, data & controlsignals.
- Each IO devices is assigned with unique set of addresses
- When processor places an address on address-lines, the intended-device responds to thecommand using control signal line.
- The processor requests either a read orwrite-operation.
- The requested-data are transferred over thedata-lines.




**Figure 7.1** A single-bus structure.

- There are 2 ways to deal with I/O-devices: 1) Memory-mapped I/O & 2) I/O-mappedI/O.

**1) Memory-MappedI/O**

- Memory and I/O-devices share a commonaddress-space.
- Any data-transfer instruction (like Move, Load) can be used to exchangeinformation.
- Forexample,

*Move DATAIN, R0;* This instruction sends the contents of location DATAIN to register R0.
Here, DATAIN □address of the input-buffer of the keyboard.

**2) I/O-MappedI/O**

- Memory and I/0 address-spaces aredifferent.
- A special instructions named **IN** and **OUT** are used fordata-transfer.
  Ex: Processor in Intel family.
- Advantage of separate I/O space: I/O-devices deal with feweraddress-lines.

**I/O Interface for an Input Device**

**1) Address Decoder:** enables the device to recognize its address when this address appears on the address-lines (Figure7.2).
**2) Status Register:** contains information relevant to operation ofI/O-device.
**3) Data Register:** holds data being transferred to or from processor. There are 2types:
i) DATAIN □Input-buffer associated withkeyboard.
ii) DATAOUT □Output data buffer of adisplay/printer.

- Both data and status register are connected to the data bus and assigned unique address.
- The address decoder, the data and status register and the control circuitry required to coordinate I/O

transfers constitute the device's interface circuit.

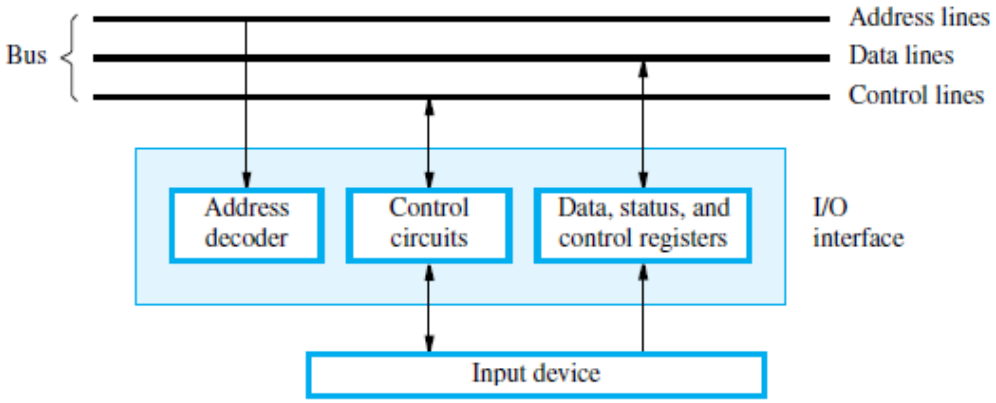



**Figure 7.2** I/O interface for an input device.

**MECHANISMS USED FOR INTERFACING I/O-DEVICES**

**1) Program ControlledI/O**

• Processor repeatedly checks status-flag to achieve required synchronization b/w processor & I/O device. (We say that the processor polls thedevice).

• Maindrawback:

The processor wastes time in checking status of device before actual data-transfer takes place.

**2) InterruptI/O**

• I/O-device initiates the action instead of theprocessor.

• I/O-device sends an INTR signal over bus whenever it is ready for a data-transferoperation.

• Like this, required synchronization is done between processor & I/Odevice.

**3) Direct Memory Access(DMA)**

• Device-interface transfer data directly to/from the memory w/o continuous involvement by the processor.

• DMA is a technique used for high speedI/O-device.

## 2.2 INTERRUPTS

- There are many situations where other tasks can be performed while waiting for an I/O device to becomeready.
- A hardware signal called an Interrupt will alert the processor when an I/O device becomesready.
- Interrupt-signal is sent on the interrupt-requestline.
- The processor can be performing its own task without the need to continuously check theI/O-device.
- The routine executed in response to an interrupt-request is calledISR.
- The processor must inform the device that its request has been recognized by sending INTA signal.
  (INTR □Interrupt Request, INTA □Interrupt Acknowledge, ISR □Interrupt ServiceRoutine)
- For example, consider COMPUTE and PRINT routines (Figure3.6).

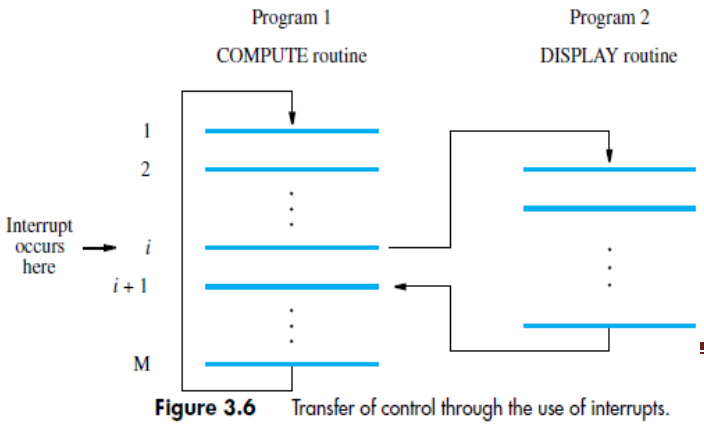



**Figure 3.6** Transfer of control through the use of interrupts.

Assume that an interrupt request arrives during execution of instruction i in Fig 3.6

- The processor first completes the execution of instruction i.
- Then, processor loads the PC with the address of the first instruction of the ISR (interrupt service routine).
- After the execution of ISR, the processor has to come back to instructioni+1.
- Therefore, when an interrupt occurs, the current content of PC is put in temporary storage location.
- A return at the end of ISR reloads the PC from that temporary storage location.
- This causes the execution to resume at instructioni+1.
- When processor is handling interrupts, it must inform device that its request has been recognized.
- This may be accomplished by special control signal on bus. An interrupt-acknowledge signal is used
- The task of saving and restoring the information can be done automatically by the processor or by program instruction.
- Saving and restoring registers involves memory transfers:
- Increases the total execution time.
- Increases the delay between the time an interrupt request is received, and the start of execution of the interrupt-service routine. This delay is called interrupt latency.
- In order to reduce the interrupt latency, most processors save only the minimal amount of information:
- This minimal amount of information includes **Program Counter and processor status registers.**
- Any additional information that must be saved, must be saved explicitly by the program instructions at the beginning of the interrupt service routine.

- **Interrupt Latency** is a delay between → time an interrupt-request is received and start of the execution of the ISR.

**Difference between Subroutine & ISR**

| Subroutine | ISR |
|---|---|
| A subroutine performs a function required by the program from which it is called. | ISR may not have anything in common with program being executed at time INTR is received |
| Subroutine is just a linkage of 2 or more function related to each other. | Interrupt is a Mechanism for coordinating I/O transfers. |

### 2.2.1 INTERRUPT HARDWARE

- Most computers have several I/O devices that can request an interrupt.
- A single interrupt-request (IR) line may be used to serve n devices (Figure4.6).
- All devices are connected to IR line via switches to ground.
- To request an interrupt, a device closes its associated switch.
- Thus, if all IR signals are inactive, the voltage on the IR line will be equal to $V_{dd}$.
- When a device requests an interrupt, the voltage on the line drops to0.
- This causes the INTR received by the processor to go to1.
- The value of INTR is the logical OR of the requests from individual devices.

  **$INTR = INTR_1 + INTR_2 + \ldots\ldots + INTR_n$**
- A special gates known as open-collector or open-drain are used to drive the INTR line.
- The Output of the open collector control is equal to a switch to the ground that is
  → open when gates input is in ”0“ state and
  → closed when the gates input is in “1“ state.
  - Resistor R is called a **Pull-up Resistor** because it pulls the line voltage up to the high-voltage state when the switches are open.

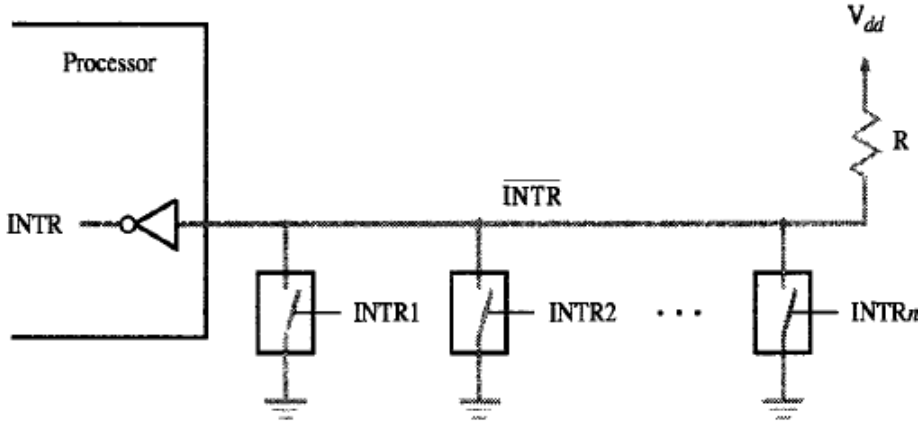



**Figure 4.6** An equivalent circuit for an open-drain bus used to implement a common interrupt-request line.

### 2.2.2 ENABLING & DISABLING INTERRUPTS

All computers fundamentally should be able to enable and disable interruptions as desired.

- Processors generally provide the ability to enable and disable such interruptions as desired.

The problem of infinite loop occurs due to successive interruptions of active INTR signals.
There are 3 mechanisms to solve problem of infinite loop:

1) Processor should ignore the interrupts until execution of first instruction of the ISR by the processor hardware.
   - By using an Interrupt-disable instruction as the first instruction in the interrupt-service routine, the programmer can ensure that no further interruptions will occur until an Interrupt-enable instruction is executed. Typically, the Interrupt-enable instruction will be the last instruction in the interrupt-service routine before the Return from-interrupt instruction.

2) Processor should automatically disable interrupts before starting the execution of the ISR.
   - The second option, which is suitable for a simple processor with only one interrupt-request line, is to have the processor automatically disable interrupts before starting the execution of the interrupt-service routine. After saving the contents of the PC Dept of CSE,SJBIT Page 64 INTR , to name the interrupt-request COMPUTER ORGANIZATION 10CS46 and the processor status register (PS) on the stack, the processor performs the equivalent of executing an Interrupt-disable instruction. It is often the case that one bit in the PS register, called Interrupt-enable, indicates whether interrupts are enabled.

3) In the third option, the processor has a special interrupt-request line for which the interrupt-handling circuit responds only to the leading edge of the signal. Such a line is said to be edge-triggered.

**Sequence of events involved in handling an interrupt-request:**

1) The device raises an interrupt-request.
2) The processor interrupts the program currently being executed.
3) Interrupts are disabled by changing the control bits in the processor status register(PS).
4) The device is informed that its request has been recognized.
   In response, the device deactivates the interrupt-request signal.
5) The action requested by the interrupt is performed by the interrupt-service routine.
6) Interrupts are enabled and execution of the interrupted program is resumed.

### 2.2.3 HANDLING MULTIPLE DEVICES

- While handling multiple devices, the issues concerned are:
  1) How can the processor recognize the device requesting an interrupt?
  2) How can the processor obtain the starting address of the appropriate ISR?
  3) Should a device be allowed to interrupt the processor while another interrupt is being serviced?
  4) How should 2 or more simultaneous interrupt-requests be handled?

When a request is received over the common interrupt-request line, additional information is needed to identify the particular device that activated the line.

The information needed to determine whether a device is requesting an interrupt is available in its status register. When a device raises an interrupt request, it sets to 1 one of the bits in its status register, which we will call the IRQ bit.

2 methods to handle multiple devices are:

1. Polling
2. Vectored Interrupts

**POLLING**

- Information needed to determine whether device is requesting interrupt is available in status-register
- Following condition-codes are used:
  - DIRQ Interrupt-request for display.
  - KIRQ Interrupt-request for keyboard.
  - KEN keyboard enable.
  - DEN Display Enable.
  - SIN, SOUT status flags.
- For an input device, SIN status flag in used.
  SIN = 1 when a character is entered at the keyboard.
  SIN = 0 when the character is read by processor.
  IRQ=1 when a device raises an interrupt-requests (Figure 4.3).
- Simplest way to identify interrupting-device is to have ISR poll all devices connected to bus.
- The first device encountered with its IRQ bit set is serviced.
- After servicing first device, next requests may be serviced.
- **Advantage:** Simple & easy to implement.
  **Disadvantage:** More time spent polling IRQ bits of all devices.

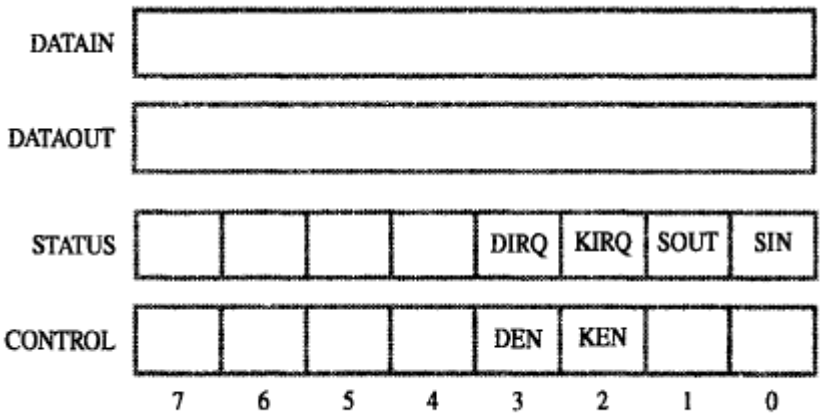



**Figure 4.3** Registers in keyboard and display interfaces.

**VECTORED INTERRUPTS**

- A device requesting an interrupt identifies itself by sending a special-code to processor over bus.
- Then, the processor starts executing the ISR.
- The special-code indicates starting-address ofISR.
- The special-code length ranges from 4 to 8bits.
- The location pointed to by the interrupting-device is used to store the staring address to ISR.
- The staring address to ISR is called the **interrupt vector**.
- Processor
  → loads interrupt-vector into PC &
  → executes appropriate ISR.
- When processor is ready to receive interrupt-vector code, it activates INTA line.
- Then, I/O-device responds by sending its interrupt-vector code & turning off the INTR signal.
- The interrupt vector also includes a new value for the Processor Status Register.

**INTERRUPT NESTING**

Interrupts should be disabled during the execution of an interrupt-service routine, to ensure that a request from one device will not cause more than one interruption. The same arrangement is often used when several devices are involved, in which case execution of a given interrupt-service routine, once started, always continues to completion before the processor accepts an interrupt request from a second device. Interrupt-service routines are typically short, and the delay they may cause is acceptable for most simple devices

- A multiple-priority scheme is implemented by using separate INTR & INTA lines for each device
- Each INTR line is assigned a different priority-level (Figure4.7).
- Priority-level of processor is the priority of program that is currently being executed.
- Processor accepts interrupts only from devices that have higher-priority than its own.
- At the time of execution of ISR for some device, priority of processor is raised to that of the device.
- Thus, interrupts from devices at the same level of priority or lower are disabled.

**Privileged Instruction**

- Processor's priority is encoded in a few bits of PS word. (PS □Processor-Status).
- Encoded-bits can be changed by **Privileged Instructions** that write into PS.
- Privileged-instructions can be executed only while processor is running in **Supervisor Mode**.
- Processor is in supervisor-mode only when executing operating-system routines.

**Privileged Exception**

- User program cannot
  → accidently or intentionally change the priority of the processor &
  → disrupt the system-operation.
- An attempt to execute a privileged-instruction while in user-mode leads to a **Privileged Exception**.

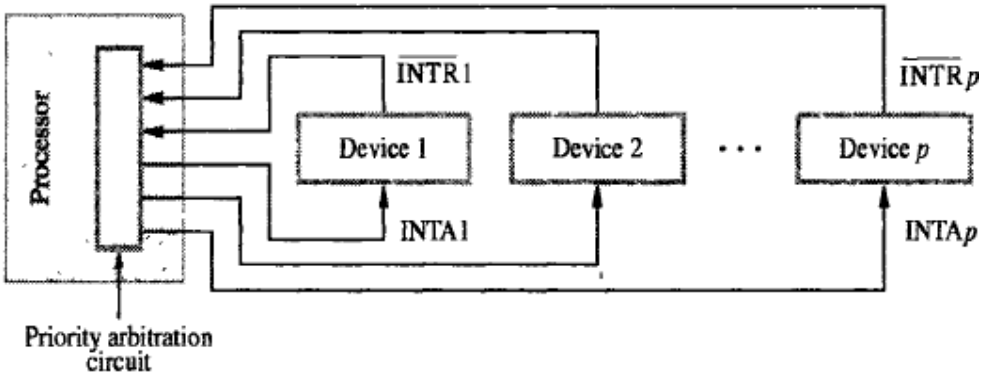



**Figure 4.7** Implementation of interrupt priority using individual interrupt-request and acknowledge lines.

**SIMULTANEOUS REQUESTS**

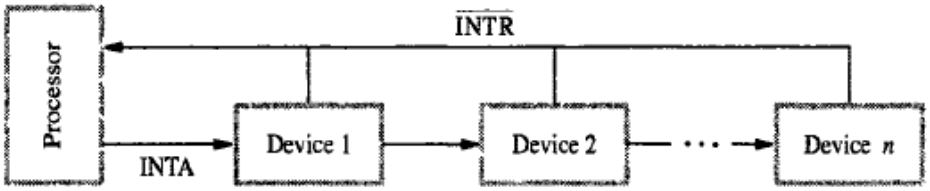
• The processor must have some mechanisms to decide which request to service when simultaneous requests arrive.

A widely used scheme is to connect the devices to form a daisy chain, as shown in fig. 4.8a

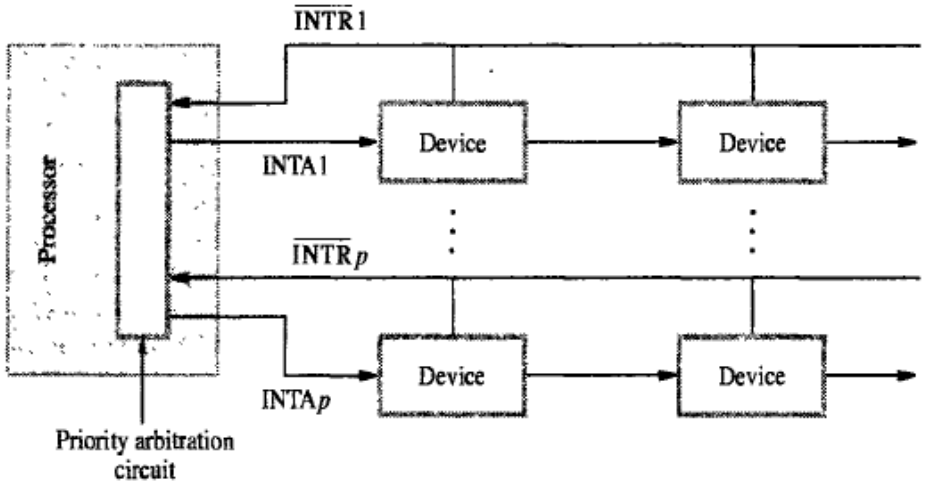
• INTR line is common to all devices (Figure4.8a).
• The interrupt-acknowledge line, INTA, is connected in a daisy-chain fashion, such that the INTA signal propagates serially through the devices.
• INTA signal propagates serially through devices.
• When several devices raise an interrupt-request, INTR line is activated.
• Processor responds by setting INTA line to 1. This signal is received by device1.
• Device-1 passes signal on to device 2 only if it does not require any service.
• If device-1 has a pending-request for interrupt, thedevice-1
  → blocks INTA signal &
  → proceeds to put its identifying-code on data-lines.
• Device that is electrically closest to processor has highest priority.
• **Advantage:** It requires fewer wires than the individual connections.

**Arrangement of Priority Groups**

• Here, the devices are organized in groups & each group is connected at a different priority level.
• Within a group, devices are connected in a daisy chain. (Figure4.8b).




(a) Daisy chain




(b) Arrangement of priority groups

**Figure 4.8** Interrupt priority schemes.

### 2.2.4 CONTROLLING DEVICE REQUESTS:

Until now, we have assumed that an I/O device interface generates an interrupt request whenever it is ready for an I/O transfer, for example whenever the SIN flag is 1. It is important to ensure that interrupt requests are generated only by those I/O devices that are being used by a given program. Idle devices must not be allowed to generate interrupt requests, even though they may be ready to participate in I/O transfer operations. Hence, we need a mechanism in the interface circuits of individual devices to control whether a device is allowed to generate an interrupt request.

The control needed is usually provided in the form of an interrupt-enable bit in the device's interface circuit. The keyboard interrupt-enable, KEN, and display interrupt enable, DEN, flags in register CONTROL perform this function. If either of these flags is set, the interface circuit generates an interrupt request whenever the corresponding status flag in register STATUS is set. At the same time, the interface circuit sets bit KIRQ or DIRQ to indicate that the keyboard or display unit, respectively, is requesting an interrupt. If an interrupt-enable bit is equal to 0, the interface circuit will not generate an interrupt request, regardless of the state of the status flag.

### 2.2.5 EXCEPTIONS

- An **interrupt** is an event that causes
  → execution of one program to be suspended &
  → execution of another program to begin.

**Exception** refers to any event that causes an interruption. For ex: I/O interrupts.

**1. Recovery from Errors**

- These are techniques to ensure that all hardware components are operating properly.
- For ex: Many computers include an ECC in memory which allows detection of errors in stored-data.
  (ECC □Error Checking Code, ESR □Exception Service Routine).
- If an error occurs, control-hardware
  → detects the errors &
  → informs processor by raising an interrupt.
- When exception processing is initiated (as a result of errors),processor.
  → suspends program being executed &
  → starts an ESR. This routine takes appropriate action to recover from the error.

**2. Debugging**

- Debugger
  → is used to find errors in a program and
  → uses exceptions to provide 2 important facilities: i) Trace & ii) Breakpoints

**i) Trace**

- When a processor is operating in trace-mode, an exception occurs after execution of every instruction (using debugging-program as ESR).
- Debugging-program enables user to examine contents of registers, memory-locations and soon.
- On return from debugging-program,
  next instruction in program being debugged is executed,
  then debugging-program is activated again.
- The trace exception is disabled during the execution of the debugging-program.

**ii) Breakpoints**

- Here, the program being debugged is interrupted only at specific points selected by user.
- An instruction called Trap (or Software interrupt) is usually provided for this purpose.
- When program is executed & reaches breakpoint, the user can examine memory & register contents.

**3. Privilege Exception**

- To protect OS from being corrupted by user-programs, **Privileged Instructions** are executed only while processor is in supervisor-mode.
- For e.g.
  When processor runs in user-mode, it will not execute instruction that change priority of processor.
- An attempt to execute privileged-instruction will produce a **Privilege Exception**.
- As a result, processor switches to supervisor-mode & begins to execute an appropriate routine in OS.

## 2.4 DIRECT MEMORY ACCESS (DMA)

• The transfer of a block of data directly b/w an external device & main-memory w/o continuous involvement by processor is called DMA.

• DMA controller
  → is a control circuit that performs DMA transfers (Figure 8.13).
  → is a part of the I/O device interface.
  → performs the functions that would normally be carried out by processor.

• While a DMA transfer is taking place, the processor can be used to execute another program.

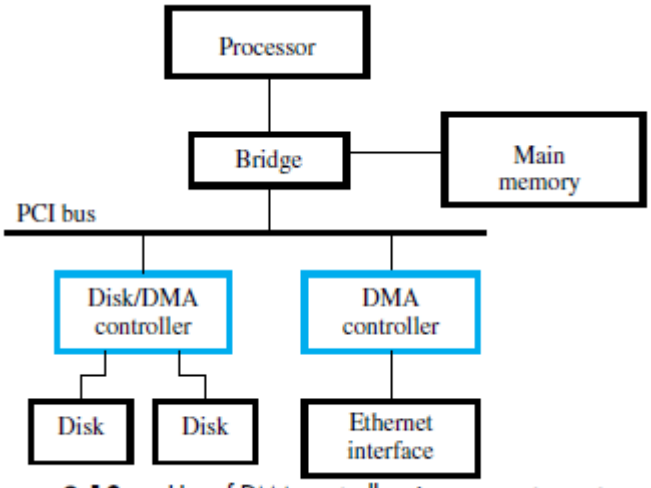



**Figure 8.13** Use of DMA controllers in a computer system.

• DMA interface has three registers (Figure8.12):
  1) First register is used for storing starting-address.
  2) Second register is used for storing word-count.
  3) Third register contains status- &control-flags.

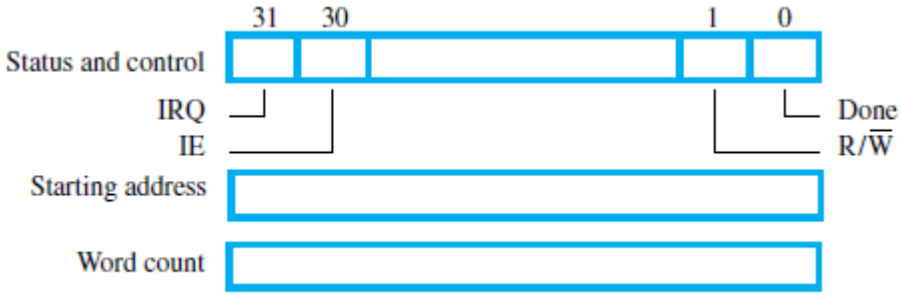



**Figure 8.12** Typical registers in a DMA controller.

• The R/W bit determines direction of transfer.
  If R/W=1, controller performs a read-operation (i.e. it transfers data from memory to I/O),
  Otherwise, controller performs a write-operation (i.e. it transfers data from I/O to memory).

• If Done=1, the controller
  → has completed transferring a block of data and
  → is ready to receive another command. (IE Interrupt Enable).

• If IE=1, controller raises an interrupt after it has completed transferring a block of data.
• If IRQ=1, controller requests an interrupt.
• Requests by DMA devices for using the bus are always given higher priority than processor requests.
• There are 2 ways in which the DMA operation can be carried out:
  1) Processor originates most memory-access cycles.
  ➢ DMA controller is said to "steal" memory cycles from processor.

- Hence, this technique is usually called **Cycle Stealing**.

2) DMA controller is given exclusive access to main-memory to transfer a block of data without any interruption. This is known as **Block Mode** (or burst mode).

### 2.4.1 BUS ARBITRATION

- The device that is allowed to initiate data-transfers on bus at any given time is called **bus-master**.
- There can be only one bus-master at any given time.
- **Bus Arbitration** is the process by which
  → next device to become the bus-master is selected &
  → bus-mastership is transferred to that device.
- The two approaches are:
  **1) Centralized Arbitration:** A single bus-arbiter performs the required arbitration.
  **2) Distributed Arbitration:** All devices participate in selection of next bus-master.
- A conflict may arise if both the processor and a DMA controller or two DMA controllers try to use the bus at the same time to access the main-memory.
- To resolve this, an arbitration procedure is implemented on the bus to coordinate the activities of all devices requesting memory transfers.
- The bus arbiter may be the processor or a separate unit connected to the bus.

### CENTRALIZED ARBITRATION

- A single bus-arbiter performs the required arbitration (Figure:4.20).
- Normally, processor is the bus-master.
- Processor may grant bus-mastership to one of the DMA controllers.
- A DMA controller indicates that it needs to become bus-master by activating BR line.
- The signal on the BR line is the logical OR of bus-requests from all devices connected to it.
- Then, processor activates BG1 signal indicating to DMA controllers to use bus when it becomes free.
- BG1 signal is connected to all DMA controllers using a daisy-chain arrangement.
- If DMA controller-1 is requesting the bus,
  Then, DMA controller-1 blocks propagation of grant-signal to other devices.
  Otherwise, DMA controller-1 passes the grant downstream by asserting BG2.
- Current bus-master indicates to all devices that it is using bus by activating BBSY line.
- The bus-arbiter is used to coordinate the activities of all devices requesting memory transfers.
- Arbiter ensures that only 1 request is granted at any given time according to a priority scheme.
  (BR □Bus-Request, BG □Bus-Grant, BBSY □Bus Busy).

- The timing diagram shows the sequence of events for the devices connected to the processor.
- DMAcontroller-2
  → requests and acquires bus-mastership and
  → later releases the bus. (Figure: 4.21).
- After DMA controller-2 releases the bus, the processor resources bus-mastership.

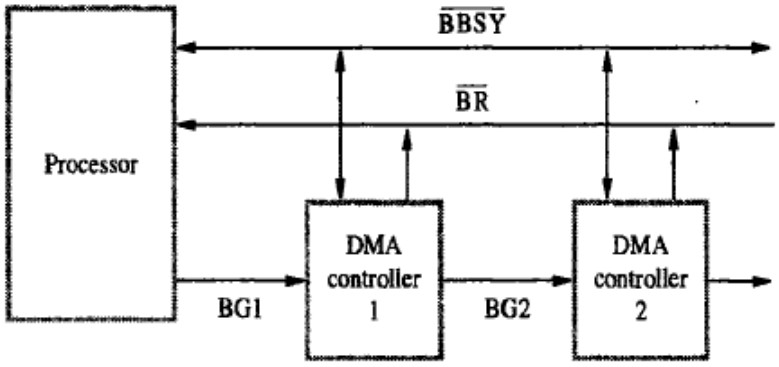



**Figure 4.20** A simple arrangement for bus arbitration using a daisy chain.

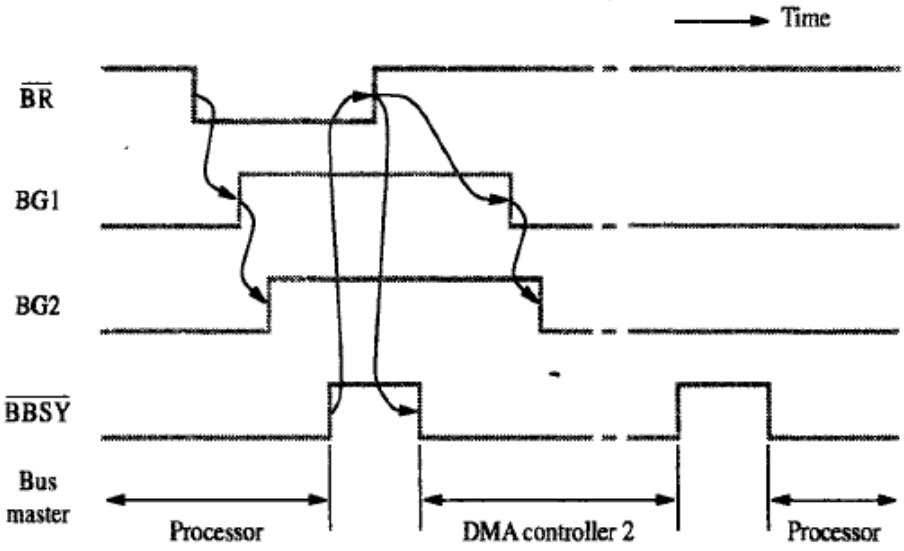



**Figure 4.21** Sequence of signals during transfer of bus mastership for the devices in Figure 4.20.

**DISTRIBUTED ARBITRATION**

- All device participate in the selection of next bus-master (Figure4.22).
- Each device on bus is assigned a 4-bit identification number(ID).
- When 1 or more devices request bus, they
  → assert Start-Arbitration signal &
  → place their 4-bit ID numbers on four open-collector lines $ARB_0$ through $ARB3$.
- A winner is selected as a result of interaction among signals transmitted over these lines.
- Net-outcome is that the code on 4 lines represents request that has the highest ID number.
- **Advantage:**
  This approach offers higher reliability since operation of bus is not dependent on any single device.

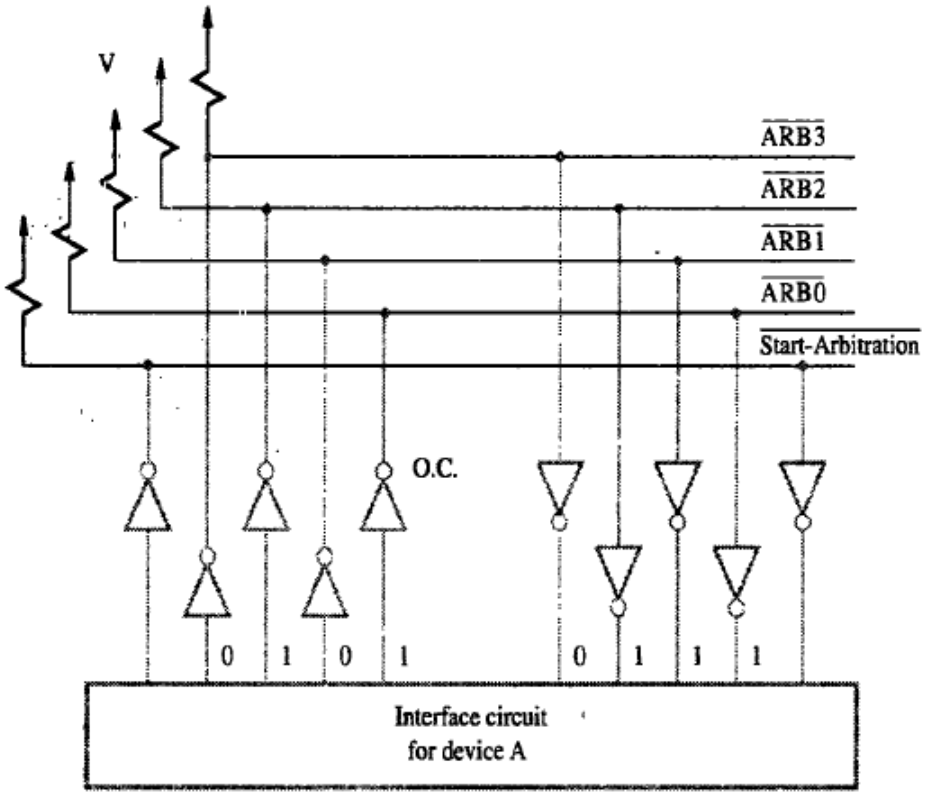



**Figure 4.22** A distributed arbitration scheme.

For E.g.

- Assume 2 devices A & B have their ID 5 (0101), 6 (0110) and their code is0111.
- Each device compares the pattern on the arbitration line to its own ID starting from MSB.
- If the device detects a difference at any bit position, it disables the drivers at that bit position.
- Driver is disabled by placing ”0” at the input of the driver.
- In e.g. “A” detects a difference in line ARB1, hence it disables the drivers on lines ARB1 &ARB0.
- This causes pattern on arbitration-line to change to 0110. This means that “B” has won contention.

## 2.5 BUSES

→It is used to inter-connect main-memory, processor & I/O-devices
→ It includes lines needed to support interrupts & arbitration.

- Primary function: To provide a communication-path for transfer of data.
- **Bus protocol** is set of rules that govern the behavior of various devices connected to the buses.
- Bus-protocol specifies parameters such as:
  → asserting control-signals
  → timing of placing information on bus
  → rate of data-transfer.
- A typical bus consists of 3 sets of lines:

1) Address
2) Data&
3) Control lines.

- Control-signals
  → specify whether a read or a write-operation is to be performed.
  → carry timing information i.e. they specify time at which I/O-devices place data on the bus.
- R/W line specifies
  → read-operation when R/W=1.
  → write-operation when R/W=0.

- During data-transfer operation,
  - One device plays the role of a bus-master.
  - Master-device initiates the data-transfer by issuing read/write command on the bus.
  - The device addressed by the master is called as Slave.
- Two types of Buses: 1) Synchronous and 2)Asynchronous.

### 2.5.1 SYNCHRONOUS BUS

- All devices derive timing-information from a common clock-line.
- Equally spaced pulses on this line define equal time intervals.
- During a ”bus cycle“, one data-transfer can take place.

**A sequence of events during a read-operation**

- At time t0, the master(processor)
  → places the device-address on address-lines &
  → sends an appropriate command on control-lines (Figure 7.3).
- The command will
  → indicate an input operation &
  → specify the length of the operand to be read.
- Information travels over bus at a speed determined by physical & electrical characteristics.
- Clock pulse width(t1-t0) must be longer than max. propagation-delay b/w devices connected to bus.
- The clock pulse width should be long to allow the devices to decode the address & control signals.
- The slaves take no action or place any data on the bus before t1.
- Information on bus is unreliable during the period t0 to t1 because signals are changing state.
- Slave places requested input-data on data-lines at time t1.
- At end of clock cycle (at time t2), master strobes (captures) data on data-lines into its input-buffer
- For data to be loaded correctly into a storage device,
  data must be available at input of that device for a period greater than setup-time of device.

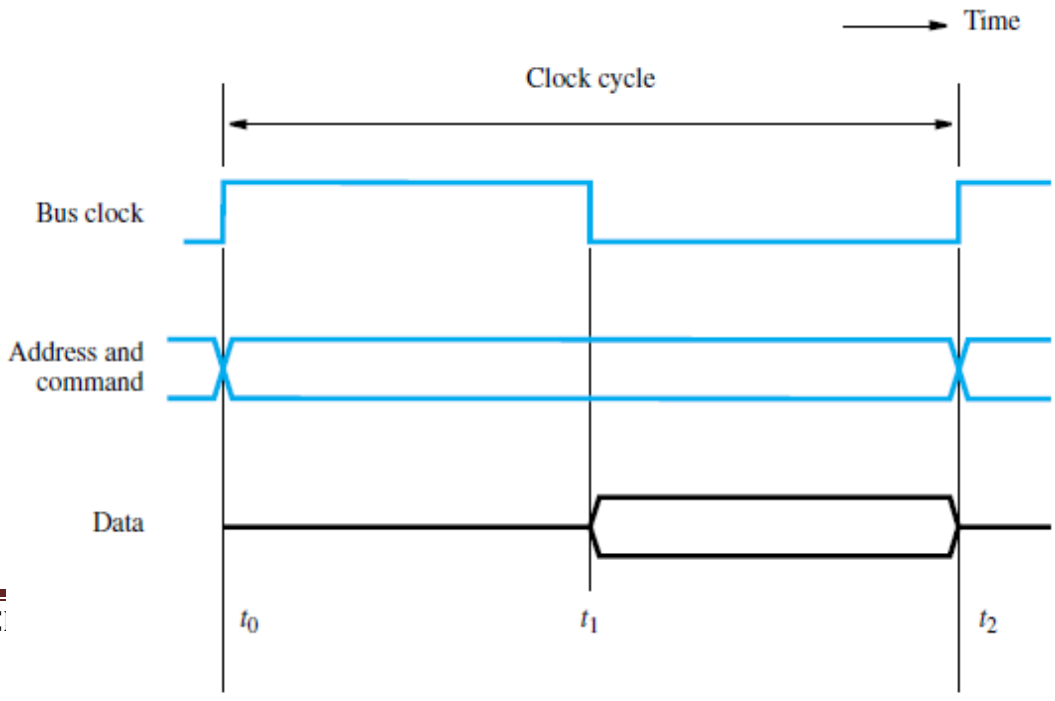



**Figure 7.3** Timing of an input transfer on a synchronous bus.

**A Detailed Timing Diagram for the Read-operation**

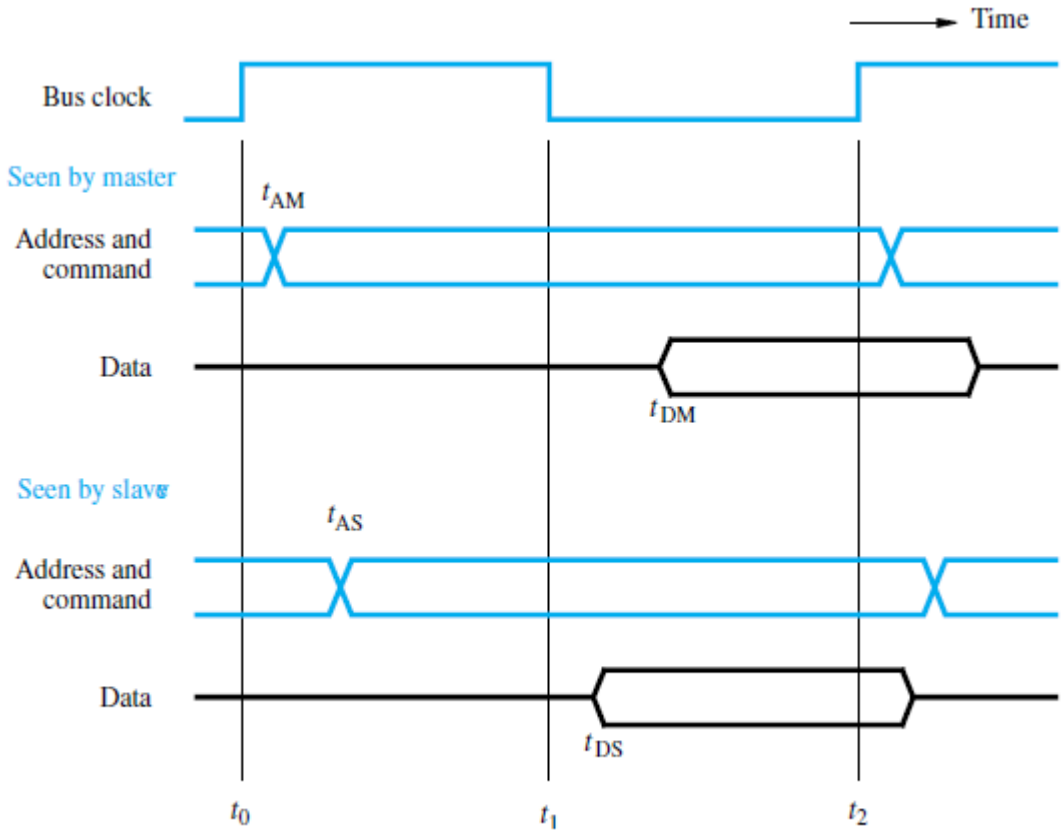



**Figure 7.4** A detailed timing diagram for the input transfer of Figure 7.3.

- The picture shows two views of the signal except the clock (Figure7.4).
- One view shows the signal seen by the master & the other is seen by thesalve.
- Master sends the address & command signals on the rising edge at the beginning of clock period(t0).
- These signals do not actually appear on the bus untiltam.
- Sometimes later, at tASthe signals reach theslave.
- The slave decodes theaddress.
- At t1, the slave sends therequested-data.
- At t2, the master loads the data into itsinput-buffer.
- Hence the period t2, tDM is the setup time for the master'sinput-buffer.
- The data must be continued to be valid after t2, for a period equal to the hold time of thatbuffers.

**Disadvantages**

- The device does notrespond.
- The error will not bedetected.

**Multiple Cycle Transfer for Read-operation**

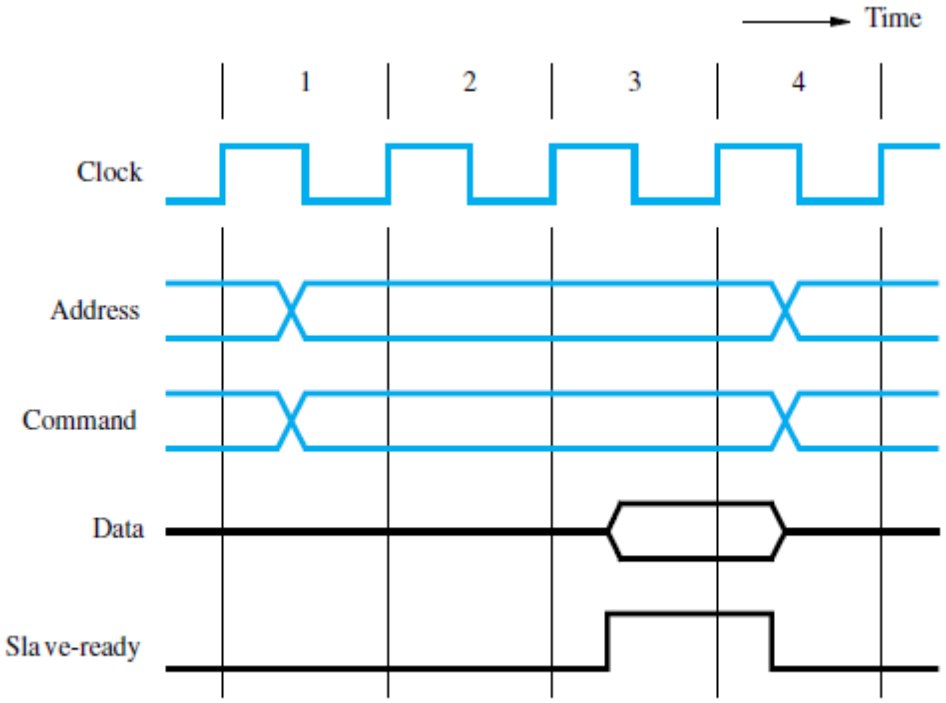



**Figure 7.5** An input transfer using multiple clock cycles.

- During, clock cycle-1, master sends address/command info the bus requesting a "read"operation.
- The slave receives & decodes address/command information (Figure7.5).
- At the active edge of the clock i.e. the beginning of clock cycle-2, it makes accession to respond immediately.
- The data become ready & are placed in the bus at clockcycle-3.
- At the same times, the slave asserts a control signal called**slave-ready**.
- The master strobes the data to its input-buffer at the end of clockcycle-3.
- The bus transfer operation is nowcomplete.
- And the master sends a new address to start a new transfer in clockcycle4.
- The slave-ready signal is an acknowledgement from the slave to themaster.

**ASYNCHRONOUS BUS**

- This method uses handshake-signals between master and slave for coordinatingdata-transfers.
- There are 2control-lines:
  - **1) Master-Ready (MR)** is used to indicate that master is ready for atransaction.
  - **2) Slave-Ready (SR)** is used to indicate that slave is ready for atransaction.

**The Read Operation proceeds as follows:**

- At $t_0$, master places address/command information onbus.
- At $t_1$, master sets MR-signal to 1 to inform all devices that the address/command-info isready.
  - MR-signal =1 causes all devices on the bus to decode the address.
  - The delay $t_1 - t_0$ is intended to allow for any skew that may occurs on thebus.
  - Skew occurs when 2 signals transmitted from 1 source arrive at destination at differenttime
  - Therefore, the delay $t_1 - t_0$ should be larger than the maximum possible busskew.
- At $t_2$,slave
  - → performs required input-operation &
  - → sets SR signal to 1 to inform all devices that it is ready (Figure 7.6).
- At $t_3$, SR signal arrives at master indicating that the input-data are available onbus.
- At $t_4$, master removes address/command information frombus.
- At $t_5$, when the device-interface receives the 1-to-0 transition of MR signal, it removes data and SR signal from the bus. This completes the inputtransfer.

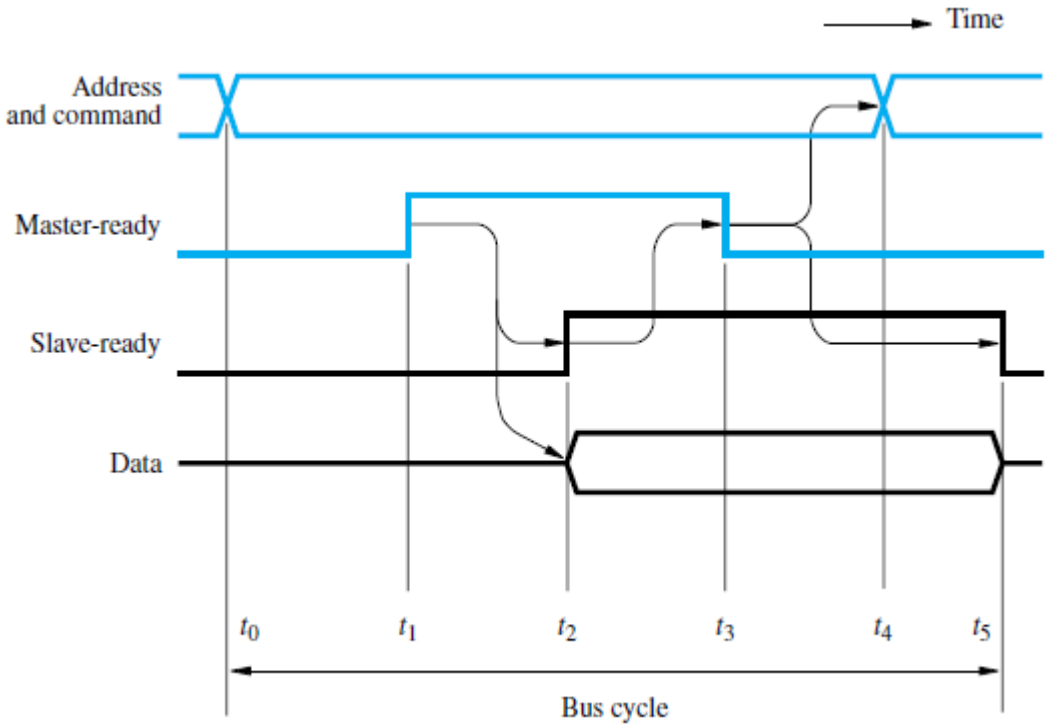



**Figure 7.6** Handshake control of data transfer during an input operation.

- A change of state is one signal is followed by a change is the other signal. Hence this scheme is called as **FullHandshake**.
- **Advantage:** It provides the higher degree of flexibility andreliability.

## 2.6 INTERFACE-CIRCUITS

- An **I/O Interface** consists of the circuitry required to connect an I/O device to a computer-bus.
- On one side of the interface, we have bus signals.

  On the other side, we have a data path with its associated controls to transfer data between the interface and the I/O device known as **port**.
- Two types are:

  **1. Parallel Port** transfers data in the form of a number of bits (8 or 16) simultaneously to or from the device.

  **2. Serial Port** transmits and receives data one bit at a time.
- Communication with the bus is the same for both formats.
- The conversion from the parallel to the serial format, and vice versa, takes place inside the interface-circuit.
- In parallel-port, the connection between the device and the computer uses

  → a multiple-pin connector and

  → a cable with as many wires.
- This arrangement is suitable for devices that are physically close to the computer.
- In serial port, it is much more convenient and cost-effective where longer cables are needed.

**Functions of I/O Interface**

1) Provides a storage buffer for at least one word of data.

2) Contains status-flags that can be accessed by the processor to determine whether the buffer is full or empty.

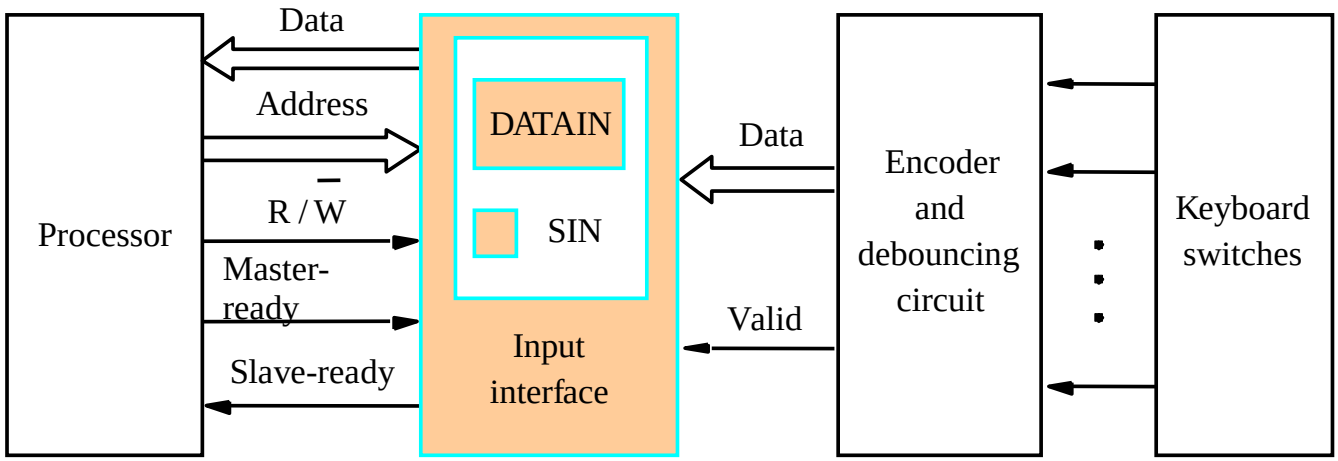
3) Contains address-decoding circuitry to determine when it is being addressed by the processor.

4) Generates the appropriate timing signals required by the bus control scheme.

5) Performs any format conversion that may be necessary to transfer data between the bus and the I/O device (such as parallel-serial conversion in the case of a serial port).

**PARALLEL-PORT**

Parallel port transfers data in the form of a number of bits, normally 8 or 16 to or from the device




- The output of the encoder consists of
  → bits representing the encoded character and
  → one signal called **valid**, which indicates the key is pressed.
- The information is sent to the interface-circuits (Figure7.10).
- Interface-circuits contain
  1) Data register DATAIN&
  2) Status-flag SIN.
- When a key is pressed, the Valid signal changes from 0 to1.
  Then, SIN=1 when ASCII code is loaded into DATAIN.
  SIN = 0 when processor reads the contents of the DATAIN.
- The interface-circuit is connected to the asynchronous bus.
- Data transfers on the bus are controlled using the handshake signals:
  1) Master ready &
  2) Slave ready.

**INPUT-INTERFACE-CIRCUIT**

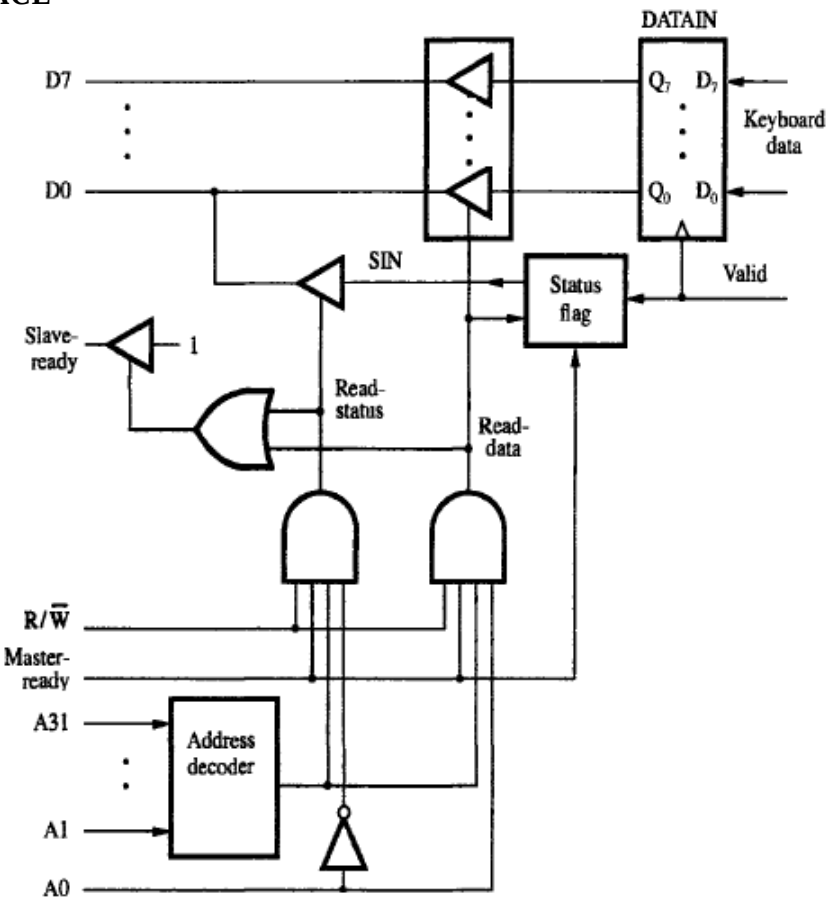



**Figure 4.29: Input-interface-circuit**

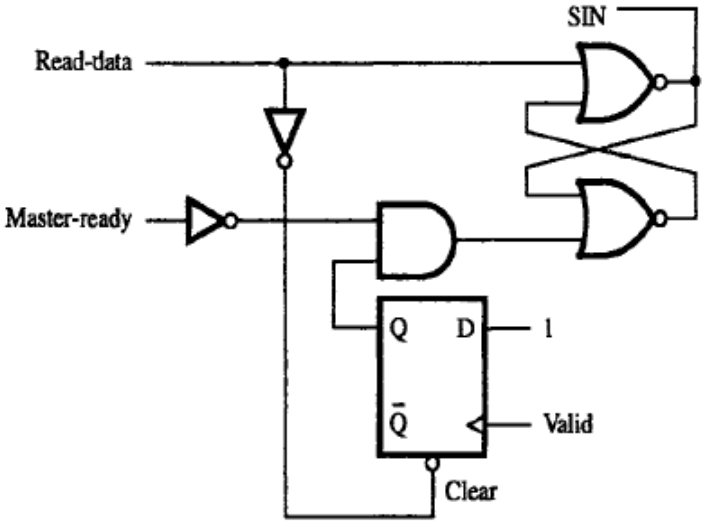


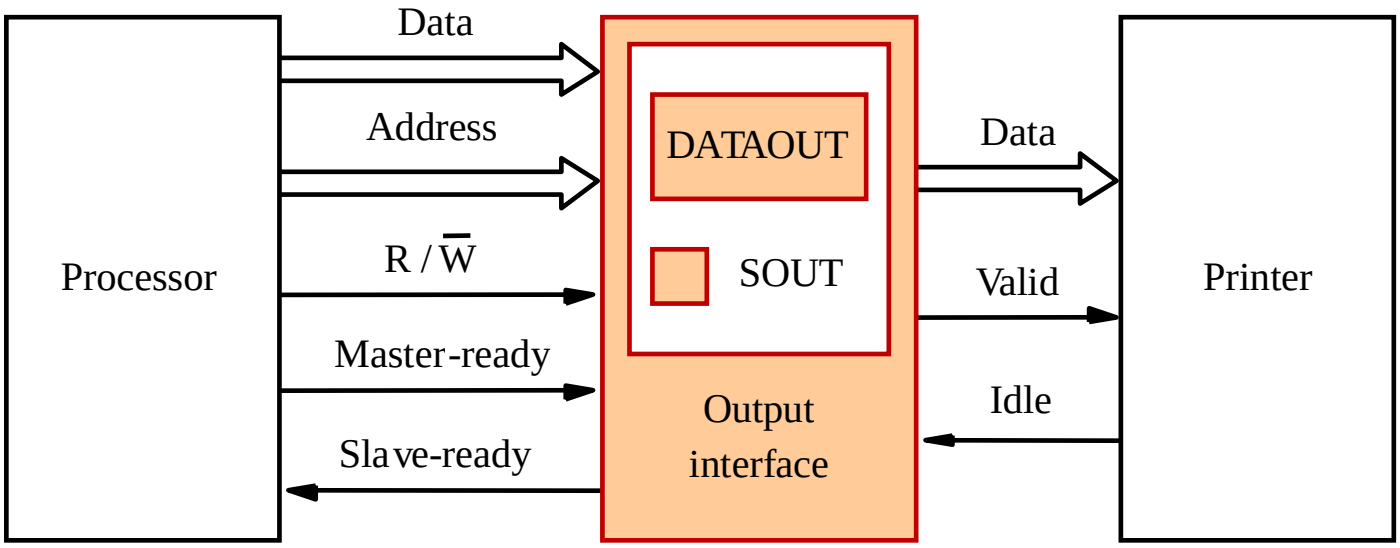

**Figure 4.30** Circuit for the status flag block in Figure 4.29.

- Output-lines of DATAIN are connected to the data-lines of bus by means of 3-state drivers (Fig4.29).

Device address and
→ processor issues a read signal and
→ address selects DATAIN.

- SIN signal is generated using a status-flag circuit (Figure4.30).
  SIN signal is connected to line D0 of the processor-bus using a 3-state driver.
- Address-decoder selects the input-interface based on bits A1 through A31.
- Bit A0 determines whether the status or data register is to be read, when Master-ready is active.
- Processor activates the Slave-ready signal, when either the Read-status or Read-data is equal to1.

**PRINTER INTERFACED TO PROCESSOR**

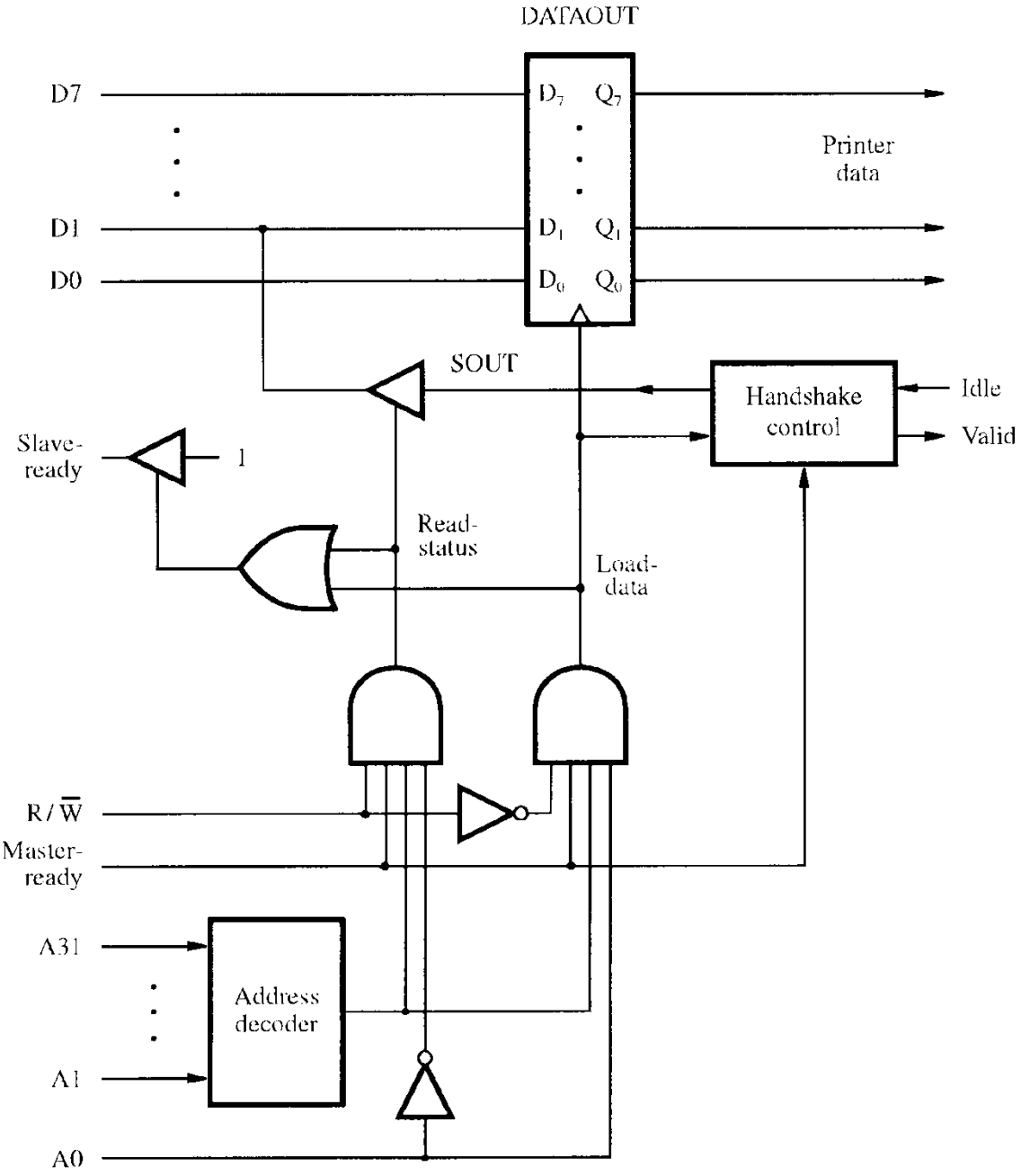



- *Printer is connected to a processor using a parallel port.*
- *Processor is 32 bits, uses memory-mapped I/O and asynchronous bus protocol.*
- *On the processor side:*

*- Data lines.*
*- Address lines*
*- Control or R/W line.*
*- Master-ready signal and*
*- Slave-ready signal.*

- *On the printer side:*

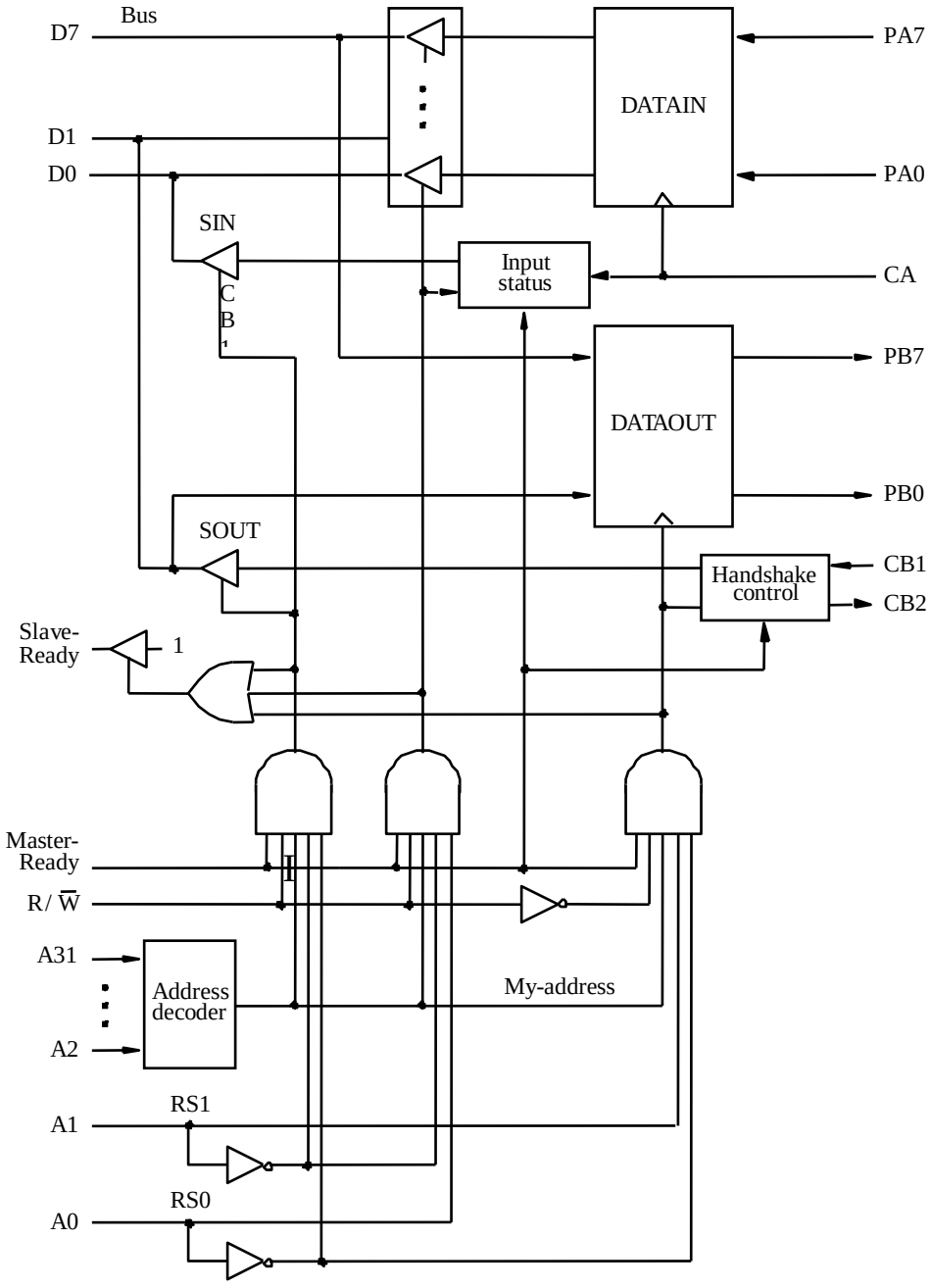
*- Idle signal line which the printer asserts when it is ready to accept a character. This causes the SOUT flag to be set to 1.*
*- Processor places a new character into a DATAOUT register.*
*- Valid signal, asserted by the interface circuit when it places a new character on the data lines.*




- Data lines of the processor bus are connected to the DATAOUT register of the interface.
- The status flag SOUT is connected to the data line D1 using a three-state driver.
- The three-state driver is turned on, the control Read-status line is1.
- Address decoder selects the output interface using address lines A1 through A31.
- Address line A0 determines whether the data is to be loaded into the DATAOUT register or status flag is to be read.
- If the Load-data line is 1, then the Valid line is set to 1.
- If the Idle line is 1, then the status flag SOUT is set to 1.

**Combined I/O interface circuit**

- Address bits A2 through A31, that is 30 bits are used to select the overall interface.
- Address bits A1 through A0, that is, 2 bits select one of the three registers, namely, DATAIN, DATAOUT, and the status register.
- Status register contains the flags SIN and SOUT in bits 0 and 1.
- Data lines PA0 through PA7 connect the input device to the DATAIN register.
- DATAOUT register connects the data lines on the processor bus to lines PB0through PB7 which connect to the output device.
- Separate input and output data lines for connection to an I/O device.



**GENERAL 8 BIT PARALLEL PROCESSING**

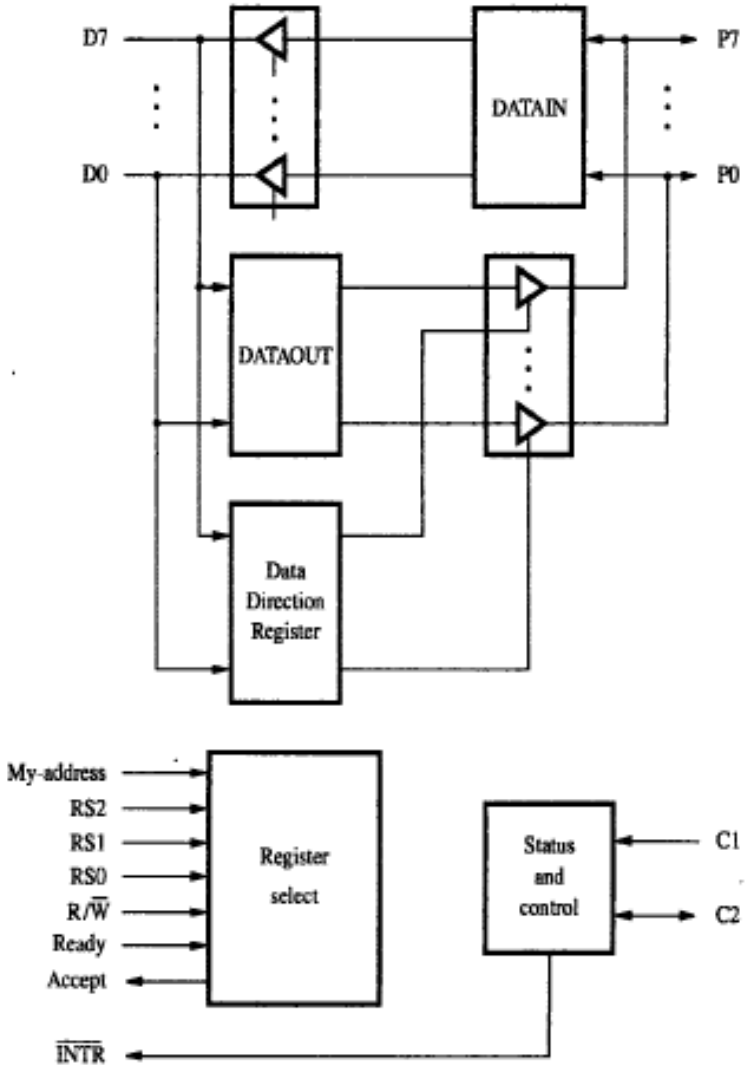



**Figure 4.34: General 8 bit parallel interface**

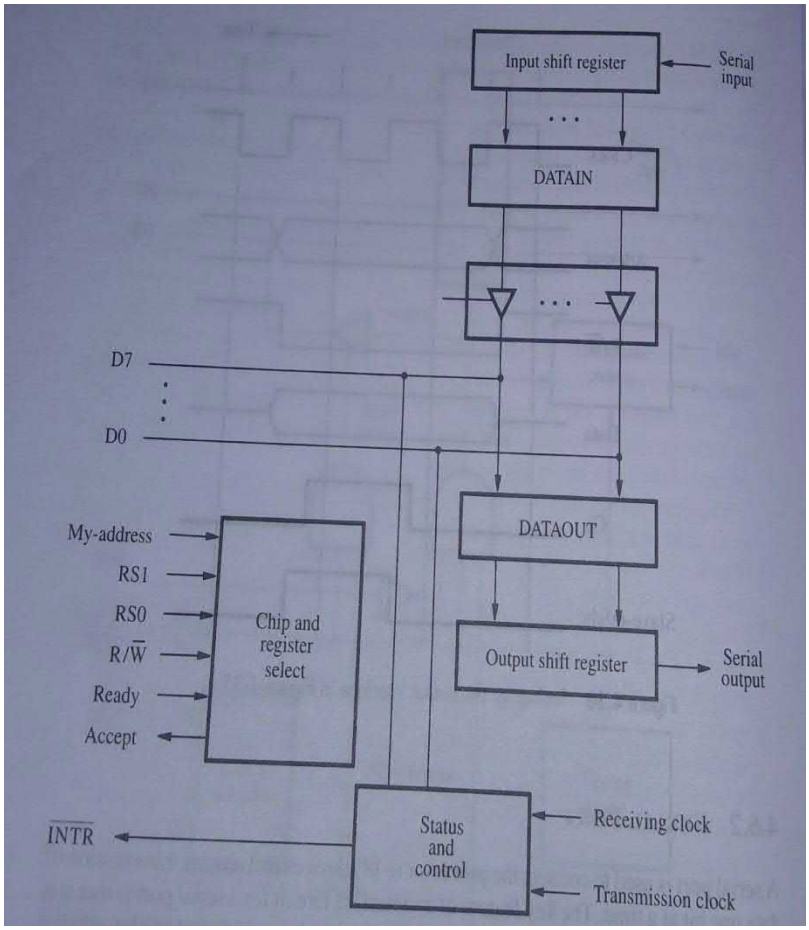
- Data-lines **P7** through **PO** can be used for either input or output purposes (Figure4.34).
- For increased flexibility,
  → some lines can be used as inputs and
  → some lines can be used as outputs.
- The **DATAOUT** register is connected to data-lines via 3-state drivers that are controlled by a **DDR**.
- The processor can write any 8-bit pattern into DDR. (DDR □Data Direction Register).
- If DDR=1,
  Then, data-line acts as an output-line;
  Otherwise, data-line acts as an input-line.
- Two lines, **C1** and **C2** are used to control the interaction between interface-circuit and I/0 device.
  Two lines, C1 and C2 are also programmable.
- Line C2 is bidirectional to provide different modes of signaling, including the handshake.
- The **Ready** and **Accept** lines are the handshake control lines on the processor-bus side.
  Hence, the Ready and Accept lines can be connected to Master-ready and Slave-ready.
- The input signal **My-address** should be connected to the output of an address-decoder.
  The address-decoder recognizes the address assigned to the interface.

- There are 3 register select lines :**RS0-RS2**.
  Three register select lines allows up to eight registers in the interface.
- An interrupt-request **INTR** is also provided.
  INTR should be connected to the interrupt-request line on the computer-bus.

**Serial port**

- Serial port is used to connect the processor to I/O devices that require transmission of data one bit at a time.
- Serial port communicates in a bit-serial fashion on the device side and bit parallel fashion on the bus side.

Transformation between the parallel and serial formats is achieved with shift registers that have parallel access capability




- Input shift register accepts input one bit at a time from the I/O device.
- Once all the 8 bits are received, the contents of the input shift register are loaded in parallel into DATAIN register.
- Output data in the DATAOUT register are loaded into the output shift register.
- Bits are shifted out of the output shift register and sent out to the I/O device one bit at a time.
- As soon as data from the input shift reg, are loaded into DATAIN, it can start

accepting another 8 bits of data.

- Input shift register and DATAIN registers are both used at input so that the input shift register can start receiving another set of 8 bits from the input device after loading the contents to DATAIN, before the processor reads the contents of DATAIN. This is called as double-buffering.

## 2.7 STANDARD I/O INTERFACE

- Consider a computer system using different interface standards.
- Let us look in to Processor bus and Peripheral Component Interconnect (PCI) bus (Figure4.38).
- These two buses are interconnected by a circuit called **Bridge**.
- The bridge translates the signals and protocols of one bus into another.
- The bridge-circuit introduces a small delay in data transfer between processor and the devices.

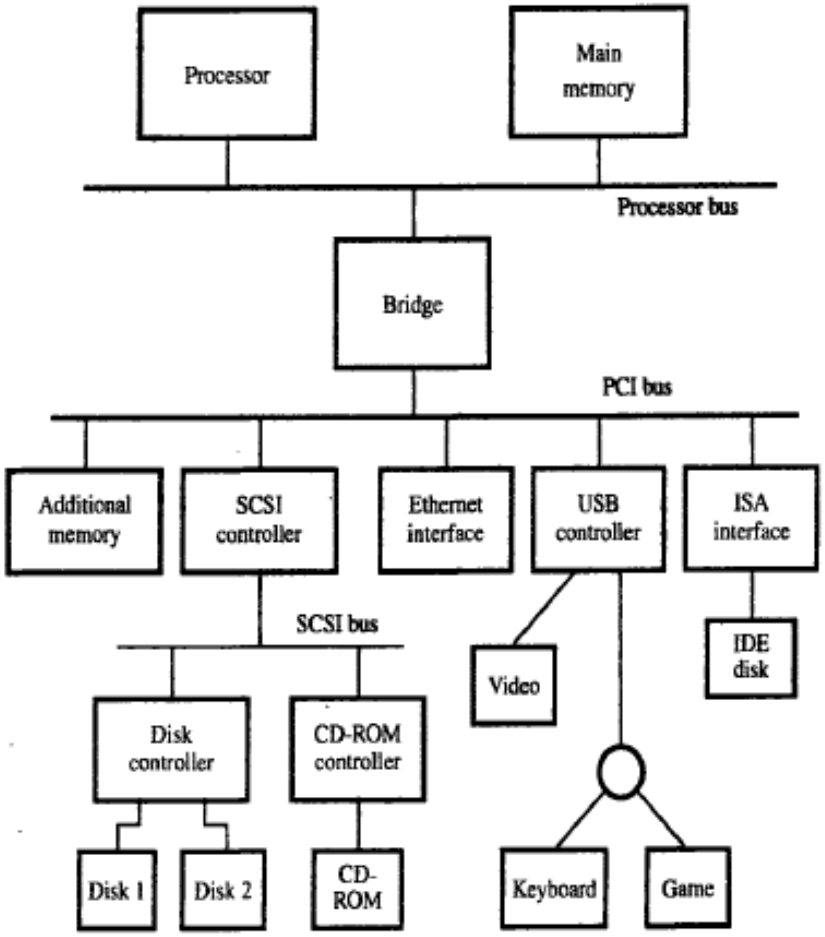



**Figure 4.38** An example of a computer system using different interface standards.

- The 3 major standard I/O interfaces are:
  1) PCI (Peripheral Component Interconnect)
  2) SCSI (Small Computer System Interface)
  3) USB (Universal Serial Bus)
- PCI defines an expansion bus on the motherboard.
- SCSI and USB are used for connecting additional devices both inside and outside the computer-box.
- SCSI bus is a high speed parallel bus intended for devices such as disk and video display.
- USB uses a serial transmission to suit the needs of equipment ranging from keyboard to game control to internal connection.
- IDE (Integrated Device Electronics) disk is compatible with ISA which shows the connection to an Ethernet.

**PCI**

- Introduced in 1992

• PCI is developed as a low cost bus that is truly processor independent.
• PCI supports high speed disk, graphics and video devices.
• PCI has plug and play capability for connecting I/O devices.
• To connect new devices, the user simply connects the device interface board to the bus.

**DATA TRANSFER IN PCI**

• The data are transferred between cache and main-memory.
• The data is a sequence of words which are stored in successive memory-locations.
• During **read-operation**,
  - When the processor specifies an address, the memory responds by sending a sequence of data-words from successive memory-locations.
• During **write-operation**,
  - When the processor sends an address, a sequence of data-words is written into successive memory-locations.
• PCI supports read and write-operation.
• A read/write-operation involving a single word is treated as a burst of length one.
• PCI has 3 address-spaces. They are
  1) Memory address-space
  2) I/O address-space&
  3) Configuration address-space.
• I/O Address-space Intended for use with processor.
  Configuration space Intended to give PCI, its plug and play capability.
• **PCI Bridge** provides a separate physical connection to main-memory.
• The master maintains the address information on the bus until data-transfer is completed.
• At any time, only one device acts as **Bus-Master**.
• A master is called "initiator" which is either processor or DMA.
• The addressed-device that responds to read and write commands is called a **Target.**
• Acompletetransferoperationonthebus,involvinganaddressandburstofdataiscalleda **transaction.**

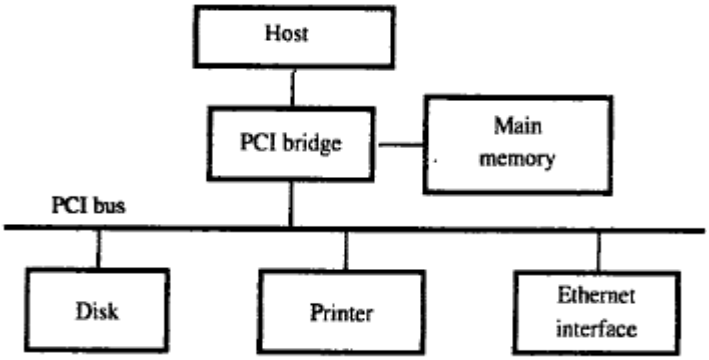



**Figure 4.39** Use of a PCI bus in a computer system.

**Table 7.1** Data transfer signals on the PCI bus.

| Name | Function |
|---|---|
| CLK | A 33-MHz or 66-MHz clock |
| FRAME# | Sent by the initiator to indicate the duration of a transmission |
| AD | 32 address/data lines, which may be optionally increased to 64 |
| C/BE# | 4 command/byte-enable lines (8 for a 64-bit bus) |
| IRDY#, TRDY# | Initiator-ready and Target-ready signals |
| DEVSEL# | A response from the device indicating that it has recognized its address and is ready for a data transfer transaction |
| IDSEL# | Initialization Device Select |

• Individual word transfers are called" **phases'**.

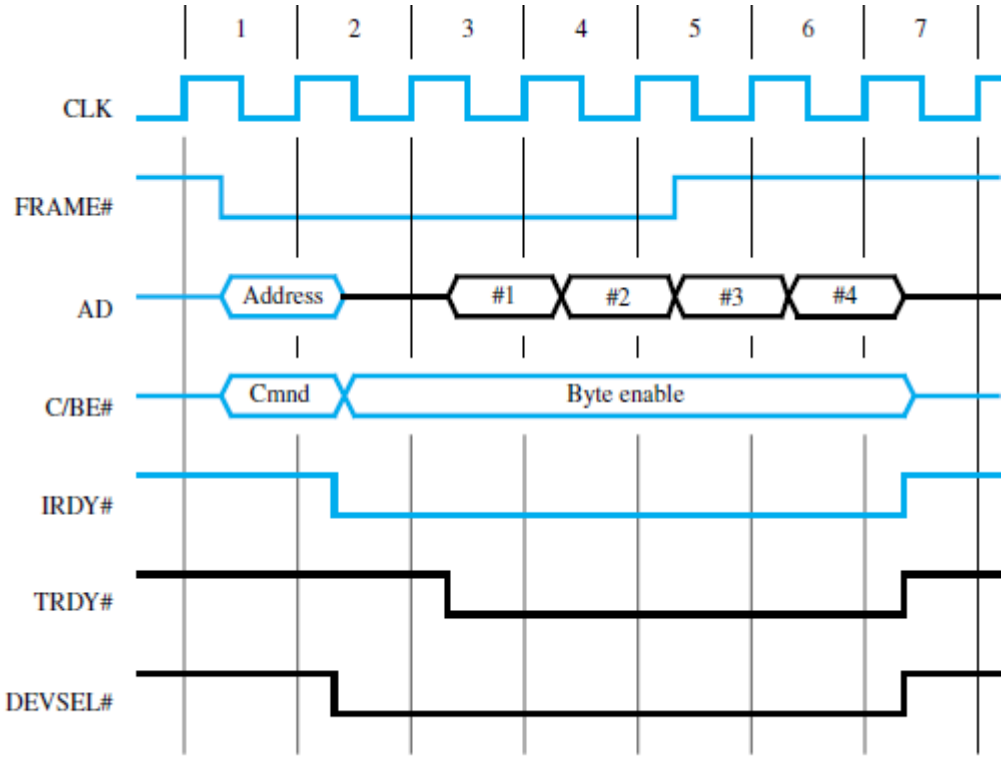



**Figure 7.19** A Read operation on the PCI bus.

- During Clockcycle-1,
  - The processor
    - → asserts FRAME# to indicate the beginning of a transaction;
    - → sends the address on AD lines and command on C/BE# Lines.
- During Clockcycle-2,
  - The processor removes the address and disconnects its drives from AD lines.
  - Selected target
    - → enables its drivers on AD lines and
    - → fetches the requested-data to be placed on bus.
  - Selected target
    - → asserts DEVSEL# and
    - → maintains it in asserted state until the end of the transaction.
  - C/BE# is
    - → used to send a bus command and it is
    - → used for different purpose during the rest of the transaction.
- During Clockcycle-3,
  - The initiator asserts IRDY# to indicate that it is ready to receive data.
  - If the target has data ready to send then it asserts TRDY#. In our eg, the target sends 3 more words of data in clock cycle 4 to6.
- During Clockcycle-5
  - The indicator uses FRAME# to indicate the duration of the burst, since it read 4 words, the initiator negates FRAME# during clock cycle5.
- During Clockcycle-7,
  - After sending $4^{th}$word, the target

→ disconnects its drivers and

→ negates DEVSEL# during clock cycle 7.

**DEVICE CONFIGURATION OF PCI**

- The PCI has a configuration ROM that stores information about that device.
- The configuration ROM's of all devices are accessible in the configuration address-space.
- The initialization software read these ROM's whenever the system is powered up or reset.
- In each case, it determines whether the device is a printer, keyboard or disk controller.
- Devices are assigned address during initialization process.
- Each device has an input signal called IDSEL# (Initialization device select) which has 21 address-lines (AD11 to AD31).
- During configuration operation,
  - The address is applied to AD input of the device and
  - The corresponding AD line is set to 1 and all other lines are set to0.

    AD11 - AD31 **Upper** address-line

    A0 -A10 **Lower**address-line:Specifythetypeoftheoperationandtoaccessthecontent of device configuration ROM.
- The configuration software scans all 21 locations. PCI bus has interrupt-request lines.
- Each device may requests an address in the I/O space or memory space

**SCSI Bus**

- SCSI stands for Small Computer System Interface.
- SCSI refers to the standard bus which is defined by ANSI (American National Standard Institute).
- SCSI bus the several options. It maybe,

| | |
|---|---|
| Narrow bus | It has 8 data-lines & transfers 1 byte at a time. |
| Wide bus | It has 16 data-lines & transfer 2 byte at a time. |
| Single-Ended Transmission | Each signal uses separate wire. |
| HVD (High Voltage Differential) | It was 5v (TTL cells) |
| LVD (Low Voltage Differential) | It uses 3.3v |

- Because of these various options, SCSI connector may have 50, 68 or 80 pins. The data transfer rate ranges from 5MB/s to 160MB/s 320Mb/s, 640MB/s. The transfer rate depends on,
  1) Length of the cable
  2) Number of devices connected.
- To achieve high transfer rate, the bus length should be 1.6m for SE signaling and 12m for LVD signaling.
- The SCSI bus us connected to the processor-bus through the SCSI controller. The data are stored on a disk in blocks called sectors.

Each sector contains several hundreds of bytes. These data will not be stored in contiguous memory-location.

- SCSI protocol is designed to retrieve the data in the first sector or any other selected sectors.
- Using SCSI protocol, the burst of data are transferred at high speed.
- The controller connected to SCSI bus is of 2 types. They are1) Initiator * 2)Target

**1) Initiator**

- It has the ability to select a particular target & to send commands specifying the operation to be performed.
- They are the controllers on the processor side.

**2) Target**

- The disk controller operates as a target.
- It carries out the commands it receive from the initiator.
- The initiator establishes a logical connection with the intended target.

**Steps for Read-operation**

1) The SCSI controller contends for control of the bus(initiator).
2) When the initiator wins the arbitration-process, the initiator
   → selects the target controller and
   → hands over control of the bus to it.
3) The target starts an output operation. The initiator sends a command specifying the required read-operation.
4) The target
   → sends a message to initiator indicating that it will temporarily suspend connection b/w them.
   → then releases the bus.
5) The target controller sends a command to the disk drive to move the read head to the first sector involved in the requested read-operation.
6. The target
   → transfers the contents of the data buffer to the initiator and
   → then suspends the connection again.
7) The target controller sends a command to the disk drive to perform another seek operation.
8) As the initiator controller receives the data, it stores them into the main-memory using the DMA approach.
9) The SCSI controller sends an interrupt to the processor indicating that the data are now available.

**BUS SIGNALS OF SCSI**

• The bus has no address-lines. Instead, it has data-lines to identify the bus-controllers involved in the selection/reselection/arbitration-process.
• For narrow bus, there are 8 possible controllers numbered from 0 to 7. For a wide bus, there are 16 controllers.
• Once a connection is established b/w two controllers, there is no further need for addressing & the data-lines are used to carry the data.

**Table 4.4** The SCSI bus signals

| Category | Name | Function |
|---|---|---|
| Data | –DB(0) to –DB(7) | Data lines: Carry one byte of information during the information transfer phase and identify device during arbitration, selection and reselection phases |
| | –DB(P) | Parity bit for the data bus |
| Phase | –BSY | Busy: Asserted when the bus is not free |
| | –SEL | Selection: Asserted during selection and reselection |
| Information type | –C/D | Control/Data: Asserted during transfer of control information (command, status or message) |
| | –MSG | Message: indicates that the information being transferred is a message |
| Handshake | –REQ | Request: Asserted by a target to request a data transfer cycle |
| | –ACK | Acknowledge: Asserted by the initiator when it has completed a data transfer operation |
| Direction of transfer | –I/O | Input/Output: Asserted to indicate an input operation (relative to the initiator) |
| Other | –ATN | Attention: Asserted by an initiator when it wishes to send a message to a target |
| | –RST | Reset: Causes all device controls to disconnect from the bus and assume their start-up state |

• All signal names are proceeded by minus sign.

• This indicates that the signals are active or that the data-line is equal to 1, when they are in the low voltage state.

**PHASES IN SCSI BUS**

- The phases in SCSI bus operation are:
  1) Arbitration
  2) Selection
  3) Information transfer
  4) Reselection

**1) Arbitration**

- When the –BSY signal is in inactive state,
  → the bus will be free &
  → any controller can request the use of bus.
- SCSI uses distributed arbitration scheme because each controller may generate requests at the same time.
- Each controller on the bus is assigned a fixed priority.
- When –BSY becomes active, all controllers that are requesting the bus
  → examines the data-lines &
  → determine whether highest priority device is requesting bus at the same time.
- The controller using the highest numbered line realizes that it has won the arbitration-process.
- At that time, all other controllers disconnect from the bus & wait for –BSY to become inactive again.

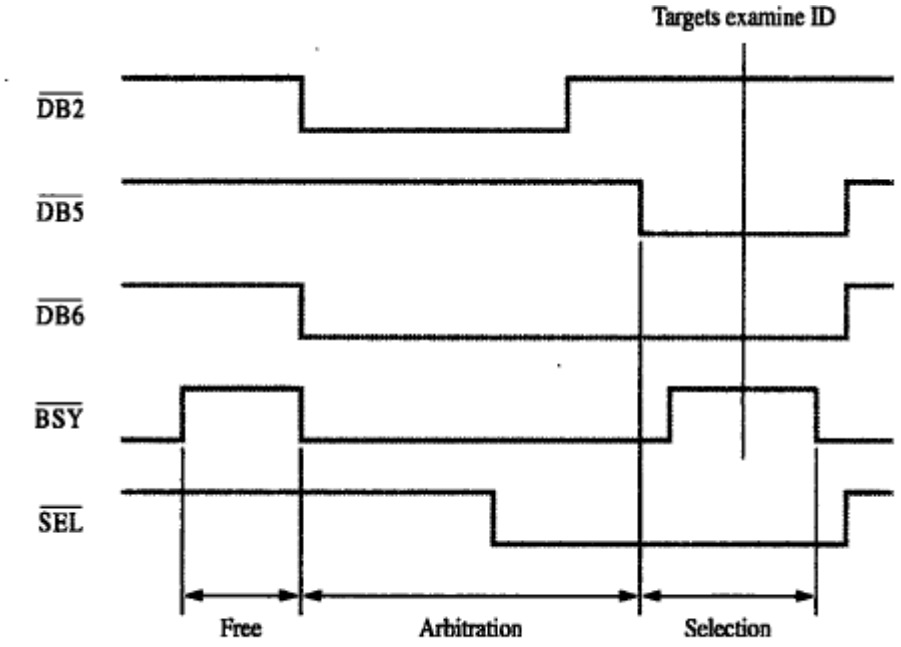



**Figure 4.42** Arbitration and selection on the SCSI bus. Device 6 wins arbitration and selects device 2.

**2) Selection**

- Here, Device
  → wins arbitration and
  → asserts –BSY and –DB6 signals.
- The Select Target Controller responds by asserting–BSY.
- This informs that the connection that it requested is established.

**3) Information Transfer**

- The information transferred between two controllers may consist of
  → commands from the initiator to the target
  → status responses from the target to the initiator or
  → data-transferred to/from the I/0 device.
- Handshake signaling is used to control information transfers, with the target controller taking the role of the bus-master.

**4) Reselection**

• The connection between the two controllers has been reestablished, with the target in control of the bus as required for data transfer to proceed.

**USB**

- USB stands for Universal Serial Bus.
- USB supports 3 speed of operation. They are,
  1) Low speed (1.5Mbps)
  2) Full speed (12 mbps)&
  3) High speed (480mbps).
- The USB has been designed to meet the key objectives. They are,
  1) Provide a simple, low-cost and easy to use interconnection system.
     This overcomes difficulties due to the limited number of I/O ports available on a computer.
  2) Accommodate a wide range of data transfer characteristics for I/O devices.
     For e.g. telephone and Internet connections
  3) Enhance user convenience through a "plug-and-play" mode of operation.
- **Advantage:** USB helps to add many devices to a computer system at any time without opening the computer-box.

**Port Limitation**

- Normally, the system has a few limited ports.
- To add new ports, the user must open the computer-box to gain access to the internal expansion bus & install a new interface card.
- The user may also need to know to configure the device & the s/w.

**Plug & Play**

- The main objective: USB provides a plug & play capability.
- The plug & play feature enhances the connection of new device at any time, while the system is operation.
- The system should
  → Detect the existence of the new device automatically.
  → Identify the appropriate device driver s/w.
  → Establish the appropriate addresses.
  → Establish the logical connection for communication.

**DEVICE CHARACTERISTICS OF USB**

- The kinds of devices that may be connected to a computer cover a wide range of functionality.
- The speed, volume & timing constrains associated with data transfer to & from devices varies significantly.

**Eg: 1 Keyboard**

- Since the event of pressing a key is not synchronized to any other event in a computer system, the data generated by keyboard are called asynchronous.

  The data generated from keyboard depends upon the speed of the human operator which is about 100 bytes/sec.

**Eg: 2 Microphone attached in a computer system internally/externally**

- The sound picked up by the microphone produces an analog electric signal, which must be converted into digital form before it can be handled by the computer.
- This is accomplished by sampling the analog signal periodically.
- The sampling process yields a continuous stream of digitized samples that arrive at regular intervals, synchronized with the sampling clock. Such a stream is called isochronous (i.e.) successive events are separated by equal period of time.
- If the sampling rate in 'S' samples/sec then the maximum frequency captured by sampling process is S/2.
- A standard rate for digital sound is 44.1KHz.

**USB ARCHITECTURE**

• To accommodate a large number of devices that can be added or removed at any time, the USB has the tree structure as shown in the figure7.17.
• Each node of the tree has a device called a **Hub**.
• A hub acts as an intermediate control point between the host and the I/O devices.
• At the root of the tree, a **Root Hub** connects the entire tree to the host computer.
• The leaves of the tree are the I/O devices being served (for example, keyboard or speaker).
• A hub copies a message that it receives from its upstream connection to all its down stream ports.
• As a result, a message sent by the host computer is broadcast to all I/O devices, but only the addressed-device will respond to that message.

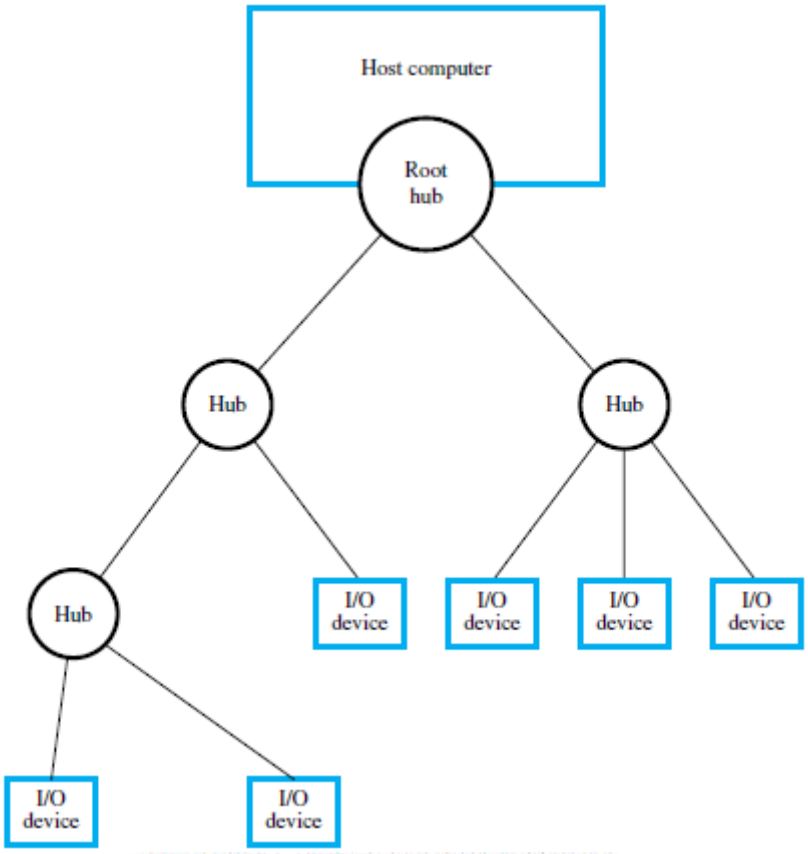



**Figure 7.17** Universal Serial Bus tree structure.

**USB ADDRESSING**

- Each device may be a hub or an I/O device.
- Each device on the USB is assigned a 7-bitaddress.
- This address
  - → is local to the USB tree and
  - → is not related in any way to the addresses used on the processor-bus.
- A hub may have any number of devices or other hubs connected to it, and addresses are assigned arbitrarily.
- When a device is first connected to a hub, or when it is powered-on, it has the address0.
- The hardware of the hub detects the device that has been connected, and it records this fact as part of its own status information.
- Periodically, the host polls each hub to
  - → collect status information and
  - → learn about new devices that may have been added or disconnected.
- When the host is informed that a new device has been connected, it uses sequence of commands to
  - → send a reset signal on the corresponding hub port.
  - → read information from the device about its capabilities.
  - → send configuration information to the device, and
  - → assign the device a unique USB address.
- Once this sequence is completed, the device
  - → begins normal operation and
  - → responds only to the new address.

**USB PROTOCOLS**

- All information transferred over the USB is organized in packets.
- A packet consists of one or more bytes of information.
- There are many types of packets that perform a variety of control functions.
- The information transferred on USB is divided into 2 broad categories: 1) Control and 2)Data.
- Control packets perform tasks such as
  - → addressing a device to initiate data transfer.
  - → acknowledging that data have been received correctly or
  - → indicating an error.
- Data-packets carry information that is delivered to a device.
- A packet consists of one or more fields containing different kinds of information.
- The first field of any packet is called the **Packet Identifier (PID)** which identifies type of that packet.
- They are transmitted twice.
  1) The first time they are sent with their true values and
  2) The second time with each bit complemented.
- The four PID bits identify one of 16 different packet types.
- Some control packets, such as ACK (Acknowledge), consist only of the PID byte.
- Control packets used for controlling data transfer operations are called **Token Packets.**

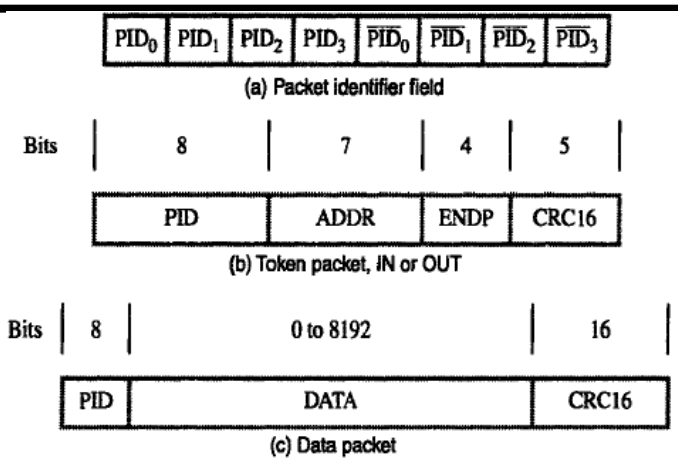
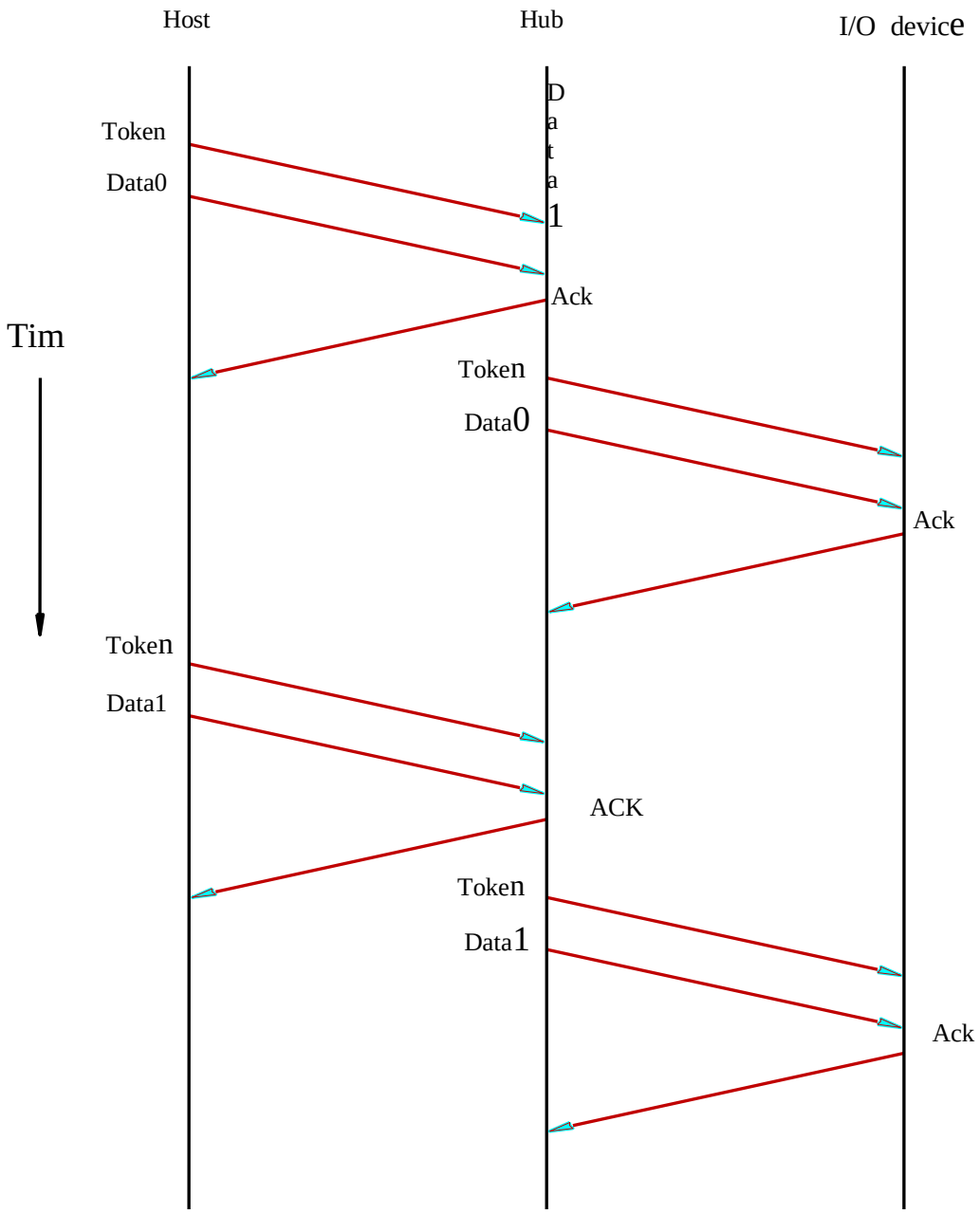



**Figure 4.45** USB packet formats.




**Isochronous Traffic on USB**

- One of the key objectives of the USB is to support the transfer of isochronous data.
- Devices that generates or receives isochronous data require a time reference to control the sampling process.
- To provide this reference. Transmission over the USB is divided into frames of equal length.
- A frame is 1ms long for low-and full-speed data.

- The root hub generates a Start of Frame control packet (SOF) precisely once every 1 ms to mark the beginning of a new frame.
- The arrival of an SOF packet at any device constitutes a regular clock signal that the device can use for its own purposes.
- To assist devices that may need longer periods of time, the SOF packet carries an 11-bit frame number.
- Following each SOF packet, the host carries out input and output transfers for isochronous devices.
- This means that each device will have an opportunity for an input or output transfer once every 1 ms.

ATME College of Engineering

## ATTENDANCE

Course Title with Code : Analog & Digital Electronics 18CS33

Semester & Section : 3 A

| Sl. No. | USN | Student Name | Date | 5 | 7 | 8 | 12 | 14 | 15 | 19 | 21 | 23 | 24 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Month | 9 | 9 | 9 | 9 | 9 | 9 | 9 | 9 | 9 | 9 |
| | | | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| 1 | 4AD19CS031 | KUSUMITHA H D | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| 2 | 4AD19CS057 | NIKHILESH N | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | A |
| 3 | 4AD19CS062 | PAVITRA M M | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| 4 | 4AD19CS064 | PALLAVI M | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| 5 | 4AD19CS065 | PRAMOD B S | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | A | A |
| 6 | 4AD19CS067 | PRATEEK G ALAVANDI | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| 7 | 4AD19CS068 | PRATHEEKSHA R NAYAK | | 1 | 2 | A | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
| 8 | 4AD19CS069 | PRAVEEN T S | | A | 1 | 2 | 3 | 4 | A | A | 5 | 6 | A |
| 9 | 4AD19CS069 | PRERANA N | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | A | A | 8 |
| 10 | 4AD19CS071 | PUNDSAREE K S | | 1 | 2 | 3 | A | 4 | 5 | 6 | 7 | 8 | 9 |
| 11 | 4AD19CS072 | RATNESHWARAN G | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| 12 | 4AD19CS073 | RAJESH S A | | 1 | 2 | A | A | 3 | 4 | 5 | 6 | 7 | A |
| 13 | 4AD19CS074 | RAKSHITH S V | | 1 | 2 | 3 | A | 4 | 5 | 6 | A | 7 | A |
| 14 | 4AD19CS075 | RIFA SEHAR | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | A | 8 | A |
| 15 | 4AD19CS076 | SAFFIYA IFFATH | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| 16 | 4AD19CS078 | SAIKRISHNA GARVARKAR | | 1 | A | A | A | 2 | A | 3 | 4 | A | A |
| 17 | 4AD19CS079 | SALMAN PASHA M | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | A | 8 | 9 |
| 18 | 4AD19CS080 | SAMPREETH M P | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| 19 | 4AD19CS081 | SANIYA NAKIM | | 1 | A | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
| 20 | 4AD19CS082 | SANJANA P | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | A |
| 21 | 4AD19CS083 | SANJAY C K | | 1 | 2 | 3 | A | 4 | 5 | 6 | 7 | 8 | 9 |
| 22 | 4AD19CS084 | SABIYA TEHSEEM | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| 23 | 4AD19CS085 | SATHVIKA K M | | 1 | 2 | 3 | A | 4 | 5 | 6 | 7 | 8 | 9 |
| 24 | 4AD19CS086 | SHRISTHA MEHDI | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| 25 | 4AD19CS087 | SHARMILA M K | | 1 | 2 | 3 | 4 | 5 | A | 6 | 7 | 8 | A |
| | No. of Abs. | | | | | | | | | | | | |
| | Initials | | | | | | | | | | | | |



## ASSESSMENT

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| 25 | 29 | 03 | 5 | 6 | 13 | 17 | 19 | 20 | 24 | 31 |
|---|---|---|---|---|---|---|---|---|---|---|
| 9 | 9 | 9 | 9 | 10 | 10 | 10 | 10 | 10 | 10 | 10 |
| 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 |
| 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 |
| 10 | 11 | 12 | A | 13 | 14 | 15 | 16 | 17 | 18 | 19 |
| 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 |
| 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 |
| A | A | A | A | A | A | A | A | A | A | A |
| 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 |
| 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 |
| A | 7 | A | A | 8 | A | A | A | 9 | A | 10 |
| 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 |
| 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 |
| 10 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 |
| A | 8 | 9 | 10 | 11 | 12 | 13 | A | 14 | 15 | 16 |
| A | 8 | 9 | 10 | 11 | 12 | 13 | A | 14 | 15 | 16 |
| 9 | 10 | 11 | 12 | 13 | 14 | 15 | A | 16 | 17 | 18 |
| 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 |
| A | 5 | 6 | 7 | 8 | 9 | A | 10 | A | 11 | A |
| 10 | 11 | 12 | 13 | 14 | A | 15 | 16 | A | 17 | 18 |
| 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 |
| 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 |
| 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 |
| A | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | A | 18 |
| 11 | 12 | 13 | 14 | 11 | 15 | 17 | 18 | 19 | 20 | 21 |
| 10 | 11 | 12 | 13 | 14 | 15 | A | A | 16 | 16 | 17 |
| 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 |
| A | 9 | 10 | 11 | 12 | A | 13 | 14 | 15 | 16 | 17 |

| AT | Assignments / Internal Test Marks A1 | T1 | A2 | T2 | A3 | T3 | T4 | CIE Marks | SEE Marks | Total Marks |
|---|---|---|---|---|---|---|---|---|---|---|
| | 10 | 40 | 10 | 46 | 10 | 48 | | 38 | | |
| | 10 | 29 | 10 | 35 | 9 | 40 | | 34 | | |
| | 10 | 37 | 10 | 38 | 10 | 45 | | 34 | | |
| | 10 | 45 | 10 | 36 | 10 | 45 | | 34 | | |
| | 8 | 33 | 8 | 34 | 9 | 40 | | 30 | | |
| | 10 | 49 | 10 | 48 | 10 | 49 | | 40 | | |
| | 10 | 34 | 10 | 36 | 10 | 45 | | 33 | | |
| | 10 | 40 | 10 | 40 | 10 | 48 | | 36 | | |
| | 10 | 43 | 10 | 41 | 10 | 49 | | 39 | | |
| | 10 | 40 | 10 | 36 | 10 | 46 | | 35 | | |
| | 10 | 36 | 10 | 32 | 10 | 48 | | 31 | | |
| | 8 | 33 | 10 | 36 | 8 | 44 | | 33 | | |
| | 10 | 38 | 8 | 29 | 9 | 40 | | 28 | | |
| | 10 | 49 | 10 | 48 | 8 | 49 | | 40 | | |
| | 10 | 43 | 10 | 43 | 8 | 48 | | 35 | | |
| | 10 | 35 | 10 | 37 | 10 | 47 | | 32 | | |
| | 8 | 35 | 9 | 34 | 10 | 42 | | 33 | | |
| | 10 | 36 | 10 | 38 | 10 | 47 | | 35 | | |
| | 10 | 31 | 10 | 36 | 10 | 43 | | 30 | | |
| | 10 | 35 | 10 | 30 | 10 | 46 | | 33 | | |
| | 8 | 18 | 9 | 24 | 10 | 40 | | 25 | | |
| | 10 | 41 | 10 | 39 | 10 | 48 | | 34 | | |
| | 9 | 28 | 10 | 36 | 10 | 47 | | 35 | | |
| | 10 | 39 | 10 | 38 | 10 | 48 | | 33 | | |
| | 10 | 38 | 10 | 32 | 8 | 43 | | 29 | | |
| | | | | | | | | | | |

ATME College of Engineering

## ATTENDANCE

Course Title with Code : CN

Semester & Section : 5A

| Sl No. | USN | Student Name | Date / Month |
|---|---|---|---|
| 1 | 4AD19CS051 | KUSUMITHA H D | |
| 2 | 4AD19CS053 | NIKHILESH N | |
| 3 | 4AD19CS057 | PUSHPA M M | |
| 4 | 4AD19CS059 | PALLAVI M | |
| 5 | 4AD19CS060 | PRAMOD B S | |
| 6 | 4AD19CS061 | PRATEEK B ALAVANDI | |
| 7 | 4AD19CS062 | PRATHEEKSHA S NAYAK | |
| 8 | 4AD19CS063 | PRAVEEN T S | |
| 9 | 4AD19CS064 | PREERANA N | |
| 10 | 4AD19CS065 | PUNDSHREE K S | |
| 11 | 4AD19CS066 | RAJASEKARAN G | |
| 12 | 4AD19CS067 | RAJESH S A | |
| 13 | 4AD19CS068 | RAKSHITH S V | |
| 14 | 4AD19CS069 | RIFA SEHAR | |
| 15 | 4AD19CS070 | SAFFIYA IFFATH | |
| 16 | 4AD19CS071 | SAIKRISHNA GHANEKAR | |
| 17 | 4AD19CS072 | SALMAN PASHA M | |
| 18 | 4AD19CS073 | SAMPREETH M P | |
| 19 | 4AD19CS074 | SANIYA NAZIM | |
| 20 | 4AD19CS075 | SANTHOSH P | |
| 21 | 4AD19CS076 | SANJAY C K | |
| 22 | 4AD19CS077 | SABIYA TEHSEEM | |
| 23 | 4AD19CS078 | SATHVIKA K M | |
| 24 | 4AD19CS079 | SHAISTHA MEHDI | |
| 25 | 4AD19CS080 | SHARMILA M K | |
| | No. of Abs | | |
| | Initials | | |



## ASSESSMENT

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| AT | Assignments / Internal Test Marks A1 | T1 | A2 | T2 | A3 | T3 | T4 | CIE Marks | SEE Marks | Total Marks |
|---|---|---|---|---|---|---|---|---|---|---|
| | 10 | 40 | 10 | A6 | 10 | 48 | | 35 | | |
| | 10 | 39 | 10 | 35 | 9 | 42 | | 34 | | |
| | 10 | 37 | 10 | 38 | 10 | 45 | | 34 | | |
| | 10 | 45 | 10 | 36 | 10 | 45 | | 36 | | |
| | 5 | 22 | 5 | 24 | 9 | 40 | | 30 | | |
| | 10 | 49 | 10 | 48 | 10 | 49 | | 40 | | |
| | 10 | 34 | 10 | 36 | 10 | 45 | | 33 | | |
| | 10 | 40 | 10 | 40 | 10 | 48 | | 36 | | |
| | 10 | 43 | 10 | 41 | 10 | 49 | | 37 | | |
| | 10 | 40 | 10 | 36 | 10 | 46 | | 35 | | |
| | 10 | 30 | 10 | 32 | 10 | 45 | | 31 | | |
| | 8 | 33 | 10 | 36 | 8 | 44 | | 33 | | |
| | 10 | 28 | 8 | 29 | 9 | 40 | | 28 | | |
| | 10 | 48 | 10 | 48 | 8 | 49 | | 40 | | |
| | 10 | 43 | 10 | 43 | 8 | 48 | | 35 | | |
| | 10 | 36 | 10 | 37 | 10 | 47 | | 32 | | |
| | 8 | 35 | 9 | 34 | 10 | 42 | | 33 | | |
| | 10 | 36 | 10 | 38 | 10 | 47 | | 34 | | |
| | 10 | 31 | 10 | 36 | 10 | 45 | | 30 | | |
| | 10 | 36 | 10 | 30 | 10 | 46 | | 33 | | |
| | 5 | 18 | 9 | 24 | 10 | 40 | | 25 | | |
| | 10 | 41 | 10 | 39 | 10 | 48 | | 34 | | |
| | 9 | 38 | 10 | 36 | 10 | 47 | | 34 | | |
| | 10 | 39 | 10 | 38 | 10 | 48 | | 33 | | |
| | 10 | 38 | 10 | 32.5 | 8 | 47 | | 29 | | |

ATME College of Engineering

**ATTENDANCE**

Course Title with Code : C

Semester & Section : 2 B

| Sl. No. | USN | Student Name | Date / Mon | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 | 31 | 32 | 33 | 34 | 35 | 36 | 37 | 38 | 39 | 40 | 41 | 42 | 43 | 44 | 45 | 46 | 47 | 48 | 49 | 50 | 51 | 52 | 53 | 54 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1. | 4AD19CL031 | KUSUMITHA H D | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 2. | 4AD19CS051 | NIKHILESH N | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 3. | 4AD19CL053 | NUSRGA M M | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 4. | 4AD19CL057 | PALLAVI M | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 5. | 4AD19CS058 | PRAMOD R S | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 6. | 4AD19CS067 | PRATEEK S BIJAWANGI | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 7. | 4AD19CL068 | PRATHEEKSHA R NAYAK | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 8. | 4AD19CL069 | PRAVEEN T S | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 9. | 4AD19CS070 | PRERANA N | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 10. | 4AD19CL071 | PUNDSHREE K S | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 11. | 4AD19CL072 | RAJASEKARAN G | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 12. | 4AD19CL073 | RAJESH S G | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 13. | 4AD19CL074 | RAKSHITH S V | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 14. | 4AD19CL075 | RIFA SEHAR | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 15. | 4AD19CL076 | SAFFIYA IFFATH | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 16. | 4AD19CS078 | SAIKRISHNA BHAVASKAR | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 17. | 4AD19CS079 | SALMAN PASHA M | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 18. | 4AD19CS080 | SAMPREETH M P | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 19. | 4AD19CS082 | SANIYA NAKEEM | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 20. | 4AD19CS084 | SANJANA P | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 21. | 4AD19CS085 | SANJAY C K | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 22. | 4AD19CL086 | SARIYA TEHSEEM | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 23. | 4AD19CL087 | SATHVIKA K M | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 24. | 4AD19CL088 | SHAISTHA MEHDI | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 25. | 4AD19CL089 | SHARMIZA M K | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | No. of Abs. | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | Initials | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |





**ASSESSMENT**

ATME College of Engineering

| 55 | 56 | 57 | 58 | 59 | 60 | Attendance AT1 | AT2 | AT3 | AT | Assignments / Internal Test Marks A1 | T1 | A2 | T2 | A3 | T3 | T4 | OE Marks | SEE Marks | Total Marks |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | 10 | 40 | 10 | 46 | 10 | 48 | | 38 | | |
| | | | | | | | | | | 10 | 39 | 10 | 38 | 9 | 40 | | 34 | | |
| | | | | | | | | | | 10 | 37 | 10 | 38 | 10 | 45 | | 34 | | |
| | | | | | | | | | | 10 | 45 | 10 | 36 | 10 | 45 | | 36 | | |
| | | | | | | | | | | 8 | 32 | 8 | 34 | 9 | 40 | | 58 | | |
| | | | | | | | | | | 10 | 49 | 10 | 48 | 10 | 49 | | 40 | | |
| | | | | | | | | | | 10 | 36 | 10 | 36 | 10 | 45 | | 33 | | |
| | | | | | | | | | | 10 | 40 | 10 | 40 | 10 | 48 | | 36 | | |
| | | | | | | | | | | 10 | 43 | 10 | 41 | 10 | 49 | | 39 | | |
| | | | | | | | | | | 10 | 40 | 10 | 36 | 10 | 46 | | 35 | | |
| | | | | | | | | | | 10 | 30 | 10 | 32 | 10 | 45 | | 31 | | |
| | | | | | | | | | | 8 | 33 | 10 | 36 | 8 | 44 | | 33 | | |
| | | | | | | | | | | 10 | 28 | 5 | 29 | 9 | 40 | | 28 | | |
| | | | | | | | | | | 10 | 49 | 10 | 48 | 8 | 49 | | 40 | | |
| | | | | | | | | | | 10 | 43 | 10 | 42 | 8 | 48 | | 35 | | |
| | | | | | | | | | | 10 | 35 | 10 | 37 | 10 | 47 | | 32 | | |
| | | | | | | | | | | 8 | 35 | 9 | 34 | 10 | 42 | | 33 | | |
| | | | | | | | | | | 10 | 36 | 10 | 35 | 10 | 47 | | 35 | | |
| | | | | | | | | | | 10 | 31 | 10 | 36 | 10 | 42 | | 30 | | |
| | | | | | | | | | | 10 | 35 | 10 | 30 | 10 | 44 | | 33 | | |
| | | | | | | | | | | 8 | 15 | 9 | 34 | 10 | 40 | | 25 | | |
| | | | | | | | | | | 10 | 41 | 10 | 39 | 10 | 48 | | 34 | | |
| | | | | | | | | | | 9 | 38 | 10 | 36 | 10 | 47 | | 35 | | |
| | | | | | | | | | | 10 | 31 | 10 | 35 | 10 | 45 | | 32 | | |
| | | | | | | | | | | 10 | 28 | 10 | 32 | 8 | 43 | | 29 | | |
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| | | | | | | | | | | | | | | | | | | | |

## ATTENDANCE

ATME College of Engineering

Course Title with Code : Analog & Digital Electronics 18ES33

Semester & Section : 3 C

| Sl. No. | USN | Student Name | Date | 5 | 7 | 8 | 12 | 14 | 15 | 19 | 21 | 22 | 24 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Month | 9 | 9 | 9 | 9 | 9 | 9 | 9 | 9 | 9 | 9 |
| | | | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| 26 | 4AD19CS080 | SHEREEN ELIZA S | | A | A | 1 | 2 | A | 3 | A | 4 | 5 | A |
| 27 | 4AD19CS081 | SREEYAS M | | 1 | 2 | 3 | A | 4 | 5 | 6 | A | 7 | A |
| 28 | 4AD19CS082 | SUKETHA K L | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| 29 | 4AD19CS083 | SUMRAH SYED | | 1 | 2 | 3 | A | 4 | 5 | 6 | 7 | 8 | 9 |
| 30 | 4AD19CS084 | SUNDHARA Y M | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| 31 | 4AD19CS085 | S K SUSHIR PRASAD | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | A |
| 32 | 4AD19CS086 | SWEKHA M | | 1 | 2 | 3 | A | 4 | 5 | A | 7 | 8 | 9 |
| 33 | 4AD19CS087 | SWEKHA S | | 1 | 2 | 3 | 4 | A | A | A | 5 | 6 | 7 |
| 34 | 4AD19CS088 | SPOORTHI KARKINAKAR M | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | A |
| 35 | 4AD19CS089 | SUMAN D R | | 1 | 2 | A | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
| 36 | 4AD19CS090 | SUMANTH R M | | 1 | 2 | A | A | 3 | 4 | 5 | 6 | 7 | 8 |
| 37 | 4AD19CS091 | SUSHMITHA C R | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| 38 | 4AD19CS092 | TEJAS PATEL H R | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| 39 | 4AD19CS093 | TEJAS GOWDA A M | | 1 | 2 | 3 | 4 | A | 5 | 6 | 7 | 8 | A |
| 40 | 4AD19CS094 | THEJASWINI L | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| 41 | 4AD19CS095 | ULLAS S M | | 1 | 2 | 3 | A | 4 | 5 | 6 | 7 | A | 8 |
| 42 | 4AD19CS096 | ULLAS R | | 1 | A | A | 2 | A | A | 3 | 4 | 5 | A |
| 43 | 4AD19CS097 | UMAIR HABIBA | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | A | 8 | 9 |
| 44 | 4AD19CS098 | VAIBHAV N | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| 45 | 4AD19CS099 | VARSHA G | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | A | 8 | 9 |
| 46 | 4AD19CS100 | VARSHA URS R | | 1 | A | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
| 47 | 4AD19CS101 | VASISHTHA K | | 1 | A | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
| 48 | 4AD19CS102 | VARUN C K | | 1 | 2 | 3 | A | 4 | 5 | 6 | 7 | 8 | 9 |
| 49 | 4AD19CS103 | VIPUL Y S | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| 50 | 4AD19CS104 | YASHAS S BHARADWAJ | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| | | No. of Abs | | | | | | | | | | | |
| | | Initials | | | | | | | | | | | |



## ASSESSMENT

ATME College of Engineering

| 28 | 29 | 5 | 6 | 6 | 13 | 14 | 19 | 20 | 26 | 27 | | Assignments / Internal Test Marks | | | | | | | | SEE Marks | Total Marks |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 9 | 9 | 19 | 20 | 19 | 19 | 19 | 19 | 19 | 19 | 19 | | | | | | | | | | | |
| 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | AT | A1 | T1 | A2 | T2 | A3 | T3 | T4 | CIE Marks | | |
| A | 6 | A | A | A | A | A | A | A | A | A | | 9 | 40 | 9 | 48 | 10 | 40 | 42 | 33 | | |
| A | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | | 10 | 37 | 9 | 36 | 10 | 47 | | 39 | | |
| 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | | 10 | 40 | 10 | 32 | 10 | 48 | | 34 | | |
| A | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | | 8 | 20 | 9 | 23 | 10 | 40 | | 25 | | |
| 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | A | 26 | | 10 | 39 | 10 | 40 | 10 | 49 | | 36 | | |
| 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 | | 10 | 39 | 10 | 22 | 10 | 39 | | 28 | | |
| 28 | 21 | 28 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | A | | 10 | 30 | 10 | 38 | 10 | 48 | | 35 | | |
| 8 | 9 | 10 | 11 | 12 | A | 13 | 14 | 15 | 16 | 17 | | 10 | 28 | 9 | 35 | 9 | 47 | | 30 | | |
| 10 | 11 | A | 12 | 13 | 14 | 15 | 16 | 17 | A | 18 | | 10 | 27 | 10 | 35 | 10 | 45 | | 31 | | |
| 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | A | 28 | 29 | | 10 | 34 | 10 | 35 | 10 | 42 | | 33 | | |
| A | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | | 10 | 31 | 10 | 31 | 10 | 40 | | 29 | | |
| 11 | 12 | 13 | A | 14 | 15 | 16 | 17 | 18 | 19 | 20 | | 10 | 31 | 10 | 36 | 10 | 46 | | 33 | | |
| 0 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | | 8 | 40 | 9 | 40 | 10 | 45 | | 36 | | |
| A | 9 | 10 | 11 | A | 12 | A | 13 | 14 | 15 | 16 | | 8 | 24 | 8 | 31 | 9 | 40 | | 29 | | |
| 6 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | | 10 | 35 | 10 | 39 | 10 | 46 | | 34 | | |
| 9 | 10 | 11 | 12 | 13 | 14 | 15 | A | 16 | 17 | 18 | | 9 | 31 | 10 | 20 | 08 | 36 | | 26 | | |
| A | 6 | 9 | A | 9 | 10 | 11 | 12 | 13 | 14 | 15 | | 8 | 30 | 8 | 20 | 10 | 39 | | 26 | | |
| 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | | 10 | 37 | 10 | 37 | 10 | 48 | | 31 | | |
| 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | A | | 10 | 27 | 10 | 34 | 10 | 40 | | 31 | | |
| 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | | 10 | 28 | 10 | 32 | 10 | 45 | | 33 | | |
| 10 | 11 | 12 | 13 | 14 | A | 15 | A | 16 | 17 | 18 | | 9 | 45 | 10 | 39 | 9 | 49 | | 35 | | |
| 20 | 11 | 12 | 13 | 14 | A | 15 | 16 | 17 | 18 | 19 | | 9 | 40 | 10 | 29 | 10 | 46 | | 31 | | |
| A | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | | 8 | 30 | 9 | 23 | 10 | 40 | | 27 | | |
| 4 | 15 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | | 10 | 35 | 10 | 40 | 10 | 49 | | 36 | | |
| 11 | 12 | 13 | 14 | 15 | 26 | 27 | 28 | 29 | 30 | 31 | | 9 | 36 | 10 | 35 | 10 | 47 | | 34 | | |
| | | | | | | | | | | | | 28 | 48 | 29 | 49 | 40 | 49 | | 35 | | |
| | | | | | | | | | | | | | | | | | | | | | |

ATME College of Engineering

## ATTENDANCE

Course Title with Code :

Semester & Section : 3 E

| Sl. No. | USN | Student Name | Date / Month |
|---|---|---|---|
| 31 | 4AD19CS080 | SHEREEN ELIZA S | |
| 32 | 4AD19CS081 | SHREYAS M | |
| 33 | 4AD19CS082 | SHWETHA K L | |
| 34 | 4AD19CS085 | SIMRAN SYED | |
| 35 | 4AD19CS086 | SINCHANA Y M | |
| 36 | 4AD19CS087 | S K SINCHIR PRASAD | |
| 37 | 4AD19CS088 | SNEHA M | |
| 38 | 4AD19CS089 | SNEHA S | |
| 39 | 4AD19CS090 | SPOORTHI KARUNAKAR M | |
| 40 | 4AD19CS091 | SUMAN B R | |
| 41 | 4AD19CS092 | SUMANTH S M | |
| 42 | 4AD19CS093 | SUSHMITHA C R | |
| 43 | 4AD19CS094 | TEJANA PATEL H B | |
| 44 | 4AD19CS095 | TEJAS GOWDA A M | |
| 45 | 4AD19CS096 | THEJASWINI L | |
| 46 | 4AD19CS097 | UMAS S M | |
| 47 | 4AD19CS098 | UMAS R | |
| 48 | 4AD19CS099 | UMME HABIBA | |
| 49 | 4AD19CS100 | VAIBAV N | |
| 50 | 4AD19CS101 | VARSHA C | |
| 51 | 4AD19CS102 | VARSHA URS R | |
| 52 | 4AD19CS103 | VARSHITHA K | |
| 53 | 4AD19CS104 | VARUN C K | |
| 54 | 4AD19CS105 | VIPUL V L | |
| 55 | 4AD19CS106 | VAIHAS S BHARADWAJ | |
| | No. of Abs. | | |
| | Initials | | |



## ASSESSMENT

ATME College of Engineering

| Sl. No. | Assignments / Internal Test Marks | | | | | | | | SEE Marks | Total Marks |
|---|---|---|---|---|---|---|---|---|---|---|
| | AT | A1 | T1 | A2 | T2 | A3 | T3 | T4 | OE Marks | | |
| 1 | | 9 | 46 | 9 | AB | 10 | 40 | 42 | 38 | | |
| 2 | | 10 | 37 | 9 | 36 | 10 | 42 | | 39 | | |
| 3 | | 10 | 40 | 10 | 32 | 10 | 48 | | 34 | | |
| 4 | | 8 | 20 | 9 | 33 | 10 | 40 | | 36 | | |
| 5 | | 10 | 39 | 10 | 40 | 10 | 49 | | 36 | | |
| 6 | | 10 | 39 | 10 | 22 | 10 | 39 | | 28 | | |
| 7 | | 10 | 36 | 10 | 38 | 10 | 48 | | 35 | | |
| 8 | | 10 | 28 | 9 | 35 | 9 | 47 | | 30 | | |
| 9 | | 10 | 28 | 10 | 35 | 10 | 45 | | 31 | | |
| 10 | | 10 | 39 | 10 | 35 | 10 | 42 | | 33 | | |
| 11 | | 10 | 31 | 10 | 33 | 10 | 40 | | 29 | | |
| 12 | | 10 | 31 | 10 | 36 | 10 | 46 | | 33 | | |
| 13 | | 5 | 40 | 9 | 40 | 10 | 45 | | 36 | | |
| 14 | | 5 | 24 | 9 | 31 | 9 | 40 | | 29 | | |
| 15 | | 10 | 35 | 10 | 39 | 10 | 48 | | 34 | | |
| 16 | | 9 | 31 | 10 | 20 | 08 | 38 | | 26 | | |
| 17 | | 8 | 20 | 8 | 20 | 10 | 39 | | 24 | | |
| 18 | | 10 | 37 | 10 | 37 | 10 | 48 | | 35 | | |
| 19 | | 10 | 27 | 10 | 34 | 10 | 40 | | 31 | | |
| 20 | | 10 | 38 | 10 | 32 | 10 | 45 | | 33 | | |
| 21 | | 9 | 45 | 10 | 39 | 9 | 47 | | 35 | | |
| 22 | | 9 | 40 | 10 | 39 | 10 | 46 | | 31 | | |
| 23 | | 8 | 30 | 9 | 33 | 10 | 40 | | 29 | | |
| 24 | | 10 | 35 | 10 | 40 | 10 | 49 | | 36 | | |
| 25 | | 9 | 36 | 10 | 35 | 10 | 47 | | 34 | | |
| | | 98 | 408 | 9 | 409 | 10 | 483 | | 35 | | |

ATME College of Engineering

## ATTENDANCE

Course Title with Code : 3

Semester & Section : 3 E

Date / Month

| Sl. No. | USN | Student Name | 44 | 45 | 46 | 47 | 48 | 49 | 50 | 51 | 52 | 53 | 54 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 01 | 4AD19CS080 | SHERLIN ELIZA S | A | P | P | 11- | 13 | | | | | | |
| 02 | 4AD19CS081 | SHREYAS M | A | 28 | P | P | 31 | | | | | | |
| 03 | 4AD19CS082 | SHWETHA K L | A | P | A | 44 | 43 | | | | | | |
| 04 | 4AD19CS083 | SIMRAN SYED | A | A | P | P | 35 | | | | | | |
| 05 | 4AD19CS084 | SINCHANA Y M | P | 38 | A | 31 | 28 | | | | | | |
| 06 | 4AD19CS085 | S K SOHSAIR PRASAD | A | P | A | P | 34 | | | | | | |
| 07 | 4AD19CS086 | SNEHA M | 39 | 40 | 41 | A | 43 | | | | | | |
| 08 | 4AD19CS087 | SNEHA S | 33 | 34 | 35 | P | 36 | | | | | | |
| 09 | 4AD19CS088 | SPOORTHI KARUNAKAR M | A | A | A | A | 37 | | | | | | |
| 10 | 4AD19CS089 | SOHAN D R | A | 37 | A | 38 | 39 | | | | | | |
| 11 | 4AD19CS090 | SUMANTH S M | P | P | 35 | A | 35 | | | | | | |
| 12 | 4AD19CS091 | SUSHMITHA C R | 35 | 35 | 40 | A | 41 | | | | | | |
| 13 | 4AD19CS092 | TEJASWINI H B | 43 | 43 | 44 | 45 | 46 | | | | | | |
| 14 | 4AD19CS093 | TEJAS GOWDA A M | A | A | A | 30 | 34 | | | | | | |
| 15 | 4AD19CS094 | THEJASWINI L | A | A | A | A | 39 | | | | | | |
| 16 | 4AD19CS095 | UJJAS I M | A | A | 33 | 34 | 35 | | | | | | |
| 17 | 4AD19CS096 | UJJAS S | A | 29 | 30 | 0 | 32 | | | | | | |
| 18 | 4AD19CS097 | UMME HABIBA | A | A | A1 | 42 | 43 | | | | | | |
| 19 | 4AD19CS098 | VAIBHAV N | A1 | A | 42 | A | 43 | | | | | | |
| 20 | 4AD19CS099 | VARSHA C | 38 | A | 39 | 40 | 41 | | | | | | |
| 21 | 4AD19CS100 | VARSHA URS P | A | 31 | 35 | 37 | 38 | | | | | | |
| 22 | 4AD19CS101 | VASHITHA K | A | A | 31 | 38 | 39 | | | | | | |
| 23 | 4AD19CS102 | VARUN C K | A | A1 | 42 | 43 | 44 | | | | | | |
| 24 | 4AD19CS103 | VIDUL V I | 37 | 40 | 41 | 42 | 43 | | | | | | |
| 25 | 4AD19CS104 | VAIHAS S BHARADWAJ | A2 | 43 | 44 | 45 | 46 | | | | | | |
| | No. of Abs | | | | | | | | | | | | |
| | Initials | | | | | | | | | | | | |



## ASSESSMENT

ATME College of Engineering

| 55 | 56 | 57 | 58 | 59 | 60 | Attendance AT1 | AT2 | AT3 | AT | Assignments / Internal Test Marks A1 | T1 | A2 | T2 | A3 | T3 | T4 | CIE Marks | SEE Marks | Total Marks |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | 9 | 40 | 9 | 48 | 10 | 40 | 42 | 33 | | |
| | | | | | | | | | | 10 | 38 | 9 | 36 | 10 | 42 | | 89 | | |
| | | | | | | | | | | 10 | 40 | 10 | 32 | 10 | 46 | | 34 | | |
| | | | | | | | | | | 8 | 20 | 9 | 33 | 10 | 40 | | 31 | | |
| | | | | | | | | | | 10 | 39 | 10 | 40 | 10 | 49 | | 36 | | |
| | | | | | | | | | | 10 | 34 | 10 | 22 | 10 | 39 | | 28 | | |
| | | | | | | | | | | 10 | 30 | 10 | 38 | 10 | 48 | | 35 | | |
| | | | | | | | | | | 10 | 36 | 9 | 35 | 9 | 47 | | 30 | | |
| | | | | | | | | | | 10 | 37 | 10 | 35 | 10 | 43 | | 31 | | |
| | | | | | | | | | | 10 | 34 | 10 | 36 | 10 | 42 | | 33 | | |
| | | | | | | | | | | 10 | 31 | 10 | 31 | 10 | 40 | | 29 | | |
| | | | | | | | | | | 10 | 31 | 10 | 36 | 10 | 46 | | 33 | | |
| | | | | | | | | | | 8 | 40 | 9 | 40 | 10 | 45 | | 36 | | |
| | | | | | | | | | | 8 | 34 | 8 | 31 | 9 | 40 | | 29 | | |
| | | | | | | | | | | 10 | 35 | 10 | 39 | 10 | 46 | | 34 | | |
| | | | | | | | | | | 9 | 31 | 10 | 20 | 08 | 38 | | 26 | | |
| | | | | | | | | | | 8 | 30 | 8 | 30 | 10 | 39 | | 26 | | |
| | | | | | | | | | | 10 | 39 | 10 | 37 | 10 | 48 | | 34 | | |
| | | | | | | | | | | 10 | 27 | 10 | 34 | 10 | 40 | | 31 | | |
| | | | | | | | | | | 10 | 38 | 10 | 32 | 10 | 45 | | 33 | | |
| | | | | | | | | | | 9 | 45 | 10 | 39 | 9 | 49 | | 35 | | |
| | | | | | | | | | | 9 | 40 | 10 | 39 | 10 | 46 | | 31 | | |
| | | | | | | | | | | 8 | 30 | 9 | 43 | 10 | 40 | | 27 | | |
| | | | | | | | | | | 10 | 35 | 10 | 40 | 10 | 49 | | 36 | | |
| | | | | | | | | | | 9 | 36 | 10 | 35 | 10 | 47 | | 34 | | |
| | | | | | | | | | | 08 | 48 | 9 | 49 | 10 | 49 | | 35 | | |
| | | | | | | | | | | 08 | 08 | 08 | 08 | 08 | 08 | | 08 | | |

ATME College of Engineering

## ATTENDANCE

Course Title with Code: Analog & Digital Electronics 18ES32

Semester & Section: 3-B

| Sl. No. | USN | Student Name | Date | 5 | 7 | 8 | 12 | 14 | 15 | 19 | 21 | 22 | 24 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Month | 9 | 9 | 9 | 9 | 9 | 9 | 9 | 9 | 9 | 9 |
| | | | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| 51 | 4AD15CS166 | YUNUS KHAN | | 1 | 2 | 3 | A | 5 | A | 7 | 8 | 9 | A |
| 52 | 4AD15CS169 | MOHAMMED ANAS | | | 1 | A | 3 | A | 5 | A | 6 | 7 | A |
| 53 | 4AD15CS162 | AMEER M | | | 1 | A | 3 | A | 5 | 6 | 7 | 8 | A |
| | | No. of Abs. | | | | | | | | | | | |
| | | Initials | | | | | | | | | | | |



ATME College of Engineering

## ASSESSMENT

| 25 | 26 | 27 | 28 | 29 | 30 | 31 | 1 | 2 | 3 | 4 |
|---|---|---|---|---|---|---|---|---|---|---|
| 9 | 9 | 9 | 9 | 9 | 9 | 9 | 10 | 10 | 10 | 10 |
| 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 |
| 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 |
| 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | A | 18 | A |
| 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | A |

| | Assignments / Internal Test Marks | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| AT | A1 | T1 | A2 | T2 | A3 | T3 | T4 | CIE marks | SEE Marks | Total Marks |
| | 10 | A5 | 9 | 40 | 10 | 49 | | 38 | | |
| | 9 | 36 | 9 | 40 | 10 | 47 | | 35 | | |
| | 8 | 30 | 8 | 35 | 10 | 43 | | 31 | | |

ATME College of Engineering

## ATTENDANCE

Course Title with Code :

Semester & Section : 3 E

| Sl. No. | USN | Student Name | Date / Month |
|---|---|---|---|
| 51 | 4AD19CI185 | YUNUS KHAN | |
| 52 | 4AD19EC1045 | MOHAMMED ANAS | |
| 53 | 4AD19EC0062 | AMEEM | |
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| | | | |
| | No. of Abs. | | |
| | Initials | | |



## ASSESSMENT

ATME College of Engineering

| | Assignments / Internal Test Marks | | | | | | | | Extra Marks | Total Marks |
|---|---|---|---|---|---|---|---|---|---|---|
| AT | A1 | T1 | A2 | T2 | A3 | T3 | T4 | CIE Marks | | |
| | 10 | 18 | 9 | 19 | 10 | 19 | | 38 | | |
| | 9 | 34 | 9 | 40 | 10 | 47 | | 33 | | |
| | 8 | 30 | 8 | 39 | 10 | 42 | | 21 | | |

ATME College of Engineering

## ATTENDANCE

Course Title with Code :

Semester & Section : 3 A

| Sl. No. | USN | Student Name | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 51 | 4AD21CS186 | YUNUS KHAN | P | P | P | P | P | P | P | P | P | P | P | P | P | P |
| 52 | 4AD21CS194 | MOHAMMED ANAS | P | P | P | P | P | P | P | P | P | P | P | P | P | P |
| 53 | 4AD21CS063 | AMJEED | P | P | P | P | P | P | P | P | P | P | P | P | P | P |
| | | No. of Abs | | | | | | | | | | | | | | |
| | | Initials | | | | | | | | | | | | | | |

| 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 | 31 | 32 | 33 | 34 | 35 | 36 | 37 | 38 | 39 | 40 | 41 | 42 | 43 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| P | P | P | P | P | P | P | P | P | P | P | P | P | P | P | P | P | P | P | P | P | P | P | P | P | P | P | P | P |
| P | P | P | P | P | P | P | P | P | P | P | P | P | P | P | P | P | P | P | P | P | P | P | P | P | P | P | P | P |
| P | P | P | P | P | P | P | P | P | P | P | P | P | P | P | P | P | P | P | P | P | P | P | P | P | P | P | P | P |
| | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | | | | | | | | | | | |

| 44 | 45 | 46 | 47 | 48 | 49 | 50 | 51 | 52 | 53 | 54 |
|---|---|---|---|---|---|---|---|---|---|---|
| A | P | P | P | A | | | | | | |
| A | P | A | A | P | | | | | | |
| P | P | A | P | P | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |



## ASSESSMENT

ATME College of Engineering

| 55 | 56 | 57 | 58 | 59 | 60 | Attendance AT1 | AT2 | AT3 | AT | A1 | T1 | A2 | T2 | A3 | T3 | T4 | CIE Marks | SEE Marks | Total Marks |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | 10 | 48 | 9 | 49 | 10 | 49 | | 38 | | |
| | | | | | | | | | | 8 | 34 | 9 | 40 | 10 | 44 | | 33 | | |
| | | | | | | | | | | 8 | 30 | 8 | 35 | 10 | 46 | | 31 | | |

ATME
College of Engineering

# Department of Computer Science and Engineering

## OFFLINE CLASS TIME TABLE FOR ARREARS SUBJECTS (ODD SEMESTER) 2020-21

**Semester : 5**

| Date | 12.08.2021 to 19.08.2021 | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| DAY | 9:00 - 10:00 | 10:00-11:00 | 11:00 - 12:00 | 12:00 - 1:00 | 1:00-2:00 | 2:00-3.00 | 3:00-4.00 | |
| Monday | | 18CS54 | 18CS54 | 18CS53 | Lunch Break | 18CS52 | 18CS52 | |
| Tuesday | | 18CS54 | 18CS54 | 18CS52 | | 18CS53 | 18CS53 | |
| Wednesday | | 18CS54 | 18CS54 | 18CS53 | | 18CS52 | 18CS52 | |
| Thursday | | 18CS54 | 18CS54 | 18CS52 | | 18CS53 | 18CS53 | |
| Friday | | 18CS54 | 18CS54 | 18CS53 | | 18CS52 | 18CS52 | |
| Saturday | | 18CS54 | 18CS54 | 18CS52 | | 18CS53 | 18CS53 | |

| Subject Code | Subject Title | Faculty Incharge |
|---|---|---|
| 18CS52 | COMPUTER NETWORKS AND SECURITY | Mrs. Sneha N P |
| 18CS53 | DATABASE MANAGEMENT SYSTEM | Mr. Kiran B / Mrs. Jyothi M Patil |
| 18CS54 | AUTOMATA THEORY AND COMPUTABILITY | Mr. Anil Kumar C J / Mrs. Keerthana M M |

Coordinator

HOD

Dept. of Computer Science & Engg
ATME College of Engineering
Mysuru-570028

10/8/21

Dean Academics

10/8/21

Principal

PRINCIPAL
ATME College of Engineering
NH 766, Mysuru-Kanakapura-Bangalore Road
Mallahalli Mysuru-570028

ATME
College of Engineering

# Department of Computer Science and Engineering

## OFFLINE CLASS TIME TABLE FOR ARREARS SUBJECTS (ODD SEMESTER) 2020-21

**Semester : 3**

| Date | 12.08.2021 to 19.08.2021 | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| DAY | 9:00 - 10:00 | 10:00-11:00 | 11:00 - 12:00 | 12:00 - 1:00 | 1:00-2:00 | 2:00-3.00 | 3:00-4.00 | |
| Monday | | 18CS32 | 18MAT31 | 18MAT31 | Lunch Break | 18CS34 | 18CS34 | |
| Tuesday | | 18CS36 | 18MAT31 | 18MAT31 | | 18CS35 | 18CS35 | |
| Wednesday | | 18CS36 | 18CS36 | 18CS34 | | 18MAT31 | 18MAT31 | |
| Thursday | | 18CS34 | 18CS34 | 18CS32 | | 18MAT31 | 18MAT31 | |
| Friday | | 18MAT31 | 18MAT31 | 18CS35 | | 18CS36 | 18CS36 | |
| Saturday | | 18CS35 | 18MAT31 | 18MAT31 | | 18CS32 | 18CS32 | |

| Subject Code | Subject Title | Faculty Incharge |
|---|---|---|
| 18MAT31 | TRANSFORM CALCULUS, FOURIER SERIES AND NUMERICAL TECHNIQUES | Mrs. Divya K |
| 18CS32 | DATA STRUCTURES AND APPLICATIONS | Mrs. Sushma V |
| 18CS34 | COMPUTER ORGANIZATION | Mrs. Nasreen Fathima |
| 18CS35 | SOFTWARE ENGINEERING | Dr. J V Gorabal |
| 18CS36 | DISCRETE MATHEMATICAL STRUCTURES | Mr. Raghuram A S |

Coordinator

HOD

HOD
Dept. of Computer Science & Engg
ATME College of Engineering
Mysuru-570028

Dean Academics 10/8/21

Prineipal 10/8/21

PRINCIPAL
ATME College of Engineering
Mysuru-Kanakapura-Bangalore Road
Mellahalli Mysuru-570028

# Model Question Paper-1 with effect from 2018-19 (CBCS Scheme)

USN | | | | | | | | | | |

## Fifth Semester B.E. Degree Examination

Application Development using Python

**TIME: 03 Hours** **Max. Marks: 100**

Note: Answer any **FIVE** full questions, choosing at least **ONE** question from each **MODULE**.

| | | | |
|---|---|---|---|
| | | **Module – 1** | |
| **Q.1** | **(a)** | Explain the math operators in Python from highest to lowest Precedence with an example for each. Write the steps how Python is evaluating the expression (5 - 1) * ((7 + 1) / (3 - 1)) and reduces it to a single value. | (6 Marks) |
| | **(b)** | Define a Python function with suitable parameters to generate prime numbers between two integer values. Write a Python program which accepts two integer values m and n (note: m>0, n>0 and m < n) as inputs and passthesevalues to the function. Suitable error messages should be displayed if the conditions for input values are not followed. | (8 Marks) |
| | **(c)** | Explain Local and Global Scope in Python programs. What are local and global variables? How can you force a variable in a function to refer to the global variable? | (6 Marks) |
| | | **OR** | |
| **Q.2** | **(a)** | What are Comparison and Boolean operators? List all the Comparison and Boolean operators in Python and explain the use of these operators with suitable examples. | (6 Marks) |
| | **(b)** | Define a Python function with suitable parameters to generate first N Fibonacci numbers. The first two Fibonacci numbers are 0 and 1 and the Fibonacci sequence is defined as a function F as $F_n = F_{n-1} + F_{n-2}$. Write a Python program which accepts a value for N (where N >0) as input and pass this value to the function. Display suitable error message if the condition for input value is not followed. | (8 Marks) |
| | **(c)** | What is Exception Handling? How exceptions are handled in Python? Write a Python programwith exception handling code to solve **divide-by-zero** error situation. | (6 Marks) |
| | | **Module – 2** | |
| **Q.3** | **(a)** | What is Dictionary in Python? How is it different from List data type? Explain how a forloop can be used to traverse the keys of the Dictionary with an example. | (6 Marks) |
| | **(b)** | Explain the methods of List data type in Python for the following operations with suitable code snippets for each.<br>(i) Adding values to a list ii) Removing values from a list<br>(iii) Finding a value in a list iv) Sorting the values in a list | (8 Marks) |
| | **(c)** | Write a Python program that accepts a sentence and find the number of words, digits, uppercase letters and lowercase letters. | (6 Marks) |
| | | **OR** | |
| **Q.4** | **(a)** | What is the difference between **copy.copy( )** and **copy.deepcopy( )** functions applicable to a List or Dictionary in Python? Give suitable examples for each. | (6 Marks) |
| | **(b)** | Discuss the following Dictionary methods in Python with examples.<br>(i) get() (ii) items() (iii) keys() (iv) values() | (8 Marks) |
| | **(c)** | Explain the various string methods for the following operations with examples.<br>(i) Removing whitespace characters from the beginning, end or both sides of a string.<br>(ii) To right-justify, left-justify, and center a string. | (6 Marks) |

| | | | |
|---|---|---|---|
| | | **Module – 3** | |
| **Q.5** | **(a)** | Write a Python Program to find an American phone number (example: 415-555-4242) in a given string using Regular Expressions. | (6 Marks) |
| | **(b)** | Describe the difference between Python **os** and **os.path** modules. Also, discuss the following methods of **os** module<br>a) chdir() b) rmdir() c) walk() d) listdir() e) getcwd() | (7 Marks) |
| | **(c)** | Demonstrate the copy, move, rename and delete functions ofshutil module with Python code snippet. | (7 Marks) |
| | | **OR** | |
| **Q.6** | **(a)** | Describe the following with suitable Python code snippet.<br>(i) Greedy and Non Greedy Pattern Matching<br>(ii) findall() method of Regex object. | (7 Marks) |
| | **(b)** | Explain the file Reading/Writing process with suitable Python Program. | (6 Marks) |
| | **(c)** | Define assertions. What does an assert statement in python consists of? Explain how assertions can be used in traffic light simulation with Python code snippet. | (7 Marks) |
| | | **Module – 4** | |
| **Q.7** | **(a)** | Define classes and objects in Python. Create a class called Employee and initialize it with employee id and name. Design methods to:<br>(i) setAge_to assign age to employee.<br>(ii) setSalary_to assign salary to the employee.<br>(iii) Display_to display all information of the employee. | (8marks) |
| | **(b)** | Illustrate the concept of **modifier** with Python code. | (5 Marks) |
| | **(c)** | Explain **init** and **__str__** method with an example Python Program. | (7 Marks) |
| | | **OR** | |
| **Q.8** | **(a)** | Define polymorphism? Demonstrate polymorphism with function to find histogram to count the number of times each letter appears in a word and in a sentence. | (7 Marks) |
| | **(b)** | Illustrate the concept of **pure** function with Python code. | (6 Marks) |
| | **(c)** | Define Class Diagram. Discuss the need for representing class relationships using Class Diagram with suitable example. | (7 Marks) |
| | | **Module – 5** | |
| **Q.9** | **(a)** | Explain the process of downloading files from the Web with the **requests** module and also saving downloaded files to the hard drive with suitable example program. | (8 Marks) |
| | **(b)** | Write a note on the following by demonstrating with code snippet.<br>(i) Opening Excel documents with **openpyxl**.<br>(ii) Getting Sheets from the Workbook.<br>(iii)Getting Cells, Rows and Columns from the Sheets. | (7 Marks) |
| | **(c)** | Describe the getText() function used for getting full text from a .docx file with example code. | (5 Marks) |
| | | **OR** | |
| **Q.10** | **(a)** | Explain how to retrieve a web page element from a **BeautifulSoup** Object by calling the **select** method and passing a string of a CSS selector for the element you are looking for with an example program. | (8 Marks) |
| | **(b)** | What is JSON? Briefly explain the **json** module of Python. Demonstrate with a Python program. | (6 Marks) |
| | **(c)** | Discuss the Creation, Encryption and Decryption of a PDF. | (6 Marks) |
| | | | |

| Table showing the Bloom's Taxonomy Level, Course Outcome and Programme Outcome | | | | |
|---|---|---|---|---|
| **Question** | | **Bloom's Taxonomy Level attached** | **Course Outcome** | **Programme Outcome** |
| **Q.1** | (a) | L2 | CO1 | PO1, PO2, PO3, PO12 |
| | (b) | L3 | CO1 | PO1, PO2, PO3, PO12 |
| | (c) | L2 | CO1 | PO1, PO2, PO3, PO12 |
| **Q.2** | (a) | L2 | CO1 | PO1, PO2, PO3, PO12 |
| | (b) | L3 | CO1 | PO1, PO2, PO3, PO12 |
| | (c) | L2 | CO1 | PO1, PO2, PO3, PO12 |
| **Q.3** | (a) | L1, L2 | CO2 | PO1, PO2, PO3, PO12 |
| | (b) | L1, L2 | CO2 | PO1, PO2, PO3, PO12 |
| | (c) | L3 | CO2 | PO1, PO2, PO3, PO12 |
| **Q.4** | (a) | L1, L2 | CO2 | PO1, PO2, PO3, PO12 |
| | (b) | L1, L2 | CO2 | PO1, PO2, PO3, PO12 |
| | (c) | L2, L3 | CO2 | PO1, PO2, PO3, PO12 |
| **Q.5** | (a) | L3 | CO3 | PO1, PO2, PO3, PO12 |
| | (b) | L2 | CO3 | PO1, PO2, PO3, PO12 |
| | (c) | L1, L2 | CO3 | PO1, PO2, PO3, PO12 |
| **Q.6** | (a) | L2 | CO3 | PO1, PO2, PO3, PO12 |
| | (b) | L3 | CO3 | PO1, PO2, PO3, PO12 |
| | (c) | L1, L2 | CO3 | PO1, PO2, PO3, PO12 |
| **Q.7** | (a) | L1,L3 | CO4 | PO1, PO2, PO3, PO12 |
| | (b) | L2 | CO4 | PO1, PO2, PO3, PO12 |
| | (c) | L1,L2 | CO4 | PO1, PO2, PO3, PO12 |
| **Q.8** | (a) | L1,L3 | CO4 | PO1, PO2, PO3, PO12 |
| | (b) | L2 | CO4 | PO1, PO2, PO3, PO12 |
| | (c) | L1,L2 | CO4 | PO1, PO2, PO3, PO12 |
| **Q.9** | (a) | L3 | CO5 | PO1, PO2, PO3, PO12 |
| | (b) | L1,L2 | CO5 | PO1, PO2, PO3, PO12 |
| | (c) | L2 | CO5 | PO1, PO2, PO3, PO12 |
| **Q.10** | (a) | L3 | CO5 | PO1, PO2, PO3, PO12 |
| | (b) | L1,L2 | CO5 | PO1, PO2, PO3, PO12 |
| | (c) | L2 | CO5 | PO1, PO2, PO3, PO12 |

| **Bloom's Taxonomy Levels** | **Lower order thinking skills** | | |
|---|---|---|---|
| | Remembering( knowledge):$L_1$ | Understanding Comprehension): $L_2$ | Applying (Application): $L_3$ |
| | **Higher order thinking skills** | | |
| | Analyzing (Analysis): $L_4$ | Valuating (Evaluation): $L_5$ | Creating (Synthesis): $L_6$ |

# Model Question Paper-1 with effect from 2020-21 (CBCS Scheme)

USN | | | | | | | | | | |

## Fifth Semester B.E. Degree Examination

## APPLICATION DEVELOPMENT USING PYTHON

**TIME: 03 Hours** **Max. Marks: 100**

Note: 01. Answer any **FIVE** full questions, choosing at least **ONE** question from each **MODULE**.
02.
03.

| | | | |
|---|---|---|---|
| **Module – 1** | | | |
| **Q.1** | **(a)** | Write a python program to find the area of square, rectangle and circle. Print the results. Take input from user | 6 |
| | **(b)** | List and explain the syntax of all flow control statements with example. | 8 |
| | **(c)** | Illustrate the use of break and continue with a code snippet. | 6 |
| **OR** | | | |
| **Q.2** | **(a)** | What are userdefined functions? How can we pass parameters in user defined functions? Explain with suitable example. | 7 |
| | **(b)** | Explain global statement with example. | 8 |
| | **(c)** | Write a function that computes and returns addition ,subtraction, multiplication , division of two integers.Take input from user. | 5 |
| **Module – 2** | | | |
| **Q.3** | **(a)** | What is list?Explain the concept of list slicing with example. | 6 |
| | **(b)** | Explain references with example. | 7 |
| | **(c)** | What is dictionary?How it is different from list?Write a program to count the number of occurances of character in a string. | 7 |
| **OR** | | | |
| **Q.4** | **(a)** | You are creating a fantasy video game. The data structure to model the player's inventory will be a dictionary where the keys are string values describing the item in the inventory and the value is an integer value detailing how many of that item the player has. For example, the dictionary value {'rope': 1, 'torch': 6, 'gold coin': 42, 'dagger': 1, 'arrow': 12} means the player has 1 rope, 6 torches, 42 gold coins, and so on.Write a function named displayInventory() that would take any possible "inventory" and display it like the following:<br><br>Inventory:<br>12 arrow<br>42 gold coin<br>1 rope<br>6 torch<br>1 dagger<br>Total number of items: 63 | 7 |
| | **(b)** | List any six methods associated with string and explain each of them with example. | 8 |

| | | | |
|---|---|---|---|
| | **(c)** | Write a Python program to swap cases of a given string.<br>Input: Java<br>Output: jAVA | 5 |
| | | **Module – 3** | |
| **Q.5** | **(a)** | List and explain Shorthand code for common character classes .Illustrate how do you define your own character class? | 7 |
| | **(b)** | Explain the usage of Caret and dollar sign characters in regular expression. | 6 |
| | **(c)** | Write a python program to extract phone numbers and email addresses using regex | 7 |
| | | **OR** | |
| **Q.6** | **(a)** | How do we specify and handle absolute ,relative paths? | 10 |
| | **(b)** | Explain saving of variables using shelve module. | 4 |
| | **(c)** | With code snippet, explain reading, extracting and creating ZIP files | 6 |
| | | **Module – 4** | |
| **Q.7** | **(a)** | What is class? How do we define a class in python? How to instantiate the class and how class members are accessed? | 8 |
| | **(b)** | Write a python program that uses datetime module within a class , takes a birthday as input and prints user's age and the number of days, hours ,minutes and seconds until their next birthday. | 7 |
| | **(c)** | Explain __init__ and __str__ methods. | 5 |
| | | **OR** | |
| **Q.8** | **(a)** | Explain operator overloading with example. | 7 |
| | **(b)** | What are polymorphic functions? Explain with code snippet | 7 |
| | **(c)** | Illustrate the concept of inheritance with example | 6 |
| | | **Module – 5** | |
| **Q.9** | **(a)** | How do we download a file and save it to harddrive using request module? | 6 |
| | **(b)** | Write a python program to give search keyword from command line arguments and open the browser tab for each result page. | 6 |
| | **(c)** | Explain selenium's webdrive methods for finding elements | 8 |
| | | **OR** | |
| **Q.10** | **(a)** | Write a program that takes a number N from command line and creates an NxN multiplication table in excel spread sheet. | 8 |
| | **(b)** | Write short notes on<br>i)Creating,copying and rotating pages with respect to pdf | 6 |
| | **(c)** | Write a program that find all the CSV files in the current working directory,read in the full contents of each file,write out the contents, skipping the first line, to a new CSV file. | 6 |
| | | | |

| Table showing the Bloom's Taxonomy Level, Course Outcome and Programme Outcome | | | | |
|---|---|---|---|---|
| **Question** | | **Bloom's Taxonomy Level attached** | **Course Outcome** | **Programme Outcome** |
| **Q.1** | (a) | L3 | 1 | 1,3,5 |
| | (b) | L2 | 1 | 1,3,5 |
| | (c) | L2 | 1 | 1,3,5 |
| **Q.2** | (a) | L2 | 1 | 1,3,5 |
| | (b) | L2 | 1 | 1,3,5 |
| | (c) | L2 | 1 | 1,3,5 |
| **Q.3** | (a) | L2 | 2 | 1,3,5 |
| | (b) | L2 | 2 | 1,3,5 |
| | (c) | L2 | 2 | 1,3,5 |
| **Q.4** | (a) | L3 | 2 | 1,3,5 |
| | (b) | L2 | 2 | 1,3,5 |
| | (c) | L2 | 2 | 1,3,5 |
| **Q.5** | (a) | L2 | 3 | 1,3,5 |
| | (b) | L2 | 3 | 1,3,5 |
| | (c) | L3 | 3 | 1,3,5 |
| **Q.6** | (a) | L2 | 3 | 1,3,5 |
| | (b) | L2 | 3 | 1,3,5 |
| | (c) | L2 | 3 | 1,3,5 |
| **Q.7** | (a) | L2 | 4 | 1,3,5 |
| | (b) | L3 | 4 | 1,3,5 |
| | (c) | L2 | 4 | 1,3,5 |
| **Q.8** | (a) | L2 | 4 | 1,3,5 |
| | (b) | L2 | 4 | 1,3,5 |
| | (c) | L2 | 4 | 1,3,5 |
| **Q.9** | (a) | L2 | 5 | 1,3,5 |
| | (b) | L3 | 5 | 1,3,5 |
| | (c) | L2 | 5 | 1,3,5 |
| **Q.10** | (a) | L3 | 5 | 1,3,5 |
| | (b) | L2 | 5 | 1,3,5 |
| | (c) | L2 | 5 | 1,3,5 |

| **Bloom's Taxonomy Levels** | **Lower order thinking skills** | | |
|---|---|---|---|
| | Remembering( knowledge):$L_1$ | Understanding Comprehension): $L_2$ | Applying (Application): $L_3$ |
| | **Higher order thinking skills** | | |
| | Analyzing (Analysis): $L_4$ | Valuating (Evaluation): $L_5$ | Creating (Synthesis): $L_6$ |

# Model Question Paper-1 with effect from 2019-20 (CBCS Scheme)

USN | | | | | | | | | | |

## Fifth Semester B.E. Degree Examination

## Automata Theory and Computability

**TIME: 03 Hours** **Max. Marks: 100**

Note: 01. Answer any **FIVE** full questions, choosing at least **ONE** question from each **MODULE**.

<table>
<tr><td colspan="3">Module – 1</td><td></td></tr>
<tr><td rowspan="2">Q.1</td><td>(a)</td><td>Define the following terms with examples: Alphabet, Power of an alphabet, String, Concatenation and Languages.</td><td>10</td></tr>
<tr><td>(b)</td><td>Define DFSM. Design a DFSM to accept each of the following languages:<br>i) L= {w∈{0,1}* : w has 001 as a substring}<br>ii) L={ w∈{0,1}* : w has even number of a’s and even number of b’s}</td><td>10</td></tr>
<tr><td colspan="3">OR</td><td></td></tr>
<tr><td rowspan="2">Q.2</td><td>(a)</td><td>Convert the following NDFSM to DFSM.
<table>
<tr><td>δ</td><td>ϵ</td><td>a</td><td>b</td><td>c</td></tr>
<tr><td>->p</td><td>{q,r}</td><td>{}</td><td>{q}</td><td>{r}</td></tr>
<tr><td>q</td><td>{}</td><td>{p}</td><td>{r}</td><td>{p,q}</td></tr>
<tr><td>*r</td><td>{}</td><td>{}</td><td>{}</td><td>{}</td></tr>
</table></td><td>10</td></tr>
<tr><td>(b)</td><td>Define distinguishable and indistinguishable states. Minimize the following DFSM.
<table>
<tr><td>δ</td><td>a</td><td>b</td></tr>
<tr><td>->A</td><td>B</td><td>F</td></tr>
<tr><td>B</td><td>G</td><td>C</td></tr>
<tr><td>*C</td><td>A</td><td>C</td></tr>
<tr><td>D</td><td>C</td><td>G</td></tr>
<tr><td>E</td><td>H</td><td>F</td></tr>
<tr><td>F</td><td>C</td><td>G</td></tr>
<tr><td>G</td><td>G</td><td>E</td></tr>
<tr><td>H</td><td>G</td><td>C</td></tr>
</table></td><td>10</td></tr>
<tr><td colspan="3">Module – 2</td><td></td></tr>
<tr><td rowspan="2">Q.3</td><td>(a)</td><td>Define Regular expression. Write the regular expression for the following languages:<br>i) Representing for strings of a’s and b’s having odd length.<br>ii) To accept strings of a’s and b’s such that third symbol from the right is a and fourth symbol from the right is b.</td><td>10</td></tr>
<tr><td>(b)</td><td>Use the fsmtoregexheuristic algorithm to construct a regular expression that describes L(M).
<table>
<tr><td>δ</td><td>a</td><td>b</td></tr>
<tr><td>->*1</td><td>2</td><td>{}</td></tr>
<tr><td>*2</td><td>3</td><td>1</td></tr>
<tr><td>3</td><td>3</td><td>1</td></tr>
</table></td><td>10</td></tr>
<tr><td colspan="3">OR</td><td></td></tr>
<tr><td rowspan="2">Q.4</td><td>(a)</td><td>Show that regular languages are closed under complement and intersection.</td><td>8</td></tr>
<tr><td>(b)</td><td>State and prove pumping lemma theorem for regular languages. And show that the language L={ww$^r$; w∈{0,1}*) is not regular.</td><td>12</td></tr>
</table>

| Module – 3 | | | |
|---|---|---|---|
| **Q.5** | **(a)** | Define CFG. Design CFG for the languages<br>i) $L=\{0^{2n}1^{m} \mid n>=0,m>=0\}$<br>ii) $L=\{0^{i}1^{j}2^{k} \mid i=j \text{ or } j=k\}$ | 10 |

| | | | |
|---|---|---|---|
| | **(b)** | Define Ambiguity. Consider the grammar E->E+E\|E*E\|(E)\|id. Find the leftmost, rightmost derivations and parse trees for the string id+id*id. And show that this grammar is ambiguous. | 10 |
| | | **OR** | |
| **Q.6** | **(a)** | Define CNF. Convert the following CFG to CNF.<br>S->aACa<br>A->B/a<br>B->C/c<br>C->cC/$\epsilon$ | 10 |
| | **(b)** | Define PDA. Design a PDA to accept the following language. L={$a^n b^n$ ; n>=0}. Draw the transition diagram for the constructed PDA. Show the ID's for the string aaabbb. | 10 |
| | | **Module – 4** | |
| **Q.7** | **(a)** | With a neat diagram, explain variants of Turing Machines | 10 |
| | **(b)** | Explain Language Acceptability and Design of Turing Machines. | 8 |
| | | **OR** | |
| **Q.8** | **(a)** | Define a Turing machine. Explain the working of a Turing machine. | 8 |
| | **(b)** | Design a Turing machine to accept L={$0^n1^n2^n$\| n>=0}. Draw the transition diagram. Show the moves made for string aabbcc. | 12 |
| | | **Module – 5** | |
| **Q.9** | **(a)** | Explain post correspondence problem. | 7 |
| | **(b)** | Explain Halting problem in Turing machine. | 6 |
| | **(c)** | Explain recursively enumerable language. | 7 |
| | | **OR** | |
| **Q.10** | **(a)** | Explain Church Turing thesis. | 7 |
| | **(b)** | Explain Quantum computer. | 6 |
| | **(c)** | Explain Growth rate of function. | 7 |
| | | | |

| Table showing the Bloom's Taxonomy Level, Course Outcome and Programme Outcome | | | | |
|---|---|---|---|---|
| **Question** | | **Bloom's Taxonomy Level attached** | **Course Outcome** | **Programme Outcome** |
| **Q.1** | (a) | L1 | 1 | 1,12 |
| | (b) | L1,L3 | 2 | 1,2,12 |
| | (c) | | | |
| **Q.2** | (a) | L3 | 2 | 1,2,12 |
| | (b) | L1,L3 | 2 | 1,2,12 |
| | (c) | | | |
| **Q.3** | (a) | L2 | 3 | 1,2,3,4,12 |
| | (b) | L3 | 3 | 1,2,3,4,12 |
| | (c) | | | |
| **Q.4** | (a) | L2 | 3 | 1,2,3,4,12 |
| | (b) | L2,L3 | 3 | 1,2,3,4,12 |
| | (c) | | | |
| **Q.5** | (a) | L1,L3 | 3 | 1,2,3,4,12 |
| | (b) | L2 | 3 | 1,2,3,4,12 |
| | (c) | | | |
| **Q.6** | (a) | L1,L3 | 4 | 1,2,3,4,12 |
| | (b) | L1,L3 | 3 | 1,2,3,4,12 |
| | (c) | | | |
| **Q.7** | (a) | L2,L3 | 3 | 1,2,3,4,12 |
| | (b) | L2 | 3 | 1,2,3,4,12 |
| | (c) | | | |
| **Q.8** | (a) | L2 | 4 | 1,2,3,4,12 |
| | (b) | L3 | 4 | 1,2,3,4,12 |
| | (c) | | | |
| **Q.9** | (a) | L2 | 5 | 1,2,12 |
| | (b) | L2 | 5 | 1,2,12 |
| | (c) | L2 | 5 | 1,2,12 |
| **Q.10** | (a) | L2 | 5 | 1,2,12 |
| | (b) | L2 | 5 | 1,2,12 |
| | (c) | L2 | 5 | 1,2,12 |

| **Bloom's Taxonomy Levels** | **Lower order thinking skills** | | |
|---|---|---|---|
| | Remembering( knowledge):$L_1$ | Understanding Comprehension): $L_2$ | Applying (Application): $L_3$ |
| | **Higher order thinking skills** | | |
| | Analyzing (Analysis): $L_4$ | Valuating (Evaluation): $L_5$ | Creating (Synthesis): $L_6$ |

## Department of Computer Science & Engineering

### List of Activities / Events planned in the department under ATMECE Decennial Celebration (10-10-2020 to 10-10-2021)

| Sl No | Events Planned | Date of Execution | Event Coordinator |
|---|---|---|---|
| 1 | Technical Talk on "Pervasive Computing" | 19 -11-2020 | M S Sunitha Patel<br>ImpanaAppaji |
| 2 | Workshop on "Front End & Database Design" | 23-11-2020 to 24-11-2020 | Anil Kumar B H<br>Jyothi M Patil |
| 3 | Webinar on NLP | 28-11-2020 | Dr. J V Gorabal |
| 4 | Faculty Development programme on "National Education Policy(NEP)" | 29-1-2021 | M S Sunitha Patel |
| 5 | One week Faculty Development Programme on "CISCO Certification" | 05-04-2021 to 09-04-2021 | Anil Kumar B H<br>Kiran B |
| 6 | Webinar on "Data Science & its Applications" | 22-06-21 | Akshatha A |
| 7 | Webinar on "Career Pathway and Study Abroad Opportunities" | 23-06-2021 | Kavyashree.E.D |
| 8 | Workshop on "Latex" | 24-06-2021 to 26-06-2021 | Anil Kumar B H |
| 9 | National Level "Hackathon"2 under CSI Student Branch | 02-07-2021 to 03-07-2021 | Anil Kumar C J<br>Lavanya N |
| 10 | Project Exhibition | 02-08-2021 | Anil Kumar B H |

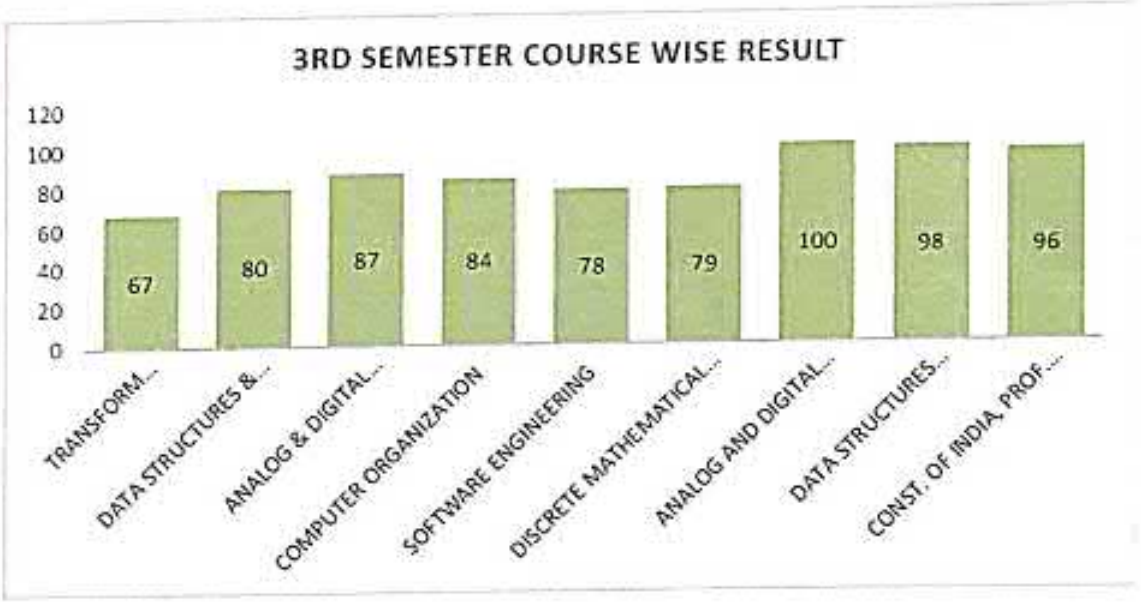
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## Department of Computer Science and Engineering

### Result analysis of Odd Semester- Academic Year- 2020-21

| Class | No. of Students | No. of Pass | FCD | FC | SC | Pass % |
|---|---|---|---|---|---|---|
| 3rd semester | | | | | | |
| Regular | 109 | 63 | 20 | 37 | 6 | 57.79 |
| Lateral | 22 | 8 | 0 | 3 | 5 | 36.36 |
| Overall | 131 | 71 | 20 | 40 | 11 | 54.20 |
| 5th semester | 112 | 68 | 18 | 41 | 9 | 60.71 |
| 7th semester | 91 | 88 | 88 | 0 | 0 | 96.70 |

**3rd Semester Course wise result**

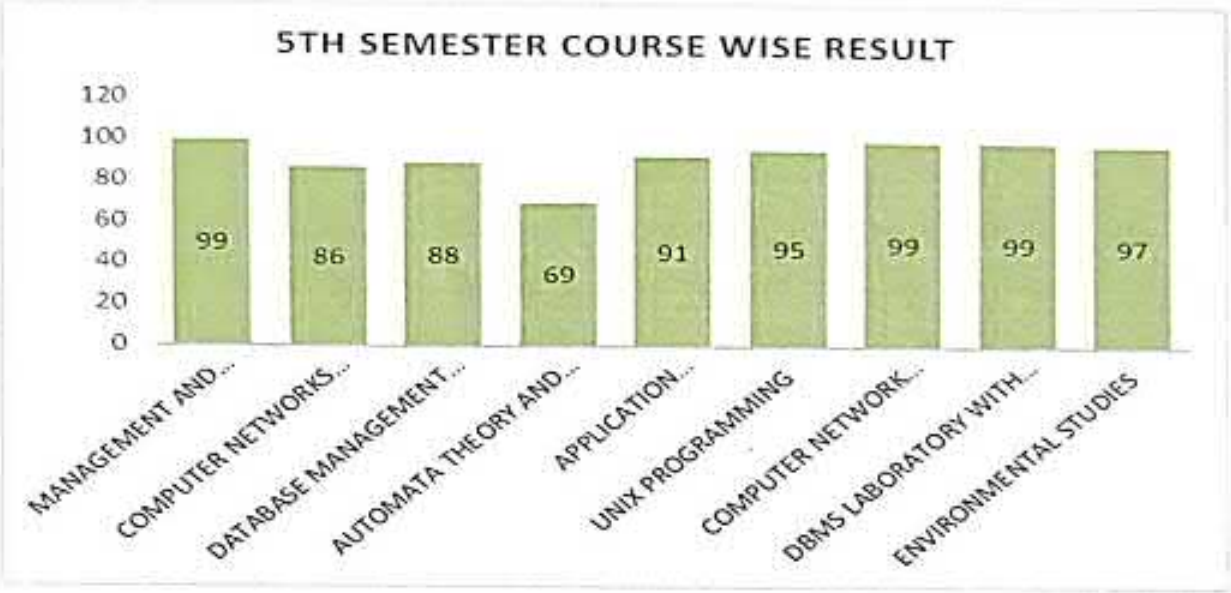



A.S. Raghuram.
Result Analysis Coordinator

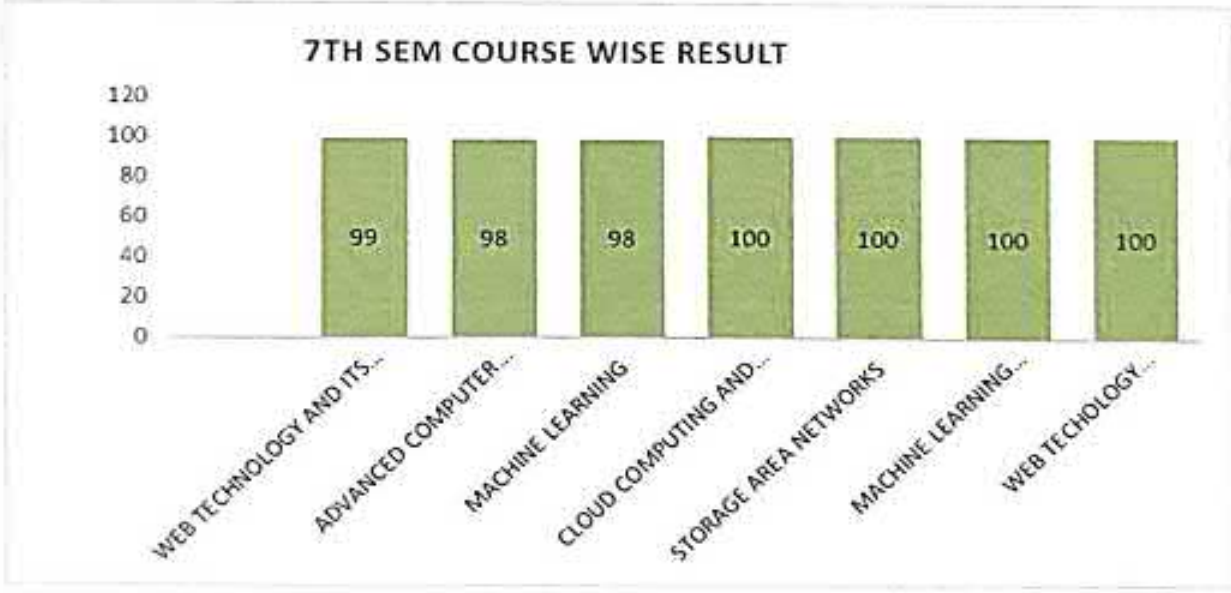
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## Department of Computer Science and Engineering

### 5th Semester Course-wise Result




### 7th Semester Course-wise Result




A.S. Raghuram
Result Analysis Coordinator

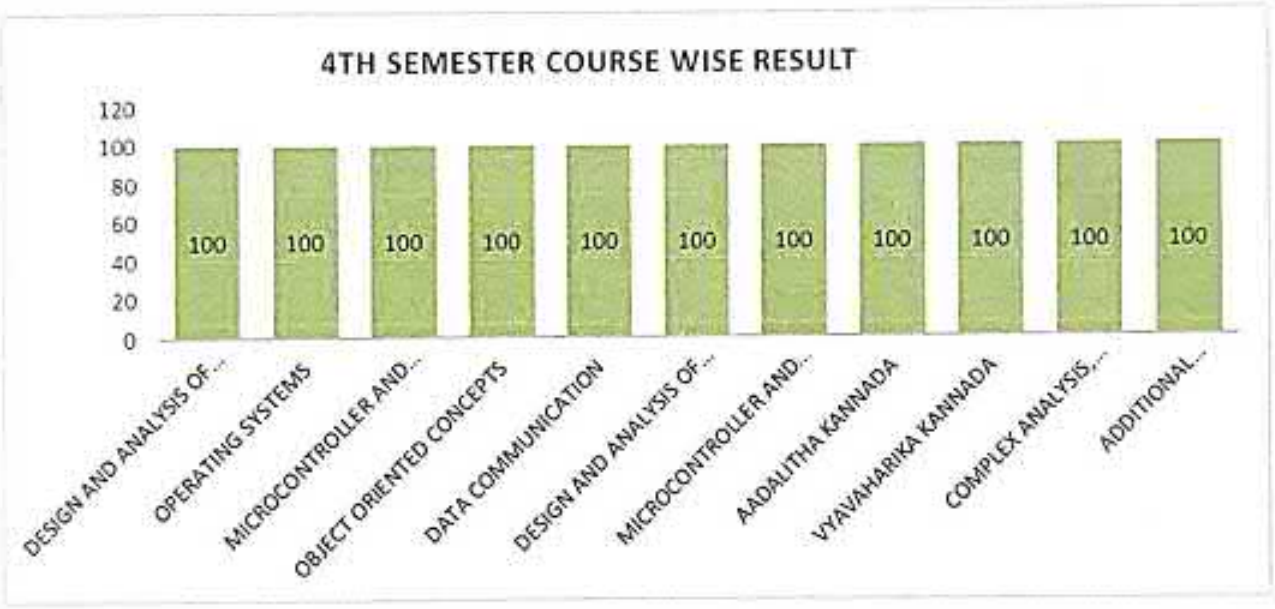
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## Department of Computer Science and Engineering

### Result analysis of Even Semester- Academic Year- 2020-21

| Class | No. of Students | No. of Pass | FCD | FC | SC | Pass % |
|---|---|---|---|---|---|---|
| 4th semester | 131 | 131 | 50 | 56 | 25 | 100 |
| 6th semester | 111 | 111 | 70 | 40 | 1 | 100% |
| 8th semester | 91 | 90 | 90 | 0 | 0 | 98.90% |

**4th Semester Course wise result**

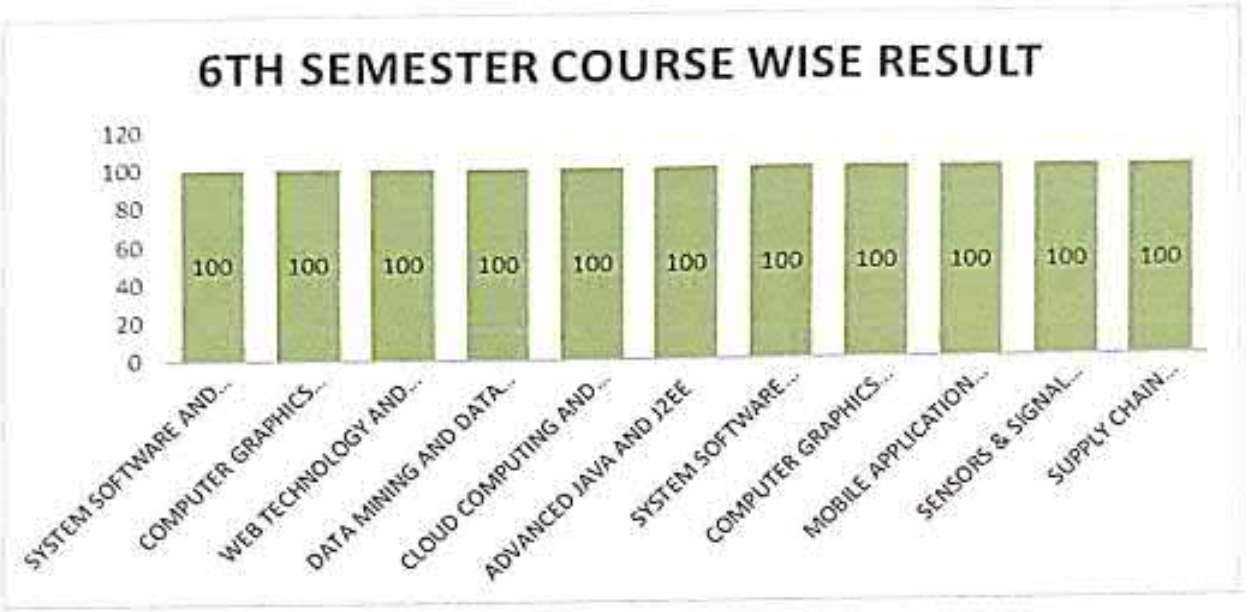



A.S. Raghuram.
Result Analysis Coordinator

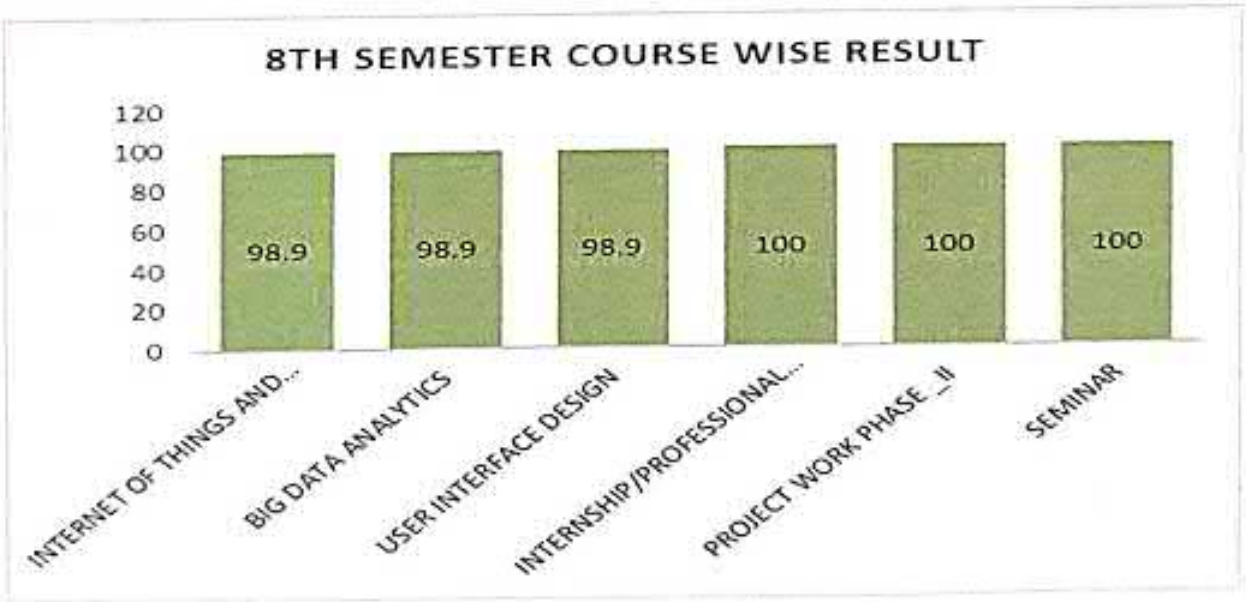
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## Department of Computer Science and Engineering

### 6th Semester Course-wise Result




### 8th Semester Course-wise Result




A.S. Raghuram.
Result Analysis Coordinator

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ATME College of Engineering

Period From Sep 2020 To Jan 2021 Semester : Odd / Even

Faculty Member : ANIL KUMAR. C. J

Designation : Associate Professor

Department : Computer Science & Engineering

Faculty Member ID : CS01008

| Sl. No. | Sem. / Sec. / Branch | Course Title | Course Code |
|---|---|---|---|
| 1 | V / B / CSE | Automata Theory and Computability | 18CS54 |
| 2 | III / B / CSE | Analog and Digital Electronics | 18CS33 |
| 3 | III / B / CSE | Analog and Digital Electronics Laboratory | 18CSL37 |
| 4 | | | |

| | Review at the end of the | | | | End of Semester |
|---|---|---|---|---|---|
| | 1st Month | 2nd Month | 3rd Month | 4th Month | |
| Staff | Completed 1½ Modules in Both ATC & ADE | Completed 2.5 Modules in ATC 2.5 Modules in ADE | Completed 3.5 Modules in ATC 4 Modules in ADE | ATC - 5 Modules Completed ADE - 4.5 Modules Completed | Completed 5 Modules in ATC & ADE and 9 Experiments in ADE Lab |
| HOD / Reviewer | Prowda 3/10/2020 | Prowda 3/11/2020 | Prowda 4/12/2020 | Prowda 5/1/2021 | Prowda 20/3/2021 |

| WEEK 1 | | MONDAY DATE | TUESDAY DATE 01/09 | WEDNESDAY DATE |
|---|---|---|---|---|
| ACTIVITY | Class Hours | | Induction program | 02/09/2020 |
| | Others | | | ➢ Attended Covid-19 response team meeting.<br>➢ Prepared Timetable for offline classes |

| WEEK 2 | | MONDAY DATE | TUESDAY DATE | WEDNESDAY DATE |
|---|---|---|---|---|
| ACTIVITY | Class Hours | 07/09/2020<br>III - period - 5B<br>ATC - functions on languages, Language hierarchy.<br>V - period - 3B<br>ADE - Karnaugh map 2 and 3 variable K-map | 08/09/2020<br>II - period - 3B<br>ADE - Four variable K-map | 09/9/2020 |
| | Others | ➢ Attended covid response duty for VTU Theory Exam<br>➢ Made allotment for student tested with +ve (Covid) to take up Examination | ➢ attended covid response team duty for VTU Theory Exam.<br>➢ worked on C#.net web services (CERP) | ➢ Attended covid response team duty for VTU Theory Exam<br>➢ Research work |

| WEEK 3 | | MONDAY DATE | TUESDAY DATE | WEDNESDAY DATE |
|---|---|---|---|---|
| ACTIVITY | Class Hours | 14/9/2020<br>III - period - 5B<br>ATC - NDFSM, From FSM to Operational systems<br>V - period - 3B<br>ADE - Quine-McCluskey method | 15/9/2020<br>II - period - 3B<br>ADE - Prime Implicant Chart, Petricks Method<br>VI - period - 3B<br>ADE lab - Experiment 4 - Adders & Subtractors (Rescheduled) | 16/9/2020 |
| | Others | ➢ Attended covid response team duty for VTU Theory Exam | ➢ Attended IEEE Student Branch Inauguration<br>➢ Attended covid response team duty for VTU Exam | ➢ Attended covid response team duty for VTU Exam<br>➢ attended meeting — NAAC criteria - 1. |

# WORK DONE DIARY

ATME College of Engineering

| WEEK 1 | THURSDAY DATE | FRIDAY DATE | SATURDAY DATE |
|---|---|---|---|
| ACTIVITY – Class Hours | 03/09/2020<br>II period – 5th B<br>ATC – Introduction, why study the theory of computation<br>IV period – 3-B<br>ADE lab – Introduction to Subpad, Electronic components & Basic Gates | 04/09/2020<br>III period – 5B<br>ATC – Strings, functions on strings, languages | 05/09/2020<br>II - period – 3B<br>ADE – Introduction, K-map, minimum form of switching functions |
| ACTIVITY – Others | > Attended covid response duty for VTU Theory Exam<br>> Added lesson plan in CRRP | > Attended Covid Response duty for VTU Theory Exam<br>> Entered IA Marks in VTU portal | > Attended covid response duty for VTU Theory Exam. |

| WEEK 2 | THURSDAY DATE | FRIDAY DATE | SATURDAY DATE |
|---|---|---|---|
| ACTIVITY – Class Hours | 10/9/2020<br>II - period – 5B<br>ATC – FSM, DFSM<br>IV - period – 3B<br>ADE Lab – Cancelled due to UPS Problem | 11/9/2020<br>III period – 5B<br>ATC – Regular Languages Designing DFSM | 12/9/2020<br>II - Period – 3B<br>ADE – Four variable K-map with don't care terms. Essential prime implicants |
| ACTIVITY – Others | > Attended NAAC presentation by IQAC cell | > Attended briefing of NEET Exam. | > Attended covid response team duty for VTU Theory Exam<br>> Attended Dept. Staff Meeting |

| WEEK 3 | THURSDAY DATE | FRIDAY DATE | SATURDAY DATE |
|---|---|---|---|
| ACTIVITY – Class Hours | 17/9/2020<br>Holiday | 18/9/2020<br>VI - period – 5B<br>ATC – Simulation for FSM, Minimizing FSM. | 19/9/2020<br>II – period – 3B<br>ADE – Simplification of incompletely specified functions |
| ACTIVITY – Others | | > NAAC Criteria-1 Work<br>> Prepared for class | > Carried out research work. |

| WEEK 4 | | MONDAY DATE | TUESDAY DATE | WEDNESDAY DATE |
|---|---|---|---|---|
| ACTIVITY | Class Hours | 21/9/2020<br>III - period - 5B<br>ATC - Canonical form of RE, Finite state Transducers, Bidirectional Transducers<br>V - period - 3B<br>ADE - Simplification using map entered variable | 22/9/2020<br>II - period - 3B<br>ADE - Combinational circuit design and simulation using gates | 23/9/2020 |
| | Others | ➢ Attended covid response team duty for VTU Exam<br>➢ Carried out NAAC WORK | ➢ Attended covid response team duty for VTU Exam<br>➢ Carried out NAAC WORK | ➢ Attended covid response team duty for VTU Exam<br>➢ Attended meeting with NAAC criteria - 1 Coordinators<br>➢ Attended Dept. staff meeting |
| **WEEK 5** | | **MONDAY DATE** | **TUESDAY DATE** | **WEDNESDAY DATE** |
| ACTIVITY | Class Hours | 28/09/2020<br>III - period - 5B<br>ATC - manipulating & simplifying REs<br>V - period - 3B<br>ADE - Gate delays & Timing diagrams | 29/09/2020<br>II - period - 3B<br>ADE - Hazards in combinational circuits | 30/9/2020 |
| | Others | ➢ prepared for class<br>➢ NAAC WORK | ➢ Attended covid-19 Team Meeting<br>➢ Attended Teachers day & Engineers day celebration | ➢ Attended Technical talk on Natural Language processing<br>➢ attended webinar on scientific writing for Journals. |
| **WEEK 6** | | **MONDAY DATE** | **TUESDAY DATE** | **WEDNESDAY DATE** |
| ACTIVITY | Class Hours | 05/10/2020<br>III - period - 5B<br>ATC - Regular & Non-Regular Languages<br>V - period - 3B<br>ADE - 3 state buffers, decoders & Encoders. | 06/10/2020<br>II - period - 3B<br>ADE - ROM & programmable logic devices | 07/10/2020 |
| | Others | ➢ prepared for class<br>➢ NAAC WORK | ➢ prepared - first IA Timetable<br>➢ prepared - Test Question paper (ADE) | ➢ Prepared Test Question papers (ATC)<br>➢ Scrutinized Question papers (Vertical head) |

| WEEK 4 | THURSDAY DATE | FRIDAY DATE | SATURDAY DATE |
|---|---|---|---|
| ACTIVITY – Class Hours | 24/9/2020<br>II -period - 5B<br>ATC - Regular Expressions<br>IV -period - 3B<br>ADE lab - Experiment No.5<br>Realization of 8:1 MUX. | 25/9/2020<br>III -period - 5B<br>ATC - Kleene's Theorem applications of REs | 26/9/2020<br>VI -period - 3B<br>ADE - Design of circuits using limited gate fan-in |
| ACTIVITY – Others | > carried out NAAC work<br>> attended NBA coordinators meeting with Dean Academics | > attended covid response team duty for VTU Exam<br>> carried out NAAC work | > NAAC Criteria-3 work. |

| WEEK 5 | THURSDAY DATE | FRIDAY DATE | SATURDAY DATE |
|---|---|---|---|
| ACTIVITY – Class Hours | 01/10/2020<br>II -period - 5B<br>ATC - Regular Grammar<br>V period - 3B<br>ADE lab - Experiment 6 - JK master slave FF using NAND Gates | 02/10/2020<br>Holiday<br>Gandhi Jayanthi | 03/10/2020<br>II -period - 3B<br>ADE - Multiplexers |
| ACTIVITY – Others | | | > carried out Research work<br>> Mentoring |

| WEEK 6 | THURSDAY DATE | FRIDAY DATE | SATURDAY DATE |
|---|---|---|---|
| ACTIVITY – Class Hours | 08/10/2020<br>First IA<br>- Done Invigilation Duty Both Morning & afternoon sessions | 09/10/2020<br>First IA<br>- Done Invigilation duty. Both Morning & afternoon sessions | 10/10/2020<br>Decennary and Founders Day Celebration |
| ACTIVITY – Others | > attended NBA coordinators meeting with Dean academics | > Scrutinized Test Question papers | |

| WEEK 7 | MONDAY DATE | TUESDAY DATE | WEDNESDAY DATE |
|---|---|---|---|
| ACTIVITY – Class Hours | 12/10/2020<br>First - 3A<br>Done Invigilation duty<br>Both Morning & Afternoon session | 13/10/2020<br>II - period - 3B<br>ADE - Programmable Logic array and Programmable Array Logic | 14/10/2020 |
| ACTIVITY – Others | ✓ NAAC Work | ✓ Prepared for class<br>✓ NAAC Work | ✓ Prepared Scheme<br>✓ Attended Dept. staff Meeting<br>✓ Attended NBA Coordinators Meeting with DEAN Academic |

| WEEK 8 | MONDAY DATE | TUESDAY DATE | WEDNESDAY DATE |
|---|---|---|---|
| ACTIVITY – Class Hours | 19/10/2020<br>III - period - 5B<br>ATC - To show some Languages are not Regular<br>V - period - 3B<br>ADE - VHDL Models of multiplexer | 20/10/2020<br>II - period - 3B<br>ADE - VHDL Modules | 21/10/2020<br>CL |
| ACTIVITY – Others | ✓ prepared for class<br>✓ NBA & NAAC Work | ✓ NBA & NAAC Work<br>✓ prepared for class | |

| WEEK 9 | MONDAY DATE | TUESDAY DATE | WEDNESDAY DATE |
|---|---|---|---|
| ACTIVITY – Class Hours | 26/10/2020<br>Holiday<br>Vijayadashami | 27/10/2020<br>II - period - 3B<br>ADE - Gated latches Edge triggered flip flops - SR & D FF. | 28/10/2020 |
| ACTIVITY – Others | | ✓ NAAC Work<br>✓ NBA Work | ✓ Attended NBA Coordinators Meeting with Dean Academics<br>✓ Attended Meeting - CERP Modules demo |

# WORK DONE DIARY

ATME College of Engineering

| WEEK 7 | | THURSDAY DATE | FRIDAY DATE | SATURDAY DATE |
|---|---|---|---|---|
| ACTIVITY | Class Hours | 15/10/2020<br>II - period - 5B<br>ATC - To show that the Language is regular<br>IV - period - 3B<br>ADE Lab - Virtual labs - Introduction | 16/10/2020<br>III - period - 5B<br>ATC - Some important Closure properties of RE | 17/10/2020<br>II period - 3B<br>ADE - Introduction to VHDL |
| | Others | > prepared for class | > prepared for class<br>> NAAC work | > Carried out Research work |

| WEEK 8 | | THURSDAY DATE | FRIDAY DATE | SATURDAY DATE |
|---|---|---|---|---|
| ACTIVITY | Class Hours | 22/10/2020<br>II - period - 5B<br>ATC - Introduction to Regular sets & Grammars<br>IV - period - 3B<br>ADE Lab - Experiment - 4 - code converters | 23/10/2020<br>III - period - 5B<br>ATC - CFGs and Languages, designing CFG's, Simplifying CFG's | 24/10/2020<br>II - period - 3B<br>ADE - Latches & Flip flops - SR latch |
| | Others | > prepared for class<br>> Attended Dept. staff Meeting | > Carried out NAAC work<br>> prepared for class | > Ayudha pooja celebration<br>> NBA work. |

| WEEK 9 | | THURSDAY DATE | FRIDAY DATE | SATURDAY DATE |
|---|---|---|---|---|
| ACTIVITY | Class Hours | 29/10/2020<br>II period - 5B<br>ATC - Proving grammar is correct, Derivation, Parse Tree, Ambiguity.<br>IV period - 3B<br>ADE Lab - Experiment 8 - Synchronous up counter using JK FF TC | 30/10/2020<br>Holiday<br>Eid-Milad | 31/10/2020<br>Holiday<br>Valmiki Jayanthi |
| | Others | > Attended Meeting - CERP modules Demo<br>> Attended dept staff Meeting | | |

| WEEK 10 | | MONDAY DATE | TUESDAY DATE | WEDNESDAY DATE |
|---|---|---|---|---|
| ACTIVITY | Class Hours | 8/11/2020<br>III period - 5B<br>ATC - Natural forms & FDA<br>V period - 3B<br>AOE - JK & T flip-flops<br>Rescheduled class due to Meeting | 3/11/2020<br>II period - 3B<br>AOE - JK & T flip-flops | 4/11/2020 |
| | Others | > Carried out NBA work<br>> Attended meeting (NBA coordinator) with Dean academics | 3/11/2020<br>> Provided new attainment process for PO-PO & PSO.<br>> Carried out NBA & NAAC work | > Carried out NBA & NAAC work<br>> Carried out research work |

| WEEK 11 | | MONDAY DATE | TUESDAY DATE | WEDNESDAY DATE |
|---|---|---|---|---|
| ACTIVITY | Class Hours | 9/11/2020<br>III period - 5B<br>ATC -<br>V period - 3B<br>- not taken due to CIA Test (2nd IA) | 10/11/2020<br>II period - 3B<br>AOE - Registers & Counters - Register & Register transfer | 11/11/2020 |
| | Others | > Attended FDP on NAAC Accreditation | > Attended FDP on NAAC Accreditation | > Attended FDP on NAAC Accreditation |

| WEEK 12 | | MONDAY DATE | TUESDAY DATE | WEDNESDAY DATE |
|---|---|---|---|---|
| ACTIVITY | Class Hours | 16/11/2020<br>Holiday | 17/11/2020<br>2nd IA | 18/11/2020 |
| | Others | | | > NBA & NAAC work<br>> Attended meeting regarding CERP meeting held |

| WEEK 10 | | THURSDAY DATE | FRIDAY DATE | SATURDAY DATE |
|---|---|---|---|---|
| ACTIVITY | Class Hours | 5/11/2020<br>II period - 5B<br>ATC - PDA - DPDA & NDPDA<br>III period - 3B<br>ADE lab - Experiment 8 - class terminated due to audio problem. | 6/11/2020<br>III period - 5B (2 periods)<br>ATC - Deterministic & non deterministic PDA | 7/11/2020<br>II period - 3B<br>ADE - Flip flops with additional inputs & Applications sequential circuits |
| | Others | ✓ Attended NAAC criteria 1 coordinators Meeting | ✓ Carried out NBA work<br>✓ Prepared for class | ✓ Carried out Research work |

| WEEK 11 | | THURSDAY DATE | FRIDAY DATE | SATURDAY DATE |
|---|---|---|---|---|
| ACTIVITY | Class Hours | 12/11/2020<br>2nd IA | 13/11/2020<br>2nd IA | 14/11/2020<br>Holiday |
| | Others | ✓ Done test invigilation duty for both morning & afternoon session.<br>✓ Attended Dept Staff meeting. | | |

| WEEK 12 | | THURSDAY DATE | FRIDAY DATE | SATURDAY DATE |
|---|---|---|---|---|
| ACTIVITY | Class Hours | 19/11/2020<br>II period - 5B<br>ATC - Alternative Equivalent definitions of a PDA, Alternative not equivalent.<br>III period - 3B<br>ADE Lab - Experiment No. 9 Asynchronous up counter | 20/11/2020<br>III period - 5B<br>ATC - Algorithms & Decision Procedures for CFLs Decidable Questions | 21/11/2020<br>II period - 3B<br>ADE - parallel adder with accumulator with registers - Shift registers |
| | Others | ✓ Attended NAAC Criteria-1 Coordinators meeting<br>✓ Attended Technical talk on "Renewable energy". | ✓ Attended webinar on "IPR & its role in Research & innovation".<br>✓ Attended dept. staff meeting<br>✓ NAAC work | ✓ Carried out research work |

| WEEK 13 | | MONDAY DATE | TUESDAY DATE | WEDNESDAY DATE |
|---|---|---|---|---|
| ACTIVITY | Class Hours | 23/11/2020<br>II period - 5B<br>ATC - Decidable & Undecidable Question<br>I period - 3B<br>ADE - no Taken due to NAAC meeting | 24/11/2020<br>II - period - 3B<br>ADE - Design of Binary counter | 25/11/2020 |
| | Others | > Attended NAAC criteria-1 coordinators Meeting<br>> Attended NBA coordinators Meeting with Dean academics | > NBA work<br>> Attended NBA coordinators meeting with Dean academics | > NBA & NAAC work<br>> Communicated with Students regarding VTU registration |

| WEEK 14 | | MONDAY DATE | TUESDAY DATE | WEDNESDAY DATE |
|---|---|---|---|---|
| ACTIVITY | Class Hours | 30/11/2020<br>II period - 5B<br>ATC - Design of Turing Machines<br>I period - 3B<br>ADE - Sequential Parity Checker | 1/12/2020<br>II period - 3B<br>ADE - State tables & Graphs | 2/12/2020 |
| | Others | > NBA & NAAC work<br>> Attended CSI - Technical talk on Data Science | > NBA work | > NBA file verification (R Files)<br>> NBA & NAAC work |

| WEEK 15 | | MONDAY DATE | TUESDAY DATE | WEDNESDAY DATE |
|---|---|---|---|---|
| ACTIVITY | Class Hours | 7/12/2020<br>EL | 8/12/2020<br>EL | 9/12/2020 |
| | Others | | | > Carried out NBA & NAAC work<br>> Carried out Research work |

# WORK DONE DIARY

ATME College of Engineering

| WEEK 13 | THURSDAY DATE | FRIDAY DATE | SATURDAY DATE |
|---|---|---|---|
| ACTIVITY – Class Hours | 26/11/2020<br>II - period - 3B<br>ATC - Turing Machine<br>IV - period - 3B<br>ADE - counters & other sequences | 27/11/2020<br>III period - 5B<br>ATC - Representation, language, acceptability by TM | 28/11/2020<br>IV period - 3B<br>ADE - counter design using SR & JK FF |
| ACTIVITY – Others | ✓ attended meeting regarding CERP Modules demo from 2:15 to 4:00 pm | ✓ NBA & NAAC WORK | ✓ attended webinar on Industrial application of NLP.<br>✓ NBA WORK |

| WEEK 14 | THURSDAY DATE | FRIDAY DATE | SATURDAY DATE |
|---|---|---|---|
| ACTIVITY – Class Hours | 3/12/2020<br>Holiday | 4/12/2020<br>III period - 5B<br>ATC - Techniques & TM construction | 5/12/2020<br>EL |
| ACTIVITY – Others | | ✓ Carried out NAAC WORK<br>✓ attended NBA coordinators meeting with dean academics<br>✓ attended presentation on MS Teams accounts maintenance | |

| WEEK 15 | THURSDAY DATE | FRIDAY DATE | SATURDAY DATE |
|---|---|---|---|
| ACTIVITY – Class Hours | 10/12/2020<br>II - period - 5B<br>ATC - variants of TM<br>IV - period - 3B<br>ADE - counters & other sequences | 11/12/2020<br>III - period - 5B<br>ATC - The model of linear bounded automata | 12/12/2020<br>II period - 3B<br>ADE<br>- not taken due to stomach pain. |
| ACTIVITY – Others | ✓ attended CO attainment process presentation by staff | ✓ NAAC & NBA WORK | ✓ Carried out NBA WORK |

ATME College of Engineering

# WORK DONE DIARY

| WEEK 16 | | MONDAY DATE | TUESDAY DATE | WEDNESDAY DATE |
|---|---|---|---|---|
| ACTIVITY | Class Hours | 14/12/2020<br>III period - SB<br>ATC - Defn of algorithm, decidability, decidable languages<br>IV period - 2B<br>ADE lab - Experiment-1 Astable Multivibrator | 15/12/2020<br>II period - 3B<br>ADE - Design of Binary Counters (Repetition) | 16/12/2020<br>CL |
| | Others | > Attended NBA coordinators Meeting with Dean Academics | > NBA work<br>> Attended webinar on "Awareness of Cyber Crime prevention & Detection. | |

| WEEK 17 | | MONDAY DATE | TUESDAY DATE | WEDNESDAY DATE |
|---|---|---|---|---|
| ACTIVITY | Class Hours | 21/12/2020<br>III period - 5B<br>ATC - The post correspondance problem - Complexity<br>IV period - 3B<br>ADE - Not taken due to NBA work discussion with HOD. | 22/12/2020<br>II - period - 3B<br>ADE - BJT biasing - fixed base bias, - collector to base bias - Multivibrators | 23/12/2020 |
| | Others | > Carried out NBA Mock Verification for - ECE department | > NBA Mock Verification - Dept. of CSE | > NBA Mock Verification for ME dept.<br>> Attended meeting regarding CERP work |

| WEEK 18 | | MONDAY DATE | TUESDAY DATE | WEDNESDAY DATE |
|---|---|---|---|---|
| ACTIVITY | Class Hours | 28/12/20<br>III 3A | 29/12/20<br>III 3A | 30/12/20<br>III 3A |
| | Others | | | |

| WEEK 16 | THURSDAY DATE | FRIDAY DATE | SATURDAY DATE |
|---|---|---|---|
| ACTIVITY – Class Hours | 17/12/2020<br>IV period - 5B<br>ATC - Decidable & undecidable languages<br>VI period - 3B<br>ADE Lab - Experiment 2 - Relaxation oscillator | 18/12/2020<br>III period - 5B<br>ATC - Halting problem, Post Correspondance problem | 19/12/2020<br>II period - 3B<br>ADE - Optoelectronic devices : photodiode, LED, Optocoupler |
| ACTIVITY – Others | > NBA Work | > NBA Work<br>> prepared for class | > NBA Work<br>> prepared SIH & other event conducted report. |

| WEEK 17 | THURSDAY DATE | FRIDAY DATE | SATURDAY DATE |
|---|---|---|---|
| ACTIVITY – Class Hours | 24/12/2020<br>III period - 5B<br>ATC - Other classes of P & NP; Quantum computers.<br>I period - 3B<br>ADE Lab - Experiment 3 - Window comparator | 25/12/2020<br>Holiday. | 26/12/2020<br>II period - 3B<br>ADE - Multivibrators, peak detectors & comparators |
| ACTIVITY – Others | > Carried out NBA work verification for EEE dept. | | > Carried out NBA work verification for CV dept.<br>> Scrutinized Test QP. |

| WEEK 18 | THURSDAY DATE | FRIDAY DATE | SATURDAY DATE |
|---|---|---|---|
| ACTIVITY – Class Hours | 31/12/20<br>IV period - 5B<br>ACT - Class not taken due to power issue.<br>I period - 3B<br>ADE Lab - Astable multivibrators (Repetition) | 01/01/21<br>III period - 5B<br>ATC - Normalization & CFG (Repetition) | 02/01/21<br>II period - 3B<br>ADE - Window comparators & active filters |
| ACTIVITY – Others | - Attended webinar on "How to write proposals for funding" | - Prepared scheme<br>- Carried out NBA work | - Attended talk on DST proposal writing<br>- Attended webinar on "creating presentation slides using LaTeX Beamer". |

# ATME College of Engineering

## C1.1.1 - The Institution ensures effective curriculum delivery through a well planned and documented process

## Supporting Documents

### Index

| Sl. No. | Academic Year | Particulars |
|---|---|---|
| 1 | **2020-21** | Academic Calendar- College & Department |
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| 9 | | Question Bank-VTU Previous Year QP |
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# Department of Mechanical Engineering

**ATME COLLEGE OF ENGINEERING**
13th Kilometer, Mysore-Kanakapura-Bangalore Road, Mysore – 570 028 P : 0821-2593335 F: 0821-2593328
Email: info@atme.in, Web : www.atme.in

# ATME COLLEGE OF ENGINEERING, MYSURU

**Revised Academic Calendar (EVEN SEMESTER, 2020-21)**

| WEEK | MONTH | SUN | MON | TUE | WED | THU | FRI | SAT | HOLIDAY (H) | COLLEGE EVENTS |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | APRIL | | | | | 1 | 2 | 3 | | |
| 2 | | 4 | 5 | 6 | 7 | 8 | 9 | 10 | | |
| 3 | | 11 | 12 | 13 | 14 | 15 | 16 | 17 | | |
| 4 | | 18 | 19 | 20 | 21 | 22 | 23 | 24 | | Commencement of 4th, 6th and 8th Semester Classes |
| 5 | | 25 | 26 | 27 | 28 | 29 | 30 | | | |
| 5 | MAY | | | | | | | 1 | May Day | |
| 6 | | 2 | 3 | 4 | 5 | 6 | 7 | 8 | | |
| 7 | | 9 | 10 | 11 | 12 | 13 | 14 | 15 | Basava Jayanthi, Ramzan | |
| 8 | | 16 | 17 | 18 | 19 | 20 | 21 | 22 | | |
| 9 | | 23 | 24 | 25 | 26 | 27 | 28 | 29 | | FIRST IA 4TH AND 6TH SEM |
| | | 30 | 31 | | | | | | | |
| 10 | JUNE | | | 1 | 2 | 3 | 4 | 5 | | |
| 11 | | 6 | 7 | 8 | 9 | 10 | 11 | 12 | | |
| 12 | | 13 | 14 | 15 | 16 | 17 | 18 | 19 | | |
| 13 | | 20 | 21 | 22 | 23 | 24 | 25 | 26 | | |
| 14 | | 27 | 28 | 29 | 30 | | | | | |

**Non Working Saturdays**

# ATME COLLEGE OF ENGINEERING, MYSURU

## Revised Academic Calendar (EVEN SEMESTER, 2020-21)

| WEEK | MONTH | SUN | MON | TUE | WED | THU | FRI | SAT | HOLIDAY (H) | COLLEGE EVENTS |
|---|---|---|---|---|---|---|---|---|---|---|
| 14 | JULY | | | | | 1 | 2 | 3 | | SECOND IA 4TH AND 6TH SEM |
| 15 | | 4 | 5 | 6 | 7 | 8 | 9 | 10 | | |
| 16 | | 11 | 12 | 13 | 14 | 15 | 16 | 17 | | |
| 17 | | 18 | 19 | 20 | 21 | 22 | 23 | 24 | Bakrid | 8th Sem Last Working Day, 8th Sem Theory Exam Begins |
| 18 | | 25 | 26 | 27 | 28 | 29 | 30 | 31 | | 8th Sem Theory Exam Ends, THIRD IA 4th AND 6th SEM |
| 18 | AUGUST | 1 | 2 | 3 | 4 | 5 | 6 | 7 | | 4th and 6th Sem Last Working Day, 8th Sem Internship Viva Voce. LAB IA 4th and 6th Sem. |
| 19 | | 8 | 9 | 10 | 11 | 12 | 13 | 14 | | Practical Exams Starts for 4th and 6th Sem |
| 20 | | 15 | 16 | 17 | 18 | 19 | 20 | 21 | Muharram | Practical Exams Ends for 4th and 6th Sem |
| 21 | | 22 | 23 | 24 | 25 | 26 | 27 | 28 | | Theory Exams Starts for 4th and 8th Sem |
| 22 | | 29 | 30 | 31 | | | | | | |
| 23 | SEPTEMBER | | | | 1 | 2 | 3 | 4 | | |
| 24 | | 5 | 6 | 7 | 8 | 9 | 10 | 11 | Ganesha Chathurthi | Theory Exams Starts for 4th and 8th Sem |
| 25 | | 12 | 13 | 14 | 15 | 16 | 17 | 18 | | |
| 26 | | 19 | 20 | 21 | 22 | 23 | 24 | 25 | Non Working Saturdays | |
| 27 | | 26 | 27 | 28 | 29 | 30 | 31 | 32 | | |
| WORKING DAYS (8th Sem) | | | 14 | 14 | 13 | 13 | 13 | 6 | 73 | |
| WORKING DAYS(4th & 6th) | | | 16 | 16 | 15 | 16 | 16 | 7 | 86 | Inclusive of IA tests and other activities |

DEAN ACADEMICS
DR. M S GOVINDE GOWDA

PRINCIPAL
DR. L BASAVARAJ

# ATME COLLEGE OF ENGINEERING, MYSURU

## Revised Academic Calendar (ODD SEMESTER, 2020-21)

| WEEK | MONTH | SUN | MON | TUE | WED | THU | FRI | SAT | HOLIDAY (H) | COLLEGE EVENTS |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | SEPTEMBER | | | 1 | 2 | 3 | 4 | 5 | | 3rd , 5th & 7th Semster : commencement of Online Classes |
| 2 | | 6 | 7 | 8 | 9 | 10 | 11 | 12 | | |
| 3 | | 13 | 14 | 15 | 16 | 17 | 18 | 19 | Mahalaya Amavasya | |
| 4 | | 20 | 21 | 22 | 23 | 24 | 25 | 26 | | |
| 5 | | 27 | 28 | 29 | 30 | | | | | |
| 5 | OCTOBER | | | | | 1 | 2 | 3 | Gandhi Jayanthi | |
| 6 | | 4 | 5 | 6 | 7 | 8 | 9 | 10 | | First I A for 3rd , 5th and 7th Semester |
| 7 | | 11 | 12 | 13 | 14 | 15 | 16 | 17 | | |
| 8 | | 18 | 19 | 20 | 21 | 22 | 23 | 24 | | |
| 9 | | 25 | 26 | 27 | 28 | 29 | 30 | 31 | Ayudha Pooja, Vijaya Dashami, Eid-Milad , Valmiki Jayanthi | |
| 10 | NOVEMBER | 1 | 2 | 3 | 4 | 5 | 6 | 7 | Kannada Rajyotsava | |
| 11 | | 8 | 9 | 10 | 11 | 12 | 13 | 14 | Naraka Chaturdashi | Second IA for 3rd , 5th and 7th Semester |
| 12 | | 15 | 16 | 17 | 18 | 19 | 20 | 21 | Balipadyami | Commencement of On-Campus Classes for Semseter 7. |
| 13 | | 22 | 23 | 24 | 25 | 26 | 27 | 28 | | |
| 14 | | 29 | 30 | | | | | | | |

Non Working Saturdays

# ATME COLLEGE OF ENGINEERING, MYSURU

**Revised Academic Calendar (ODD SEMESTER, 2020-21)**

| WEEK | MONTH | SUN | MON | TUE | WED | THU | FRI | SAT | HOLIDAY (H) | COLLEGE EVENTS |
|---|---|---|---|---|---|---|---|---|---|---|
| 14 | DECEMBER | | | 1 | 2 | 3 | 4 | 5 | Kanakadasa Jayanthi | |
| 15 | | 6 | 7 | 8 | 9 | 10 | 11 | 12 | | |
| 16 | | 13 | 14 | 15 | 16 | 17 | 18 | 19 | | |
| 17 | | 20 | 21 | 22 | 23 | 24 | 25 | 26 | Christmas | |
| 18 | | 27 | 28 | 29 | 30 | 31 | | | | Third IA for Semesters 3, 5 and 7 |
| 18 | JANUARY | | | | | | 1 | 2 | | |
| 19 | | 3 | 4 | 5 | 6 | 7 | 8 | 9 | | LAB Interenals for Semesters 3,5 and 7 |
| 20 | | 10 | 11 | 12 | 13 | 14 | 15 | 16 | Makra Sankranthi | Improvement IA for Semesters 3,5 and 7, LAST working day for ODD Sem 2020-21 |
| 21 | | 17 | 18 | 19 | 20 | 21 | 22 | 23 | | Comencement of Odd Semester Practical Exams |
| 22 | | 24 | 25 | 26 | 27 | 28 | 29 | 30 | Republic Day | |
| 23 | | 31 | | | | | | | | |
| 23 | FEBRUARY | | 1 | 2 | 3 | 4 | 5 | 6 | | End of Odd Semester Practical Exams |
| 24 | | 7 | 8 | 9 | 10 | 11 | 12 | 13 | | Commencement of Odd Semester Theory Exams |
| 25 | | 14 | 15 | 16 | 17 | 18 | 19 | 20 | | |
| 26 | | 21 | 22 | 23 | 24 | 25 | 26 | 27 | | |
| 27 | | 28 | | | | | | | | |
| | | | | | | | | Non Working Saturdays | | |
| No. Of Working Days | | | 17 | 20 | 20 | 17 | 17 | 9 | Total No. Of Working Days | 100 |

# ATME COLLEGE OF ENGINEERING, MYSURU

## Revised Academic Calendar (ODD SEMESTER, 2020-21)

| WEEK | MONTH | SUN | MON | TUE | WED | THU | FRI | SAT | HOLIDAY (H) | COLLEGE EVENTS |
|---|---|---|---|---|---|---|---|---|---|---|
| 14 | MARCH | | 1 | 2 | 3 | 4 | 5 | 6 | | |
| 15 | | 7 | 8 | 9 | 10 | 11 | 12 | 13 | Mahashivaratri | |
| 16 | | 14 | 15 | 16 | 17 | 18 | 19 | 20 | | |
| 17 | | 21 | 22 | 23 | 24 | 25 | 26 | 27 | | 25th End of odd semester Theory exams, 26th Mar 2021 Commencement of Even Semester |
| 18 | | 28 | 29 | 30 | 31 | | | | | |
| 18 | APRIL | | | | | 1 | 2 | 3 | Good Friday | |
| 19 | | 4 | 5 | 6 | 7 | 8 | 9 | 10 | | |
| 20 | | 11 | 12 | 13 | 14 | 15 | 16 | 17 | Chadramana Yugadi, Ambedkar Jayanthi | |
| 21 | | 18 | 19 | 20 | 21 | 22 | 23 | 24 | | |
| 22 | | 25 | 26 | 27 | 28 | 29 | 30 | | Mahavir Jayanthi | |
| 23 | MAY | | | | | | | 1 | May Day (Labour Day) | |
| 23 | | 2 | 3 | 4 | 5 | 6 | 7 | 8 | | |
| 24 | | 9 | 10 | 11 | 12 | 13 | 14 | 15 | Idul-Fitr, Basava Jayathi | |
| 25 | | 16 | 17 | 18 | 19 | 20 | 21 | 22 | | |
| 26 | | 23 | 24 | 25 | 26 | 27 | 28 | 29 | | |
| 27 | | 30 | 31 | | | | | | | |

Non Working Saturdays

Sd-
Dr. L Basavaraj
Principal

ATME College of Engineering

Department of Mechanical Engineering

# Academic calendar for the year 2020-21 (EVEN Semester)

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| APRIL | W1 | | | | 1 | 2 | 3 | 4 | | |
| | W2 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 19 : Commencement of 4th, 6th and 8th Semester | |
| | W3 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | | |
| | W4 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | | |
| | W5 | 26 | 27 | 28 | 29 | 30 | | | | |
| MAY | W6 | | | | | | 1 | 2 | 24 to 26: First IA 4th and 6th sem | 1: May Day/ Labour Day<br>14: Basava Jayanthi |
| | W7 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | | |
| | W8 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | | |
| | W9 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | | |
| | W10 | 24 | 25 | 26 | 27 | 28 | 29 | 30 | | |
| | W11 | 31 | | | | | | | | |
| JUNE | W12 | | 1 | 2 | 3 | 4 | 5 | 6 | | |
| | W13 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | | |
| | W14 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | | |
| | W15 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | | |
| | W16 | 28 | 29 | 30 | | | | | | |
| JULY | W17 | | | | 1 | 2 | 3 | 4 | 1 to 3: Second IA 4th and 6th sem<br>20: 8th Sem Last Working Day<br>22:8th Sem Theory Exam Begins<br>30:8th Sem Theory Exam Ends<br>29 to 31:Third IA 4th and 6th Sem | 21: Bakrid |
| | W18 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | | |
| | W19 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | | |
| | W20 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | | |
| | W21 | 26 | 27 | 28 | 29 | 30 | 31 | | | |
| AUGUST | W22 | | | | | | | 1 | 2 to 6: 8th Sem Internship Viva Voce<br>7: 4th and 6th Sem Last Working Day<br>9 – 19: Practical Examination for 4th and 6th sem<br>23: Commencement of Theory Examination for 4th and 6th sem | 20: Last Day of Moharam |
| | W23 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | | |
| | W24 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | | |
| | W25 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | | |
| | W26 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | | |

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | W27 | 30 | 31 | | | | | | | |

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| SEPTEMBER | W28 | | | 1 | 2 | 3 | 4 | 5 | 9: End of Theory examination for 4th and 6th sem<br>13: Commencement of ODD Semester | 10: Ganesha Chathurthi |
| | W29 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | | |
| | W30 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | | |
| | W31 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | | |
| | W32 | 27 | 28 | 29 | 30 | | | | | |

**NOTE:**

* **Club Activities will be during all Wednesdays as per Schedule.**
* **Aptitude trainings will be run as per schedule.**
* **Technical trainings will be run as per schedule.**
* **Mentoring as per scheduled timetable.**

| List of Non working Saturdays |
|---|
| Date |
| 10/04/2021 |
| 24/04/2021 |
| 08/05/2021 |
| 22/05/2021 |
| 12/06/2021 |
| 26/06/2021 |
| 10/07/2021 |
| 24/07/2021 |
| 14/08/2021 |
| 28/08/2021 |
| 11/09/2021 |
| 25/09/2021 |

HOD
Department of Mechanical Engineering
ATME College of Engineering
Mysuru - 570028

ATME College of Engineering

Department of Mechanical Engineering

# Academic calendar for the year 2020-21 (ODD Semester)

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| SEPTEMBER | W1 | | 1 | 2 | 3 | 4 | 5 | 6 | 1 : Commencement of Online Classes of ODD sem 2020-21 for higher semester. | 17: Mahalaya Amavase |
| | W2 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | | |
| | W3 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | | |
| | W4 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | | |
| | W5 | 28 | 29 | 30 | | | | | | |
| OCTOBER | W5 | | | | 1 | 2 | 3 | 4 | 8, 9 &10: First IA Test for higher Semester (III, V, VII sem)<br>W8: Technical Talk | 2: Gandhi Jayanthi<br>25: Ayudha Pooja<br>26: Vijaya Dashami<br>30: Eid-Milad<br>31: Valmiki Jayanthi |
| | W6 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | | |
| | W7 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | | |
| | W8 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | | |
| | W9 | 26 | 27 | 28 | 29 | 30 | 31 | | | |
| NOVEMBER | W9 | | | | | | | 1 | 11,12,13: Second IA Test for higher Semester (III,V,VII sem)<br>W13: Technical talk<br>17: Commencement of On-Campus Classes for Semester 7 | 1: Kannada Rajyotsava<br>14: Naraka Chaturdashi<br>16: Bali Padyami |
| | W10 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | | |
| | W11 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | | |
| | W12 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | | |
| | W13 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | | |
| | W14 | 30 | | | | | | | | |
| DECEMBER | W14 | | 1 | 2 | 3 | 4 | 5 | 6 | 28,29,30: Third IA Test for higher Semester (III,V,VII sem) | 3: Kanakadasa Jayanthi<br>25: Christmas |
| | W15 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | | |
| | W16 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | | |
| | W17 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | | |
| | W18 | 28 | 29 | 30 | 31 | | | | | |
| JANUARY | W18 | | | | | 1 | 2 | 3 | 1: Commencement of offline Classes for III Sem lateral entry students<br>7,8: Lab IA for higher Semester (V,VII sem)<br>11,12,13,15: Improvement IA for higher Semester (III,V,VII sem)<br>18: Commencement of Offline Classes for III(Regular), V Sem Students<br>21-30: Practical Examination Schedule for V & VII sem<br>27: Fist IA for III Sem Lateral entry students | 14: Makara Shankranthi<br>26: Republic day |
| | W19 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | | |
| | W20 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | | |
| | W21 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | | |
| | W22 | 25 | 26 | 27 | 28 | 29 | 30 | 31 | | |

ATME College of Engineering

## Department of Mechanical Engineering

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| FEBRUARY | W23 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 1,2,3: Fist IA for III Sem Lateral entry students<br>27: Last working day for 3rd Semester<br>19,20,22: Second IA for III Sem Lateral entry students<br>20: Commencement of Theory Examination for 5th semester<br>26,27: Third IA for III Sem Lateral entry students<br>27: Commencement of Theory Examination for 7th semester | |
| | W24 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | | |
| | W25 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | | |
| | W26 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | | |
| MARCH | W27 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 1: Third IA for III Sem Lateral entry students<br>3: Lab IA for 3rd semester.<br>10: Last working day for 3rd semester<br>15:Commencement of Theory Examination for 3rd semester<br>31: End of Theory Examination for 3rd semester | 1:Mahashivaratri |
| | W28 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | | |
| | W29 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | | |
| | W30 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | | |
| | W31 | 29 | 30 | 31 | | | | | | |
| APRIL | W32 | | | | 1 | | 3 | 4 | 05-09: Practical Examination Schedule for 3rd semester<br>12: Commencement of Even semester | 2: Good Friday<br>13:Chandramana yugadi<br>14:Ambedkar Jayanthi<br>25:Mahavir jayanthi |
| | W33 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | | |
| | W34 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | | |
| | W35 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | | |
| | W36 | 26 | 27 | 28 | 29 | 30 | | | | |

**NOTE:**

* **Club Activities will be during all Wednesdays as per Schedule.**
* **Aptitude trainings will be run as per schedule.**
* **Technical trainings will be run as per schedule.**
* **Mentoring as per scheduled timetable.**

| List of Non working Saturdays |
|---|
| **Date** |
| 05-09-2020 |
| 19-09-2020 |
| 03-10-2020 |
| 17-10-2020 |
| 07-11-2020 |
| 21-11-2020 |
| 05-12-2020 |
| 19-12-2020 |
| 02-01-2021 |
| 06-02-2021 |
| 20-02-2021 |
| 03-02-2021 |
| 07-02-2021 |

**H.o.D**

Department of Mechanical Engineering
ATME College of Engineering
Mysuru - 570028

## Lesson Plan & Work done Diary for AY 2020-21, EVEN Semester

| Course with Code: APPLIED THERMODYNAMICS - 18ME42 | | | | TLP Planned | Faculty: PAVAN KUMAR K P | | Semester & Section: 4 A | |
|---|---|---|---|---|---|---|---|---|
| Module | Class No. | Date planned (DD/MM) | Topics to be covered | | Date of Conduction (DD/MM) | Topics Covered | TLP Executed | Remarks if any deviation |
| MODULE-1 | 1 | 19/4/2021 | Introduction and Air standard cycles, Carnot cycle | MS Teams | 19/4/2021 | Introduction and Air standard cycles, Carnot cycle | MS Teams | Solving more Numerical problems and derivations |
| | 2 | 21/4/2021 | Performance of Carnot cycle derivation and problems | MS Teams | 21/4/2021 | Performance of Carnot cycle derivation and problems | MS Teams | |
| | 3 | 23/4/2021 | Otto cycle performance parameters derivation and problems | MS Teams | 23/4/2021 | Otto cycle performance parameters derivation and problems | MS Teams | |
| | 4 | 24/4/2021 | Problems on otto cycle | MS Teams | 24/4/2021 | Problems on otto cycle | MS Teams | |
| | 5 | 26/4/2021 | Problems on otto cycle | MS Teams | 26/4/2021 | Problems on otto cycle | MS Teams | |
| | 6 | 28/4/2021 | Diesel Cycle performance parameters derivation and problems | MS Teams | 28/4/2021 | Diesel Cycle performance parameters derivation and problems | MS Teams | |
| | 7 | 30/4/2021 | Problems on Diesel cycle | MS Teams | 30/4/2021<br>1/5/2021 | Problems on Diesel cycle | MS Teams | |
| | 8 | 1/5/2021 | Dual ,Stirling cycles Cycle performance parameters derivation and problems | MS Teams | 3/5/2021 | Dual ,Stirling cycles Cycle performance parameters derivation and problems | MS Teams | |
| | 9 | 3/5/2021 | Problems on dual combustion cycle | MS Teams | 5/5/2021 | Problems on dual combustion cycle | MS Teams | |
| | 10 | 5/5/2021 | Comparison of Otto and Diesel cycles,I C Engines | MS Teams | 7/5/2021 | Comparison of Otto and Diesel cycles I C Engines Classification | MS Teams | |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | Classification of IC engines, Combustion of SI engine and CI engine | | | of IC engines, Combustion of SI engine and CI engine | | |
| | 11 | 7/5/2021 | Detonation and factors affecting detonation, Performance analysis of I.C Engines | MS Teams | 8/5/2021 | Detonation and factors affecting detonation, Performance analysis of I.C Engines | MS Teams | |
| | 12 | 8/5/2021 | Heat balance, Morse test ,IC Engine fuels, Ratings and Alternate Fuels, Numerical problems | MS Teams | 10/5/2021<br>12/5/2021 | Heat balance, Morse test ,IC Engine fuels, Ratings and Alternate Fuels, Numerical problems | MS Teams | |

| **Course with Code: APPLIED THERMODYNAMICS – 18ME42** | | | | | **Faculty: PAVAN KUMAR K P** | | **Semester & Section: 4 A** | |
|---|---|---|---|---|---|---|---|---|
| **Module** | **Class No.** | **Date planned (DD/MM)** | **Topics to be covered** | **TLP Planned** | **Date of Conduction (DD/MM)** | **Topics Covered** | **TLP Executed** | **Remarks if any deviation** |
| **MODULE-2** | 13 | 10/5/2021 | Gas power Cycles: Gas turbine (Brayton) cycle; description and analysis | MS Teams | 15/5/2021 | Gas power Cycles: Gas turbine (Brayton) cycle; description and analysis | MS Teams | **Solving Numerical problems and derivation** |
| | 14 | 12/5/2021 | Ideal Brayton cycle and actual brayton cycle | MS Teams | 17/5/2021 | Ideal Brayton cycle and actual brayton cycle | MS Teams | |
| | 15 | 15/5/2021 | Gas turbine cycle with Regenerator Numerical problems | MS Teams | 19/5/2021 | Gas turbine cycle with Regenerator Numerical problems | MS Teams | |
| | 16 | 17/5/2021 | Gas turbine cycle with Reheating Numerical problems | MS Teams | 21/5/2021 | Gas turbine cycle with Reheating Numerical problems | MS Teams | |
| | 17 | 19/5/2021 | Gas turbine cycle with intercooling Numerical problems | MS Teams | 22/5/2021 | Gas turbine cycle with intercooling Numerical problems | MS Teams | |
| | 18 | 21/5/2021 | Introduction to Jet Propulsion cycles, Pluse jest, Ram jet, Turbojet | MS Teams | 24/5/2021 | Introduction to Jet Propulsion cycles, Pluse jest, Ram jet, Turbojet | MS Teams | |

| Course with Code: APPLIED THERMODYNAMICS – 18ME42 | | | | | Faculty: PAVAN KUMAR K P | | Semester & Section: 4 A | |
|---|---|---|---|---|---|---|---|---|
| **Module** | **Class No.** | **Date planned (DD/MM)** | **Topics to be covered** | **TLP Planned** | **Date of Conduction (DD/MM)** | **Topics Covered** | **TLP Executed** | **Remarks if any deviation** |
| MODULE-3 | 19 | 22/5/2021 | **Vapour Power cycle:** Carnot vapour power cycle, drawbacks as a reference cycle | MS Teams | 24/5/2021 | Carnot vapour power cycle, drawbacks as a reference cycle | MS Teams | |
| | 20 | 24/5/2021 | Simple Rankine cycle; description, T-S diagram, analysis for performance | MS Teams | 26/5/2021 | Simple Rankine cycle; description, T-S diagram, analysis for performance | MS Teams | |
| | 21 | 26/5/2021 | Comparison of Carnot and Rankine cycles | MS Teams | 26/5/2021 | Comparison of Carnot and Rankine cycles | MS Teams | |
| | 22 | 28/5/2021 | Effects of pressure and temperature on Rankine cycle performance | MS Teams | 28/5/2021 | Effects of pressure and temperature on Rankine cycle performance | MS Teams | |
| | 23 | 28/5/2021 | Actual vapour power cycles. Ideal and practical regenerative Rankine cycles | MS Teams | 28/5/2021 | Actual vapour power cycles. Ideal and practical regenerative Rankine cycles | MS Teams | |
| | 24 | 29/5/2021 | open and closed feed water heaters. | MS Teams | 29/5/2021 | open and closed feed water heaters. | MS Teams | |
| | 25 | 31/5/2021 | Reheat Rankine cycle. Characteristics of an Ideal working fluid in vapour power cycles | MS Teams | 31/5/2021 | Reheat Rankine cycle. Characteristics of an Ideal working fluid in vapour power cycles | MS Teams | |
| | 26 | 2/6/2021 | Numerical problems | MS Teams | 02/06/2021 | Numerical problems | MS Teams | |
| | 27 | 4/06/2021 | Numerical problems | MS Teams | 04.06.2021 | Numerical problems | MS Teams | **Solving more Numerical problems** |
| | 28 | 05/06/2021 | Numerical problems | MS Teams | 05.06.2021<br>11.06.2021 | Numerical problems | MS Teams | |

| Course with Code: APPLIED THERMODYNAMICS – 18ME42 | | | | | Faculty: PAVAN KUMAR K P | | Semester & Section: 4 A | |
|---|---|---|---|---|---|---|---|---|
| **Module** | **Class No.** | **Date planned (DD/MM)** | **Topics to be covered** | **TLP Planned** | **Date of Conduction (DD/MM)** | **Topics Covered** | **TLP Executed** | **Remarks if any deviation** |
| MODULE-4 | 29 | 11/06/2021 | **Refrigeration Cycles:** Vapour compression refrigeration system; description, analysis, refrigerating effect. Capacity, power required units of refrigeration, COP, Refrigerants and their desirable properties | MS Teams | 14.06.2021 | Vapour compression refrigeration system; description, analysis, refrigerating effect. Capacity, power required units of refrigeration, COP, | MS Teams | |
| | 30 | 14/06/2021 | Refrigerants. Air cycle refrigeration; reversed Carnot cycle | MS Teams | 16.06.2021 | Refrigerants and their desirable properties , Refrigerants. Air cycle refrigeration; reversed Carnot cycle | MS Teams | |
| | 31 | 16/06/2021 | reversed Brayton cycle, vapour absorption refrigeration system. | MS Teams | 19.06.2021 | reversed Brayton cycle, vapour absorption refrigeration system | MS Teams | |
| | 32 | 19/06/2021 | Numerical problems | MS Teams | 21.06.2021 | Numerical problems | MS Teams | |
| | 33 | 21/06/2021 | Numerical problems | MS Teams | 23.06.2021 | Numerical problems | MS Teams | |
| | 34 | 23/06/2021 | Psychometric properties of Air, Psychometric Chart | MS Teams | 25.06.2021 | Psychometric properties of Air, Psychometric Chart | MS Teams | |
| | 35 | 25/06/2021 | Analyzing Air-conditioning Processes; Heating, Cooling, Dehumidification and Humidification | MS Teams | 26.06.2021 | Analyzing Air-conditioning Processes; Heating, Cooling, Dehumidification and Humidification | MS Teams | |
| | 36 | 26/06/2021 | Evaporative Cooling. Adiabatic mixing of two moist air streams, cooling towers | MS Teams | 28.06.2021 | Evaporative Cooling. Adiabatic mixing of two moist air streams, cooling towers | MS Teams | |
| | 37 | 28/06/2021 | Numerical problems | MS Teams | 01.07.2021 | Numerical problems | MS Teams | **Class rescheduled due to vaccination drive in college** |
| | 38 | 30/06/2021 | Numerical problems | Chalk & Talk | 02.07.2021 | Numerical problems | MS Teams | |

| Course with Code: APPLIED THERMODYNAMICS – 18ME42 | | | | | Faculty: PAVAN KUMAR K P | | Semester & Section: 4 A | |
|---|---|---|---|---|---|---|---|---|
| **Module** | **Class No.** | **Date planned (DD/MM)** | **Topics to be covered** | **TLP Planned** | **Date of Conduction (DD/MM)** | **Topics Covered** | **TLP Executed** | **Remarks if any deviation** |
| MODULE-5 | 39 | 02/07/2021 | **Module5 Reciprocating Compressor:** Operation of a single stage reciprocating compressors. Work input through p-v diagram and steady state steady flow analysis | MS Teams | 03.07.2021 | **Module 5 Reciprocating Compressor:** Operation of a single stage reciprocating compressors. Work input through p-v diagram and steady state steady flow analysis | MS Teams | |
| | 40 | 03/07/2021 | Effect of Clearance and Volumetric efficiency. Adiabatic, Isothermal and Mechanical efficiencies | MS Teams | 05.07.2021 | Effect of Clearance and Volumetric efficiency. Adiabatic, Isothermal and Mechanical efficiencies | MS Teams | |
| | 41 | 05/07/2021 | Multi-stage compressor, saving in work, Optimum intermediate pressure, Inter-cooling, Minimum work for compression | MS Teams | 12.07.2021 | Multi-stage compressor, saving in work, Optimum intermediate pressure, Inter-cooling, Minimum work for compression | MS Teams | |
| | 42 | 12/07/2021 | Numerical problems | MS Teams | 14.07.2021 | Numerical problems | MS Teams | |
| | 43 | 14/07/2021 | Numerical problems | MS Teams | 15.07.2021 | Numerical problems | MS Teams | **Extra class has been taken** |
| | 44 | 16/07/2021 | Numerical problems | MS Teams | 16.07.2021 | Numerical problems | MS Teams | |
| | 45 | 17/07/2021 | Flow of steam through nozzles, Shape of nozzles | MS Teams | 17.07.2021 | Numerical problems | MS Teams | |
| | 46 | 19/07/2021 | effect of friction, Critical pressure ratio | MS Teams | 19/07/2021 | Flow of steam through nozzles, Shape of nozzles | MS Teams | |
| | 47 | 23/07/2021 | Supersaturated flow | MS Teams | 23/07/2021 | effect of friction, Critical pressure ratio | MS Teams | |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | 48 | 24/7/2021 | Numerical problems | MS Teams | 24/7/2021 | Supersaturated flow | MS Teams | |
| | 49 | 26/07/2021 | Revision class | MS Teams | 26/07/2021 | Numerical problems | MS Teams | |
| | 50 | 28/07/2021 | Revision class | MS Teams | 28/07/2021 | Revision class | MS Teams | |

| | Activity | Planned | Actual | Remarks |
|---|---|---|---|---|
| 1 | Theory Classes | 50 | 50 | |
| 2 | Assignments/Quizzes/ Self-study | 1/5 | 3/5 | |
| 3 | Tutorials/ Extra classes | 1 | 1 | |
| 4 | Internal Assessments | 3 | 3 | |
| 5 | ICT based Teaching (% of usage in Curriculum) | 100% | 100% | Due to COVID pandemic all classes are conducted online |

| Planning | Execution |
|---|---|
| **Faculty Signature:** | **Faculty Signature:** |
| **HoD Signature:** | **HoD Signature:** |

A T M E
College of Engineering

Department of Mechanical Engineering

Ref No / ATME/ ME/ 2020-21/19

Date: 06/05/2021

**MINUTES OF MEETING**

3.0 pm

**AGENDA:**

- On-Line classes progress
- Any other academic matters

**The following discussions and announcements were made.**

- HOD welcomed all to the meeting
- HOD mentioned that Minutes of the meeting held with Honorable chairman on 5/05/2021 has been circulated through email to all the faculties
- Faculties were once again briefed and explained regarding the key points of the above said meeting and email by HOD
- HOD discussed about the submission of papers to conference. 7 papers from staff and 2 papers from students is submitted to conference from the department
- All faculties are informed to prepare online class lesson plan till 24.5.2021
- HOD informed that online class verification details is shared to all faculties, and also informed to adhere to the ppt template given by the DA and some faculty members use slang words in the class which should not be done
- It is informed that, the faculties have to alter the classes if they are not in a position to take their classes
- HOD is sent the details of student attendance for all faculties and informed all counselors to call their parents to inform regarding online classes and attendance position of their wards
- HOD informed all faculties to update on line class report to VTU by the end of every week
- All class teachers are informed to check the free certificate courses available for the students. And also informed class teachers, it is their responsible to register for the students
- HOD informed all faculties that 5th semester results are declared, we have got 88% overall results

- HOD informed that updating faculty information in website and CERP should be completed.
- HOD informed that all faculties have to complete the details of TDS, and send the same to establishment by 20/5/2021.
- HOD informed that online classes for 2nd semester will starts from 19/5/2021, and detailed timetable is sent to faculties who are handling for 1st year classes.
- It is informed that Project coordinators to brief the 6th sem students about mini projects rules and regulations as per the scheme.

HOD
Department of Machanical Engineering
ATME College of Engineering
Mysuru - 570028

## COURSE MODULES OF THE SUBJECT TAUGHT FOR EVEN SEM 2020-21

**Course Syllabus with CO's**

| Faculty Name: | | | Academic Year: 2020-2021 | | | | |
|---|---|---|---|---|---|---|---|
| Department: MECHANICAL ENGINEERING | | | | | | | |
| Course Code | Course Title | Core/Elective | Prerequisite | Contact Hours | | | Total Hrs/ Sessions |
| | | | | L | T | P | |
| **18ME42** | **Applied thermodynamics** | **CORE** | **Knowledge on different types of cycles, and study of performance of reciprocating compressor and steam nozzle** | **3** | **2** | **0** | **50Hrs** |
| **Objectives** | **Course Learning Objectives:**<br>**1. To understand the applications of the first and second laws of Thermodynamics to various gas processes and cycles.**<br>**2. To understand fundamentals of I. C. Engines, Construction and working Principle of an Engine and Compare Actual, Fuel-Air and Air standard cycle Performance.**<br>**3. To study Combustion in SI and CI engines and its controlling factor in order to extract maximum power.**<br>**4. To know the concepts of testing of I. C. Engines and methods to estimate Indicated, Brake and Frictional Power and efficiencies.**<br>**5. To understand theory and performance Calculation of Positive displacement compressor.**<br>**6. To understand the concepts related to Refrigeration and Air conditioning.**<br>**7. To get conversant with Psychrometric Charts, Psychrometric processes, human comfort conditions.** | | | | | | |
| **Topics Covered as per Syllabus** | | | | | | | |
| **Module – 1**<br>**Air standard cycles**: Carnot, Otto, Diesel, Dual and Stirling cycles, p-v and T -s diagrams, description, efficiencies and mean effective pressures. Comparison of Otto and Diesel cycles.<br>**I.C.Engines:** Classification of IC engines, Combustion of SI engine and CI engine, Detonation and factors affecting detonation, Performance analysis of I.C Engines, Heat balance, Morse test, IC Engine fuels, Ratings and Alternate Fuels.<br>**Module –2**<br>**Gas power Cycles:** Gas turbine (Brayton) cycle; description and analysis. Regenerative gas turbine cycle. Intercooling and reheating in gas turbine cycles. Introduction to Jet Propulsion cycles.<br>**Module –3**<br>**Vapour Power Cycles:** Carnot vapour power cycle, drawbacks as a reference cycle. Simple Rankine cycle; description, T-S diagram, analysis for performance. Comparison of Carnot and Rankine cycles. Effects of pressure and temperature on Rankine cycle performance.<br>Actual vapour power cycles. Ideal and practical regenerative Rankine cycles, open and closed feed water | | | | | | | |

heaters. Reheat Rankine cycle. Characteristics of an Ideal working fluid in vapour power cycles.

**Module –4**

**Refrigeration Cycles:** Vapour compression refrigeration system; description, analysis, refrigerating effect. Capacity, power required units of refrigeration, COP, Refrigerants and their desirable properties, alternate Refrigerants. Air cycle refrigeration; reversed Carnot cycle, reversed Brayton cycle, vapour absorption refrigeration system.

**Psychrometrics and Air-conditioning Systems:** Psychometric properties of Air, Psychometric Chart, Analyzing Air-conditioning Processes; Heating, Cooling, Dehumidification and Humidification, Evaporative Cooling. Adiabatic mixing of two moist air streams. Cooling towers.

**Module –5**

**Reciprocating Compressors: Operation** of a single stage reciprocating compressors. Work input through p-v diagram and steady state steady flow analysis. Effect of Clearance and Volumetric efficiency. Adiabatic, Isothermal and Mechanical efficiencies. Multi-stage compressor, saving in work, Optimum intermediate pressure, Inter-cooling, Minimum work for compression.

**Steam nozzles**: Flow of steam through nozzles, Shape of nozzles, effect of friction, Critical pressure ratio, Supersaturated flow.

**List of Text Books**

**TEXT BOOKS:**

1.Engineering Thermodynamics P.K. Nag Tata McGraw Hill 6th Edition 2018
2 Applications of Thermodynamics V.Kadambi, T. R.Seetharam, K. B. Subramanya Kumar Wiley Indian Private Ltd 1st Edition ,2019
3 Thermodynamics Yunus A, Cengel, Michael A Boles Tata McGraw Hill ,7th Edition

**List of Reference Books**

1 Thermodynamics for engineers Kenneth A. Kroos and Merle C. Potter Cengage Learning ,2016
2 Principles of Engineering Thermodynamics Michael J, Moran, Howard N. Shapiro Wiley. 8th Edition
3 An Introduction to ThermoDynamics Y.V.C.Rao Wiley Eastern Ltd ,2003.
4 Thermodynamics Radhakrishnan PHI 2nd revised edition
5 I.C Engines Ganeshan.V Tata McGraw Hill 4th Edi. 2012
6 I.C.Engines M.L.Mathur& Sharma. Dhanpat Rai& sons-India

**List of URLs, Text Books, Notes, Multimedia Content, etc**

1)http://nptel.ac.in/courses/112106133/

2)http://atme.in/mechanical/resourses-mechanical-department/

3)https://www.youtube.com/watch?v=6IwhQtw3JFg

| | |
|---|---|
| **Course Outcomes** | **Students will be able to**<br>1. Apply thermodynamic concepts to analyze the performance of air standard cycles, I.C engines and distinguish between combustion phenomenon in SI engine and CI engine.<br>2. Apply thermodynamic concepts to analyze the performance of gas power cycles and describe the working of Jet propulsion systems.<br>3. Apply thermodynamic concepts to analyze the performance of vapour power cycles<br>4. Understand the principles and applications of refrigeration systems and apply thermodynamic concepts to determine performance parameters of refrigeration and air conditioning systems.<br>5. Demonstrate the working principle of Air compressors and Steam nozzles, applications, relevance of air and identify methods for performance improvement. |

Internal Assessment Marks: 30(IA) +10(Assignment) (3 Session Tests are conducted during the semester and marks allotted based on average of 3 session Tests).

## The Correlation of Course Outcomes (CO's) and Program Outcomes (PO's)

| Subject Code: | 18ME42 | TITLE: Applied thermodynamics | | | | | Faculty Name: | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| List of Course Outcomes | Program Outcomes | | | | | | | | | | | Total |
| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | |
| CO-1 | 3 | 2 | - | - | - | - | - | - | - | - | - | - | 5 |
| CO-2 | 3 | 2 | - | - | - | - | 2 | - | - | - | - | - | 7 |
| CO-3 | 3 | 2 | - | - | - | - | - | - | - | - | - | 2 | 7 |
| CO-4 | 3 | 2 | - | - | - | - | - | - | - | - | - | 2 | 7 |
| CO-5 | 3 | 2 | - | - | - | - | - | - | - | - | - | - | 5 |
| Total | 15 | 10 | - | - | - | - | 2 | - | - | - | - | 4 | 31 |

Note: 3 = Strong Contribution 2= Average Contribution 1 = Weak Contribution - = No Contribution

## The Correlation of Course Outcomes (CO's) and Program Specific Outcomes (PSO's)

| Subject Code: 18ME42 | TITLE: Applied thermodynamics | Faculty Name: | |
|---|---|---|---|
| List of Course Outcomes | Program Specific Outcomes | | |
| | PSO1 | PS02 | Total |
| CO-1 | 2 | - | 2 |
| CO-2 | 2 | - | 2 |
| CO-3 | 2 | - | 2 |
| CO-4 | 2 | - | 2 |
| CO-5 | 2 | - | 2 |
| Total | 10 | - | 10 |

Note: 3 = Strong Contribution 2 = Average Contribution 1= Weak Contribution - = No Contribution

HOD
Department of Mechanical Engineering
ATME College of Engineering
Mysuru - 570028

ATME
College of Engineering

9001:2015

| DEPARTMENT OF MECHANICAL ENGINEERING | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Higher Semester Faculty workload (ONLINE)** | | | | | | | |
| **Sl. No.** | **Faculty Name** | **Designation** | **No. of Subjects Allocated** | **Contact hours (Theory) per week** | **Contact hours (Lab) per week** | **Aptitude Training** | **Total Contact hours per week** |
| 1 | Dr. M S Govinde Gowda | Professor & Dean(Academic Affairs) | 1 | 3 | 0 | | 3 |
| 2 | Dr. Rathnakar G | Professor & Dean(Student Affairs) | 1 | 3 | 0 | | 3 |
| 3 | Dr. Srinivasa K | Professor & HOD | 1 | 3 | 0 | | 3 |
| 4 | Mr. Devaraj M R | Associate Professor | 1 | 3 | 1 | | 4 |
| 5 | Mr. Ravikumar S | Associate Professor | 2 | 7 | 2 | | 9 |
| 6 | Mr. Suresh Kumar S | Associate Professor | 2 | 6 | 1 | | 7 |
| 7 | Mr. Deepak MVS | Assistant Professor | 1 | 3 | 0 | | 3 |
| 8 | Dr. Manjunath H S | Assistant Professor | 2 | 7 | 2 | | 9 |
| 9 | Dr. Chethan S | Assistant Professor | 2 | 6 | 2 | 1 | 9 |
| 10 | Mr. Raghu | Assistant Professor | 2 | 6 | 2 | | 8 |
| 11 | Mr. Niranjan Kumar V S | Assistant Professor | 2 | 6 | 2 | | 8 |
| 12 | Dr. Md. Nadeem M | Assistant Professor | 1 | 3 | 2 | | 5 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 13 | Mr. Yathisha N | Assistant Professor | 2 | 6 | 2 | 1 | 9 |
| 14 | Mr. Ramanuja C M | Assistant Professor | 2 | 6 | 1 | 1 | 8 |
| 15 | Mr. Swarnakiran S | Assistant Professor | 2 | 5 | 1 | 1 | 7 |
| 16 | Mr. Rohith S | Assistant Professor | 2 | 6 | 1 | 1 | 8 |
| 17 | Mr. Yashwanth N | Assistant Professor | 2 | 7 | 2 | | 9 |
| 18 | Mr. Karthik Kumar M | Assistant Professor | 2 | 7 | 2 | 1 | 10 |
| 19 | Mr. Pavan Kumar K P | Assistant Professor | 2 | 6 | 1 | 1 | 8 |

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H.O.D.
Department of Mechanical Engineering
AIME College of Engineering, Mysuru

# ATME College of Engineering

DEPARTMENT OF MECHANICAL ENGINEERING

OFFLINE CLASS TIME TABLE 2020-21

9001:2015

**SECTION : 3B** **ROOM NO.**

| DAY / TIME | 9.00 -10.00 | 10.00 -11.00 | 11.00 - 11.15 | 11.15 - 12.15 | 12.15 - 1.15 | 1.15-2.00 | 2.00 - 2:55 | 2.55 - 3:50 | 3.50 - 4:45 |
|---|---|---|---|---|---|---|---|---|---|
| Mon | | 18MAT31 | BREAK | 18ME36B | 18ME32 | LUNCH BREAK | 18ME33 | 18MATDIP31 | |
| Tue | | 18ME33 | | 18MAT31 | 18ME32 | | 18ME35B | 18ME36B | |
| Wed | | 18ME36B | | 18MATDIP31 | 18ME35B | | 18MAT31 | 18ME34 | |
| Thu | | 18ME32 | | 18MAT31 | 18ME34 | | 18CPC39 | 18ME32 | |
| Fri | | 18ME35B | | 18ME33 | 18MATDIP31 | | 18MEL37B (B2) / 18MEL38B (B1) | | |
| Sat | | 18ME33 | | 18ME34 | 18ME32 | | 18MEL37B (B1) / 18MEL38B (B2) | | |

| Subject Code | Subject Title | Hrs/week | Faculty In – Charge | | Initials |
|---|---|---|---|---|---|
| 18MATDIP31 | Additional Mathematics | 3 | Mr. Sudhakar N | | SN |
| 18MAT31 | Mathematics | 4 | Mr.Sudhakar N | | SN |
| 18ME32 | Mechanics of Materials | 5 | Mr. Suresh Kumar S | | SKS |
| 18ME33 | Basic Thermodynamics | 4 | Mr. Ravikumar S | | SRK |
| 18ME34 | Material Science | 3 | Mr. Deepak MVS | | MVS |
| 18ME35B | Metal Casting and Welding | 3 | Dr. Chethan S | | Dr.CS |
| 18ME36B | Mechanical Measurements and Metrology | 3 | Mr. Ramanuja C M *(CLASS TEACHER)* | | RCM |
| 18MEL37B | Mechanical Measurements and Metrology lab | 3 | B1 | Dr. Chethan S | Dr.CS |
| | | | B2 | Dr. Chethan S | Dr.CS |
| 18MEL38B | Foundry,Forging and Welding lab | 3 | B1 | Mr. Devaraj MR | MRD |
| | | | B2 | Mr. Niranjan Kumar V S | NVS |
| 18CPC39 | Constitution of India, Professional Ethics and Cyber Law | 1 | Mr. Chandrashekar G | | CG |

Coordinator

30/12/2020

HOD

H.O.D.
Department of Mechanical Engineering
ATME College of Engineering, Mysuru

31/12/20

Dean (Academics)

31/12/20

Principal

PRINCIPAL
ATME College of Engineering
13th KM, Mysuru-Kanakapura-Bengaluru Road
Mellahalli, Mysuru-570028

# ATME College of Engineering

## DEPARTMENT OF MECHANICAL ENGINEERING

## ONLINE CLASS TIME TABLE 2020 - 2021 (ODD SEM)

ISO 9001:2015

**SECTION : 3 A & B**

| TIME / DAY | 9:00 - 10:00 | 10:00-11:00 | 11:15 - 12:15 | 12:15 - 1:15 | 1:15-2:00 | 2:00-3:00 | 3:00-4:00 | |
|---|---|---|---|---|---|---|---|---|
| Mon | | 18MAT31 | 18ME32 | 18ME35A /35B | LUNCH BREAK | 18ME36A /36B | | |
| Tue | | 18ME33 | 18ME36A /36B | 18MAT31 | | APTITUDE | | |
| Wed | | 18ME35A / 35B | 18ME34 | 18MAT31 | | 18ME33 | | |
| Thu | | 18ME33 | 18ME32 | 18MEL37A /37B | | 18ME34 | | |
| Fri | | 18ME36A /36B | 18ME35A /35B | 18CPC39 | | 18MAT31 | | |
| Sat | | 18ME34 | MENTORING | 18ME32 | | 18MEL38A /38B | | |

| Subject Code | Subject Title | Faculty In – Charge | Classes /week |
|---|---|---|---|
| 18MAT31 | Mathematics | Mrs.Banupriya J (A) / Mr.Sudhakar N (B) | 4 |
| 18ME32 | Mechanics of Materials | Mr. Yashwanth N (A)(CLASS TEACHER) / Mr. Suresh Kumar S (B) | 3 |
| 18ME33 | Basic Thermodynamics | Mr. Pavan Kumar K P (A) / Mr. Ravikumar S (B) | 3 |
| 18ME34 | Material Science | Mr. Devaraj M R (A) / Mr. Deepak MVS (B) | 3 |
| 18ME35A | Metal cutting and forming | Mr. Niranjan Kumar V S (A) | 3 |
| 18ME35B | Metal Casting and Welding | Dr. Chethan S (B) | 3 |
| 18ME36A | Computer Aided Machine Drawing | Mr. Rohith S (A) | 3 |
| 18ME36B | Mechanical Measurements and Metrology | Mr. Ramanuja C M (B) | 3 |
| 18MEL37A | Meterial Testing Lab | Mr. Yathisha N & Mr. Karthik Kumar M | 1 |
| 18MEL37B | Mechanical Measurements and Metrology lab | Dr. Chethan S | 1 |
| 18MEL38A | Workshop and Machine Shop Practice (Consists of Fitting, and Machining) | Mr Niranjan Kumar V S & Mr. Thej Kumar J | 1 |
| 18MEL38B | Foundry,Forging and Welding lab | Mr. Devaraj MR & Mr. Niranjan Kumar V S | 1 |
| 18CPC39 | Constitution of India, Professional Ethics and Cyber Law | Mr. Chandrashekar C (A & B) | 1 |

Coordinator

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ATME College of Engineering, Mysuru

30/8/20
Dean (Academics)

30/8/20
Principal

# ATME College of Engineering

**DEPARTMENT OF MECHANICAL ENGINEERING**

**ONLINE CLASS TIME TABLE 2020 - 2021 (ODD SEM)**

ISO 9001:2015

**SECTION : 5 A & B**

| TIME / DAY | 9:00 - 10:00 | 10:00-11:00 | 11:15 - 12:15 | 12:15 - 1:15 | 1:15-2:00 | 2:00-3:00 | 3:00-4:00 | |
|---|---|---|---|---|---|---|---|---|
| Mon | | 18ME54 | 18ME52 | 18ME55 | LUNCH BREAK | MENTORING | | |
| Tue | | 18ME53 | 18ME56 | 18ME54 | | Technical Training | | |
| Wed | | 18ME55 | 18ME53 | 18ME51 | | APTITUDE | | |
| Thu | | 18ME51 | 18ME56 | 18ME52 | | 18MEL58 | | |
| Fri | | 18ME54 | 18ME53 | 18ME55 | | 18ME51 | | |
| Sat | | 18MEL57 | 18ME52 | 18CIV59 | | 18ME56 | | |

| Subject Code | Subject Title | Faculty In – Charge | Classes /week |
|---|---|---|---|
| 18ME51 | Management and Economics | Mr. Ramanuja C M (A) / Mr. Niranjan Kumar V S (B)(**CLASS TEACHER**) | 3 |
| 18ME52 | Design of Machine Elements I | Dr. Srinivasa K (A) / Mr. Rohith S (B) | 3 |
| 18ME53 | Dynamics of Machines | Mr. Suresh Kumar S (A)(**CLASS TEACHER**) / Mr. Yathisha N (B) | 3 |
| 18ME54 | Turbo Machines | Dr. M S Govinde Gowda (A) / Mr. Raghu (B) | 3 |
| 18ME55 | Fluid Power Engineering | Mr. Raghu (A) / Mr. Pavan Kumar K P (B) | 3 |
| 18ME56 | Operations Management | Dr. Chethan S (A) / Dr. Rathnakar G (B) | 3 |
| 18MEL57 | Fluid Mechanics/Machines lab | Mr. Ravi Kumar S / Dr Manjunath H S / Mr. Yashwanth N / Mr. Niranjan Kumar V S / Mr. Raghu / Dr. Chethan S | 1 |
| 18MEL58 | Energy Conversion Lab | Mr. Pavan Kumar K P / Mr. Raghu / Mr. Suresh Kuamr S / Mr. Ravi Kumar S / Dr. MD Nadeem M | 1 |
| 18CIV59 | Environmental Studies | Dr. Suresh K J | 1 |

Coordinator

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Department of Mechanical Engineering
ATME College of Engineering, Mysuru

30/5/20
Dean (Academics)

Principal

# ATME College of Engineering

**DEPARTMENT OF MECHANICAL ENGINEERING**

**ONLINE CLASS TIME TABLE 2020 - 2021 ( ODD SEM)**

ISO 9001:2015

**SECTION : 7 A & B**

| TIME / DAY | 9:00 - 10:00 | 10:00-11:00 | 11:15 - 12:15 | 12:15 - 1:15 | 1:15-2:00 | 2:00-3:00 | 3:00-4:00 | |
|---|---|---|---|---|---|---|---|---|
| Mon | | 17ME753 | 17ME742 | 17ME71 | LUNCH BREAK | 17ME72 | | |
| Tue | | 17ME73 | 17ME72 | 17ME742 | | **Technical Training** | | |
| Wed | | **17MEL77** | 17ME753 | 17ME73 | | 17ME72 | | |
| Thu | | 17ME753 | 17ME742 | 17ME71 | | 17ME73 | | |
| Fri | | 17ME71 | 17ME72 | 17ME73 | | 17MEL76 | | |
| Sat | | **MENTORING** | 17ME73 | 17ME71 | | **PROJECT WORK** | | |

| Subject Code | Subject Title | Faculty In – Charge | Classes /week |
|---|---|---|---|
| 17ME71 | Energy Engineering | Dr. Manjunath H S (A) / Mr. Ravikumar S (B) | 4 |
| 17ME72 | Fluid Power Systems | Mr. Yashwanth N (A) / Mr. Karthik Kumar M (B) | 4 |
| 17ME73 | Control Engineering | Mr. Swarnakiran S (A & B)(Bsec - **CLASS TEACHER**) | 5 |
| 17ME742 | Tribology | Mr. Yathisha N (A)(**CLASS TEACHER**) / Dr. Md. Nadeem M (B) | 3 |
| 17ME753 | Mechatronics | Mr. Karthik Kumar M (A) / Dr. Manjunath H S (B) | 3 |
| 17MEL76 | Design Lab | Mr. Swarnakiran S / Mr. Karthik Kumar M / Dr. Manjunath H S / Mr. Yathisha N/Mr.Rohith S | 1 |
| 17MEL77 | CIM Lab | Mr. Yashwanth N / Dr. Mohanakumara K C / Dr. MD Nadeem M / Mr. Ramanuja C M | 1 |

Coordinator

HOD

H.O.D.
Department of Mechanical Engineering
ATME College of Engineering, Mysuru

30/9/20

Dean (Academics)

29/9/20

Principal

# ATME College of Engineering

**DEPARTMENT OF MECHANICAL ENGINEERING**

**ONLINE CLASS TIME TABLE 2020 - 2021 ( ODD SEM)**

ISO 9001:2015

**SECTION : 7 A & B**

| TIME / DAY | 9:00 - 10:00 | 10:00-11:00 | 11:15 - 12:15 | 12:15 - 1:15 | 1:15-2:00 | 2:00-3:00 | 3:00-4:00 | |
|---|---|---|---|---|---|---|---|---|
| Mon | | 17ME753 | 17ME742 | 17ME71 | L B U R N E C A H K | | | |
| Tue | | 17ME73 | 17ME72 | 17ME742 | | | | |
| Wed | | 17ME72 | 17ME753 | 17ME73 | | | | |
| Thu | | 17ME753 | 17ME742 | **17MEL76** | | | | |
| Fri | | 17ME71 | 17ME72 | 17ME73 | | | | |
| Sat | | 17ME72 | **17MEL77** | 17ME71 | | | | |

| Subject Code | Subject Title | Faculty In – Charge | Classes /week |
|---|---|---|---|
| 17ME71 | Energy Engineering | Dr. Manjunath H S (A) / Mr. Ravikumar S (B) | 3 |
| 17ME72 | Fluid Power Systems | Mr. Yashwanth N (A) / Mr. Karthik Kumar M (B) | 4 |
| 17ME73 | Control Engineering | Mr. Swarnakiran S (A & B)**(Bsec - CLASS TEACHER)** | 3 |
| 17ME742 | Tribology | Mr. Yathisha N (A)**(CLASS TEACHER)** / Dr. Md. Nadeem M (B) | 3 |
| 17ME753 | Mechatronics | Mr. Karthik Kumar M (A) / Dr. Manjunath H S (B) | 3 |
| 17MEL76 | Design Lab | Mr. Swarnakiran S / Mr. Karthik Kumar M / Dr. Manjunath H S / Mr. Yathisha N/Rohith S | 1 |
| 17MEL77 | CIM Lab | Mr. Yashwanth N / Dr. Mohanakumara K C / Dr. MD Nadeem M / Mr. Ramanuja C M | 1 |

Coordinator

HOD
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Department of Mechanical Engineering
ATME College of Engineering, Mysuru

Dean (Academics)

Principal

# Control Engineering-17ME73

As Per 2017 scheme

# ATME COLLEGE OF ENGINEERING

## ❖ VISION

Development of academically excellent, culturally vibrant, socially responsible and globally competent human resources.

## ❖ MISSION

- To keep pace with advancements in knowledge and make the students competitive and capable at the global level.
- To create an environment for the students to acquire the right physical, intellectual, emotional and moral foundations and shine as torch bearers of tomorrow's society.
- To strive to attain ever-higher benchmarks of educational excellence.

## DEPARTMENT OFMECHANICAL ENGINEERING

### ❖ VISION

To impart excellent technical education in mechanical engineering to develop technically competent, morally upright and socially responsible mechanical engineering professionals.

### ❖ MISSION:

- To provide an ambience to impart excellent technical education in mechanical engineering.
- To ensure state of-the- art facility for learning, skill development and research in mechanical engineering.
- To engage students in co-curricular and extra-curricular activities to impart social & ethical values and imbibe leadership quality.

## *PROGRAM EDUCATIONAL OBJECTIVES (PEO'S)*

After successful completion of program, the graduates will be

**PEO 1:** Graduates will be able to have successful professional career in the allied areas and be proficient to perceive higher education.

**PEO 2:** Graduates will attain the technical ability to understand the need analysis, design, manufacturing, quality changing and analysis of the product.

**PEO 3:** Work effectively, ethically and socially responsible in allied fields of mechanical engineering.

**PEO 4:** Work in a team to meet personal and organizational objectives and to contribute to the development of the society in large.

## *PROGRAM OUTCOMES (PO'S)*

The Mechanical engineering program students will attain:

**PO1.Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems

**PO2.Problem analysis:** Identify, formulate, research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences

**PO3.Design/development of solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations

**PO4.Conduct investigations of complex problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions

**PO5. Modern tool usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations

**PO6.The engineer and society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice

**PO7.Environment and sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development

**PO8. Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice

**PO9. Individual and team work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings

**PO10.Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions

**PO11.Project management and finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments

**PO12.Life-long learning:** Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change

## SYLLABUS

| Faculty Name: | | | Academic Year: **2020-21** | | | | |
|---|---|---|---|---|---|---|---|
| Department: **Mechanical Engineering** | | | | | | | |
| Course Code | Course Title | Core/Elective | Prerequisite | Contact Hours | | | Total Hrs/ Sessions |
| | | | | L | T | P | |
| **17ME73** | **Control Engineering** | **core** | Engineering Mathematics II, Engineering Mathematics III, Dynamics of Machinery, Mechatronics. | **3** | **2** | **-** | **54** |

**Course Learning Objectives:**

1. Modeling of mechanical, hydraulic, pneumatic and electrical systems.
2. Representation of system elements by blocks and its reduction.
3. Transient and steady state response analysis of a system.
4. Frequency response analysis using polar plot.
5. Frequency response analysis using Bode plot.
6. Analysis of system using root locus plots.
7. Different system compensators and variable characteristics of linear systems.

**Topics Covered as per Syllabus**

**MODULE 1**

**Introduction:** Concept of automatic controls, Open loop and closed loop systems, Concepts of feedback, requirements of an ideal control system, Types of controllers -Proportional, Integral, Differential, Proportional & Integral, Proportional Differential and Proportional Integral Differential controllers.

**10 Hours**

**MODULE 2**

**Modeling of Physical Systems:** Mathematical Models of Mechanical, Electrical, Thermal, Hydraulic and Pneumatic Systems.

**Analogous Systems:** Direct and inverse analogs for mechanical, thermal and fluid systems.

**Block diagram Algebra**: General representation of a feedback control system, transfer functions, rules of block diagram algebra, reduction of block dia. to obtain closed loop transfer function.

**Signal flow graphs:** Mason's gain formula.

**10 Hours**

**MODULE 3**

**Steady state operation:** Steady state analysis for general block dia. for a control system, steady state characteristics, equilibrium in a system.

**Transient Response:** Transient response and steady state analysis of unit, step input, general operational representation for a differential equation of control system, distinct, repeated and complex conjugate zeros, general form of transient response, Routh's stability criterion for a control system.

**Root Locus Plots:** Root locus method: Significance of Root locus, angle and magnitude conditions, breakaway points, angles of departure and arrival, construction of Root locus using general rules and steps, Lead and Lag compensation. **10 Hours**

**MODULE 4**

**Frequency Domain Analysis**: Relationship between time and frequency response, Polar plot, Bode's Plot, Nyquist plot and Nyquist stability criterion, Relative Stability, Phase and Gain Margins.

**10 Hours**

**MODULE 5**

**System Compensation and State Variable Characteristics of Linear Systems:** Series and feedback compensation, Introduction to state concepts, state equation of linear continuous data system. Matrix representation of state equations, controllability and observability, Kalman and Gilberts test.

**10 Hours**

**List of Text Books:**

1. Modern control theory, Katsuhiko Ogata, Pearson Education International , Fifth edition.
2. "Control systems Principles and Design", M.Gopal, 3rd Edition, TMH, 2000.

**Reference Books:**

1. Control system engineering, Norman S Nise, John Wiley &Sons, Inc., Sixth edition
2. Modern control systems, Richard C. Dorf, Robert H Bishop, Pearson Education International, Twelfth edition.
3. Automatic control systems, Farid Golnaraghi, Benjamin C Kuo, John Wiley & Sons, Inc., Nineth edition.
4. J.Nagrath and M.Gopal," Control System Engineering", New Age International Publishers, 5th Edition, 2007.
5. "Feedback control systems", Schaum's series, 2001.
6. System dynamics and control, Eronini-Umez, Thomas Asia Pte ltd., Singapore 2002.

**List of URLs, Text Books, Notes, Multimedia Content, etc**

1. **Control engineering,** Swarnakiran S, Sunstar publisher, 2018.
2. https://nptel.ac.in/courses/108101037/

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| **MODULE 2:** ***Modelling of Physical Systems*** | **7** |
| **MODULE 3:** ***Steady state operation*** | **21** |
| **MODULE 4:** ***Frequency Domain Analysis*** | **37** |
| **MODULE 5:** ***System Compensation and State Variable Characteristics of Linear Systems*** | **49** |

**MODULE - 1**

# INTRODUCTION

**LESSON STRUCTURE**

**1.1. Introduction**

**1.2. Open Loop System**

**1.3. Closed loop control system**

**1.4. Concepts of feedback**

**1.5. Requirements of Ideal control system**

**1.6. Types of controllers**

## OBJECTIVES:

- To **demonstrate** fundamentals of Control engineering and types of Control system.
- To **demonstrate** the concept of feedback control system.
- To **illustrate** different types of Controllers need for controlling action.

## 1.1.Introduction:

A system is an arrangement of or a combination of different physical components connected or related in such a manner so as to form an entire unit to attain a certain objective.

Control system is an arrangement of different physical elements connected in such a manner so as to regulate, director command itself to achieve a certain objective

Any control system consists of three essential components namely input, system and output. The input is the stimulus or excitation applied to a system from an external energy source. A system is the arrangement of physical components and output is the actual response obtained from the system. The control system may be one of the following types.

1) Man made
2) Natural and / or biological and
3) Hybrid consisting of man-made and natural or biological.

Requirements of good control system are accuracy, sensitivity, noise, stability, bandwidth, speed, oscillations

M.S. SWARNAKIRAN S

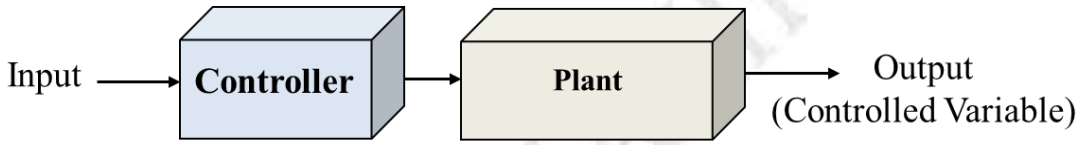
Types of control systems

Control systems are classified into two general categories based upon the control action which is responsible to activate the system to produce the output viz.

1) Open loop control system in which the control action is independent of the output.
2) Closed loop control system in which the control action is somehow dependent upon the output and are generally called as feedback control systems.

## 1.2. Open Loop System

It is a system in which control action is independent of output. To each reference input there is a corresponding output which depends upon the system and its operating conditions. The accuracy of the system depends on the calibration of the system. In the presence of noise or disturbances open loop control will not perform satisfactorily.




Example: Automatic hand driver, bread toaster, electric lift, traffic signals, coffee server, theatre lamp etc.

**Advantages of open loop system:**

1. They are simple in construction and design.
2. They are economic.
3. Easy for maintenance.
4. Not much problem of stability.
5. Convenient to use when output is difficult to measure.

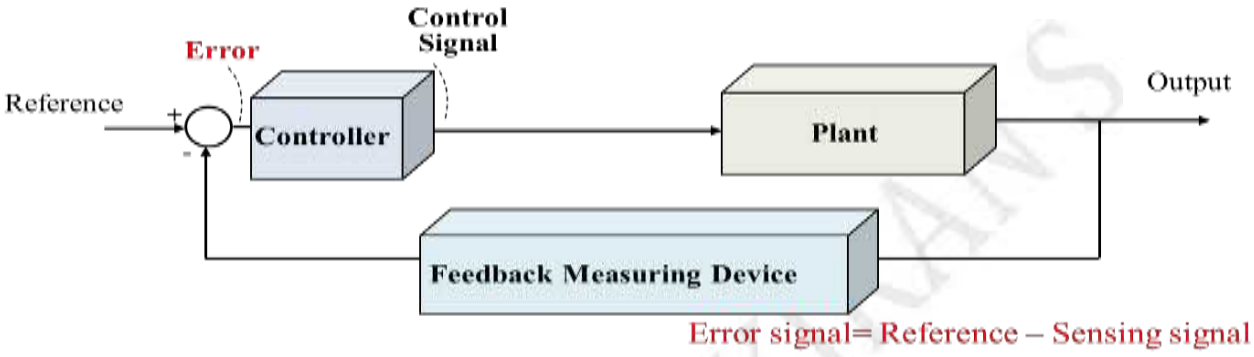
**Disadvantages of open loop system**

1. Inaccurate and unreliable because accuracy is dependent on accuracy of calibration.
2. Inaccurate results are obtained with parameter variations, internal disturbances.
3. To maintain quality and accuracy, recalibration of controller is necessary from time to time.

## 1.3. A closed loop control system:

Is a system in which the control action depends on the output. In closed loop control system the actuating error signal, which is the difference between the input signal and the feedback signal (output signal or its function) is fed to the controller.

The elements of closed loop system are command, reference input, error detector, control element controlled system and feedback element.




Example: Refrigerator, Robot arm

**Elements of closed loop system are:**

1. **Command:** The command is the externally produced input and independent of the feedback control system.
2. **Reference Input Element:** It is used to produce the standard signals proportional to the command.
3. **Error Detector:** The error detector receives the measured signal and compares it with reference input. The difference of two signals produces error signal.
4. **Control Element:** This regulates the output according to the signal obtained from error detector.
5. **Controlled System:** This represents what we are controlling by feedback loop.
6. **Feedback Element:** This element feedback the output to the error detector for comparison with the reference input.

**Example:** Automatic electric iron, servo voltage stabilizer, sun-seeker solar system, water level controller, human perspiration system.

**Advantages of closed loop system:**

1. Accuracy is very high as any error arising is corrected.
2. It senses changes -in output due to environmental or parametric change, internal disturbance etc. and corrects the same.
3. High bandwidth.
4. Facilitates automation.

**Disadvantages**

1. Complicated in design and maintenance costlier.
2. System may become unstable.

## 1.4. Concepts of feedback:

Feedback system is that in which part of output is feeded back to input. In feedback system corrective action starts only after the output has been affected.

## 1.5.Requirements of good control system :

Requirements of good control system are,

1. Accuracy
2. Sensitivity
3. Noise
4. Stability
5. Bandwidth
6. Speed
7. Oscillations

## 1.6. Types of controllers:

An automatic controller compares the actual value of the system output with the reference input (desired value), determines the deviation, and produces a control signal that will reduce the deviation to zero or a small value. The manner in which the automatic controller produces the control signal is called the control action. The controllers may be classified according to their control actions as,

1. Proportional controllers.
2. Integral controllers.
3. Proportional-plus- integral controllers.

Mr. SWARNAKIRAN S

4. Proportional-plus-derivative controllers.
5. Proportional-plus- integral-plus-derivative controllers

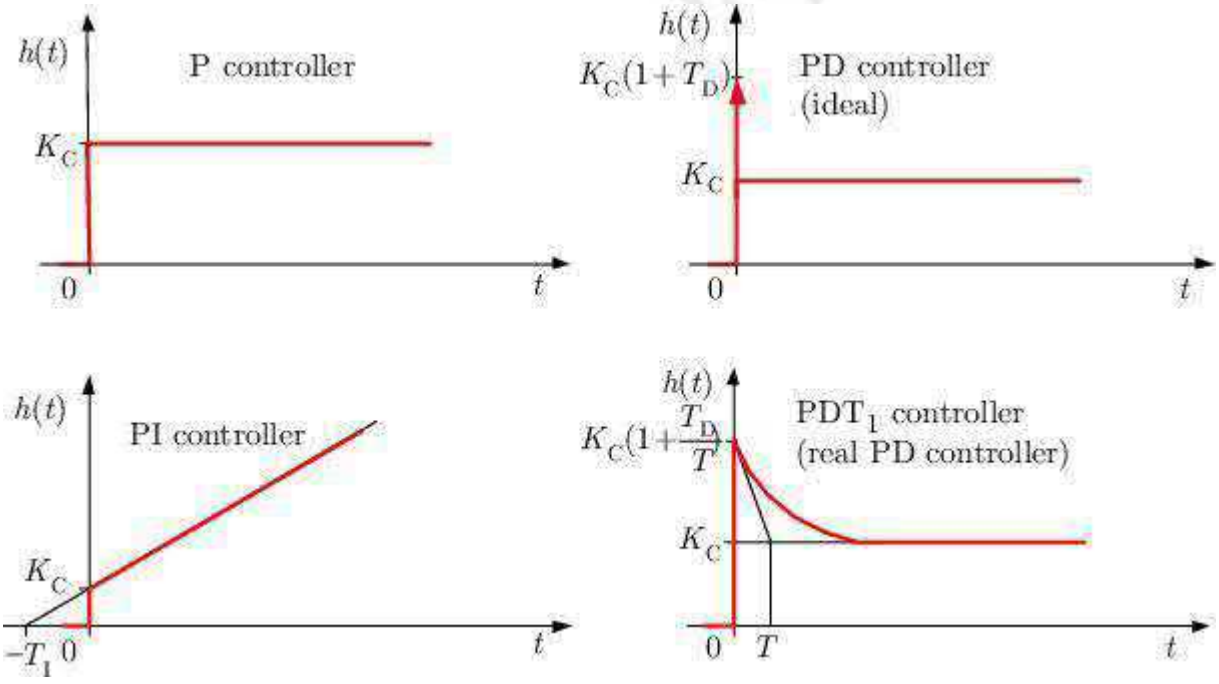
**A proportional control system** is a feedback control system in which the output forcing function is directly proportional to error.

**A integral control system** is a feedback control system in which the output forcing function is directly proportional to the first time integral of error.

**A proportional-plus-derivative control system** is a feedback control system in which the output forcing function is a linear combination of the error and its first time derivative.

**A proportional-plus- integral control system** is a feedback control system in which the output forcing function is a linear combination of the error and its first time integral.

**A proportional-plus-derivative-plus- integral control system** is a feedback control system in which the output forcing function is a linear combination of the error, its first time derivative and its first time integral.



## OUTCOMES:

At the end of the unit, the students are able to:

- Different types of control system.
- Ideal requirements of a good control system.
- Different types of controllers.

## QUESTIONS:

1. Define control system.
2. Distinguish between open loop and closed loop control system with suitable example.
3. What are the requirements of an ideal control system? Explain them.
4. With a suitable example explain regulatory system and follow - up system.
5. Explain the concept of feedback control system.
6. What is control action?
7. Explain proportional integral differential controller with the block diagram.
8. Explain following controller. State its characteristics.
    a) Proportional plus derivative control action
    b) Proportional plus integral control action.

**LIST OF TEXT BOOKS:**

1. Modern control theory, Katsuhiko Ogata, Pearson Education International , Fifth edition.
2. "Control systems Principles and Design", M.Gopal, 3rd Edition, TMH, 2000.

## Reference Books:

1. Control engineering, Swarnakiran S, Sunstar publisher, 2018.
2. Control system engineering, Norman S Nise, John Wiley &Sons, Inc., Sixth edition
3. Modern control systems, Richard C. Dorf, Robert H Bishop, Pearson Education International, Twelfth edition.
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**MODULE - 2**

# MATHEMATICAL MODELS

## LESSON STRUCTURE:

**2.1. Modeling of Control Systems**
**2.2. Modeling of Mechanical Systems**
**2.3. Mathematical Modeling of Electrical System**
**2.4. Force Voltage Analogy**
**2.5. Force Current Analogy**
**2.6. Transfer Functions definition**
**2.7. Block Diagram:**
**2.8. Signal Flow Graphs**
**2.9. Mason's Gain Formula**

## OBJECTIVES:

- To develop mathematical model for the mechanical, electrical, servo mechanism and hydraulic systems.
- To teach students the concepts of block diagrams and transfer functions.
- To teach students the concepts of Signal flow graph.

## 2.1. Modeling of Control Systems:

The first step in the design and the analysis of control system is to build physical and mathematical models. A control system being a collection of several physical systems (sub systems) which may be of mechanical, electrical electronic, thermal, hydraulic or pneumatic type. No physical system can be represented in its full intricacies. Idealizing assumptions are always made for the purpose of analysis and synthesis. An idealized representation of physical system is called a Physical Model.

Control systems being dynamic systems in nature require a quantitative mathematical description of the system for analysis. ***This process of obtaining the desired mathematical description of the system is called Mathematical Modeling.***

In Unit 1, we have learnt the basic concepts of control systems such as open loop and feedback control systems, different types of Control systems like regulator systems, follow-up systems and servo mechanisms. We have also discussed a few simple applications. In this chapter we learn the concepts of modeling.

The requirements demanded by every control system are many and depend on the system under consideration. Major requirements are 1) Stability 2) Accuracy and 3) Speed of Response. An ideal control system would be stable, would provide absolute accuracy (maintain zero error despite disturbances) and would respond instantaneously to a change in the reference variable. Such a system cannot, of course, be produced. However, study of automatic control system theory would provide the insight necessary to make the most effective compromises so that the engineer can design the best possible system. One of the important steps in the study of control systems is modeling. Following section presents modeling aspects of various systems that find application in control engineering.

The basic models of dynamic physical systems are differential equations obtained by the application of appropriate laws of nature. Having obtained the differential equations and where possible the numerical values of parameters, one can proceed with the analysis. When the mathematical model of a physical system is solved for various input conditions, the results represent the dynamic response of the system. The mathematical model of a system is linear, if it obeys the principle of ***superposition and homogeneity***.

A mathematical model is ***linear***, if the differential equation describing it has coefficients, which are either functions of the independent variable or are constants. If the coefficients of the describing differential equations are functions of time (the independent variable), then the mathematical model is ***linear time-varying***. On the other hand, if the coefficients of the describing differential equations are constants, the model is ***linear time-invariant***. Powerful mathematical tools like the Fourier and Laplace transformations are available for use in linear systems. Unfortunately no physical system in nature is perfectly linear. Therefore certain assumptions must always be made to get a linear model.

Usually control systems are complex. As a first approximation a simplified model is built to get a general feeling for the solution. However, improved model which can give better accuracy can then be obtained for a complete analysis. Compromise has to be made between simplicity of the model and accuracy. It is difficult to consider all the details for mathematical analysis. Only most important features are considered to predict behavior of the system under specified conditions. A more complete model may be then built for complete analysis.

## 2.2. Modeling of Mechanical Systems:

Mechanical systems can be idealized as spring- mass-damper systems and the governing differential equations can be obtained on the basis of Newton's second law of motion, which states that

$$F = ma: \text{ for rectilinear motion}$$

where F: Force, m: mass and a: acceleration (with consistent units)

$$T = I\alpha: \text{ or } J\alpha \text{ for rotary motion}$$

where T: Torque, I or J: moment of inertia and α: angular acceleration (with consistent units)

Mass / inertia and the springs are the energy storage elements where in energy can be stored and retrieved without loss and hence referred as conservative elements. Damper represents the energy loss (energy absorption) in the system and hence is referred as dissipative element. Depending upon the choice of variables and the coordinate system, a given physical model may lead to different mathematical models. The minimum number of independent coordinates required to determine completely the positions of all parts of a system at any instant of time defines the degrees of freedom (DOF) of the system. A large number of practical systems can be described using a finite number of degrees of freedom and are referred as discrete or lumped parameter systems. Some systems, especially those involving continuous elastic members, have an infinite number of degrees of freedom and are referred as continuous or distributed systems. Most of the time, continuous systems are approximated as discrete systems, and solutions are obtained in a simpler manner. Although treatment of a system as continuous gives exact results, the analysis methods available for dealing with continuous systems are limited to a narrow selection of problems. Hence most of the practical systems are studied by treating them as finite lumped masses, springs and dampers. In general, more accurate results are obtained by increasing the number of masses, springs and dampers-that is, by increasing the number of degrees of freedom.

Mechanical systems can be of two types:

1) Translation Systems
2) Rotational Systems.

The variables that described the motion are displacement, velocity and acceleration.

And also we have three parameters-

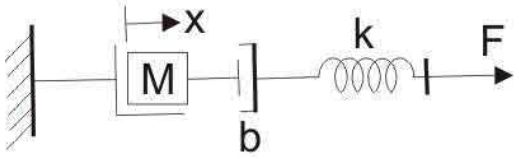
- Mass which is represented by 'M'.
- Coefficient of viscous friction which is represented by 'B'.

- Spring constant which is represented by 'K'.

In rotational mechanical type of systems we have three variables-

- Torque which is represented by 'T'.
- Angular velocity which is represented by 'ω'
- Angular displacement represented by 'θ'

Now let us consider the linear displacement mechanical system which is shown below-




spring mass mechanical system

We have already marked various variables in the diagram itself. We have x is the displacement as shown in the diagram. From the Newton's second law of motion, we can write force as

$$F_1 = M\frac{dx^2}{d^2y} + B\frac{dt}{dy} + Kx$$
$$F_2 = B\frac{dt}{dx}$$
$$F_3 = Kx$$

From the diagram we can see that the,

$$F = F_1+F_2+F_3$$

On substituting the values of $F_1$, $F_2$ and $F_3$ in the above equation and taking the Laplace transform we have the transfer function as,

$$T = \frac{1}{Ms^2 + Bs + K}$$

## 2.3. Mathematical Modeling of Electrical System:

In electrical type of systems we have three variables -

- Voltage which is represented by 'V'.
- Current which is represented by 'I'.
- Charge which is represented by 'Q'.

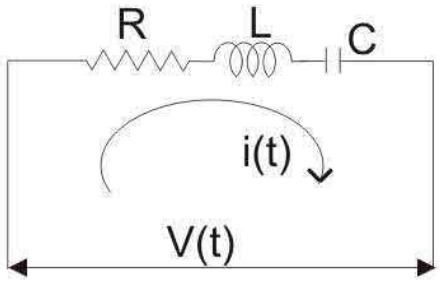
And also we have three parameters which are active and passive elements –

- Resistance which is represented by 'R'.
- Capacitance which is represented by 'C'.
- Inductance which is represented by 'L'.

Now we are in condition to derive analogy between electrical and mechanical types of systems. There are two types of analogies and they are written below:

## 2.4. Force Voltage Analogy :

In order to understand this type of analogy, let us consider a circuit which consists of series combination of resistor, inductor and capacitor.




A voltage V is connected in series with these elements as shown in the circuit diagram. Now from the circuit diagram and with the help of KVL equation we write the expression for voltage in terms of charge, resistance, capacitor and inductor as,

$$V = L\frac{dt^2}{d^2q} + R\frac{dt}{dq} + \frac{q}{C}$$

Now comparing the above with that we have derived for the mechanical system we find that-

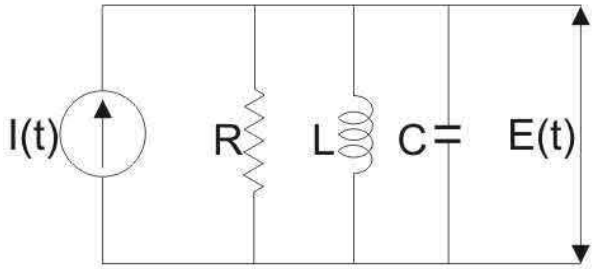
1. Mass (M) is analogous to inductance (L).
2. Force is analogous to voltage V.
3. Displacement (x) is analogous to charge (Q).

4. Coefficient of friction (B) is analogous to resistance R and
5. Spring constant is analogous to inverse of the capacitor (C).

This analogy is known as force voltage analogy.

## 2.5. Force Current Analogy :

In order to understand this type of analogy, let us consider a circuit which consists of parallel combination of resistor, inductor and capacitor.




A voltage E is connected in parallel with these elements as shown in the circuit diagram. Now from the circuit diagram and with the help of KCL equation we write the expression for current in terms of flux, resistance, capacitor and inductor as,

$$I = C\frac{dt^2}{d^2\psi} + \frac{1}{R}\frac{dt}{d\psi} + \frac{\psi}{L}$$

Now comparing the above with that we have derived for the mechanical system we find that,

1. Mass (M) is analogous to Capacitor (C).
2. Force is analogous to current I.
3. Displacement (x) is analogous to flux (ψ).
4. Coefficient of friction (B) is analogous to resistance 1/ R and
5. Spring constant K is analogous to inverse of the inductor (L).

This analogy is known as force current analogy.

## 2.6. Transfer Functions definition

The transfer function of a control system is defined as the ration of the Laplace transform of the output variable to Laplace transform of the input variable assuming all initial conditions to be zero.

$$G(s) = \frac{C(s)}{R(s)} \Rightarrow R(s).G(s) = C(s)$$

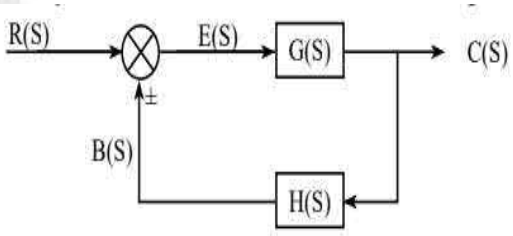
## 2.7.Block Diagram:

A control system may consist of a number of components. In order to show the functions performed by each component in control engineering, we commonly use a diagram called the **Block Diagram**.

A block diagram of a system is a pictorial representation of the function performed by each component and of the flow of signals. Such a diagram depicts the inter-relationships which exists between the various components. A block diagram has the advantage of indicating more realistically the signal flows of the actual system.

In a block diagram all system variables are linked to each other through functional blocks. The ―Functional Block or simply ―Block is a symbol for the mathematical operation on the input signal to the block which produces the output. The transfer functions of the components are usually entered in the corresponding blocks, which are connected by arrows to indicate the direction of flow of signals. Note that signal can pass only in the direction of arrows. Thus a block diagram of a control system explicitly shows a unilateral property.

**Block diagram of a closed loop system.**




The output C(s) is fed back to the summing point, where it is compared with reference input R(s). The closed loop nature is indicated in fig1.3. Any linear system may be represented by a block diagram consisting of blocks, summing points and branch points. A branch is the point from which the output signal from a block diagram goes concurrently to other blocks or summing points.

When the output is fed back to the summing point for comparison with the input, it is necessary to convert the form of output signal to that of he input signal. This conversion is followed by the feedback element whose transfer function is H(s) as shown in fig 1.4. Another important role of the feedback element is to modify the output before it is compared with the input.

The ratio of the feedback signal B(s) to the actuating error signal E(s) is called the open loop transfer function.

$$\text{Open loop transfer function} = B(s)/E(s) = G(s)H(s)$$

The ratio of the output C(s) to the actuating error signal E(s) is called the feed forward transfer function.

$$\text{Feed forward transfer function} = C(s)/E(s) = G(s)$$

If the feedback transfer function is unity, then the open loop and feed forward transfer function are the same. For the system shown in Fig1.4, the output C(s) and input R(s) are related as follows.

$$C(s) = G(s)\, E(s)$$

$$E(s) = R(s) - B(s)$$

$$= R(s) - H(s)\, C(s)$$

$$\text{But } B(s) = H(s)\, C(s)$$

Eliminating E(s) from these equations

$$C(s) = G(s)\,[R(s) - H(s)\, C(s)]$$

$$C(s) + G(s)\,[H(s)\, C(s)] = G(s)\, R(s)$$

$$C(s)[1 + G(s)H(s)] = G(s)R(s)$$

$$\frac{C(s)}{R(s)} = \frac{G(s)}{1 + G(s)\, H(s)}$$

C(s)/R(s) is called the closed loop transfer function.

The output of the closed loop system clearly depends on both the closed loop transfer function and the nature of the input. If the feedback signal is positive, then

$$\frac{C(s)}{R(s)} = \frac{G(s)}{1 - G(s)\, H(s)}$$

## 2.8.SIGNAL FLOW GRAPHS

An alternate to block diagram is the signal flow graph due to S. J. Mason. A signal flow graph is a diagram that represents a set of simultaneous linear algebraic equations. Each signal flow graph consists of a network in which nodes are connected by directed branches. Each node represents a system variable, and each branch acts as a signal multiplier. The signal flows in the direction indicated by the arrow.

**Definitions:**

**Node:** A node is a point representing a variable or signal.
**Branch:** A branch is a directed line segment joining two nodes.
**Transmittance:** It is the gain between two nodes.
**Input node:** A node that has only outgoing branches. It is also, called as source and corresponds to independent variable.
**Output node:** A node that has only incoming branches. This is also called as sink and Corresponds to dependent variable.
**Mixed node:** A node that has incoming and outgoing branches.
**Path:** A path is a traversal of connected branches in the direction of branch arrow.
**Loop:** A loop is a closed path.
**Self-loop:** It is a feedback loop consisting of single branch.
**Loop gain:** The loop gain is the product of branch transmittances of the loop.
**Non-touching loops:** Loops that do not possess a common node.
**Forward path:** A path from source to sink without traversing an node more than once.
**Feedback path:** A path which originates and terminates at the same node.
**Forward path gain:** Product of branch transmittances of a forward path.

**Properties of Signal Flow Graphs:**

1. Signal flow applies only to linear systems.
2. The equations based on which a signal flow graph is drawn must be algebraic equations in the form of effects as a function of causes. Nodes are used to represent variables. Normally the nodes are arranged left to right, following a succession of causes and effects through the system.
3. Signals travel along the branches only in the direction described by the arrows of the branches.
4. The branch directing from node $X_k$ to $X_j$ represents dependence of the variable Xj on $X_k$ but not the reverse.
5. The signal traveling along the branch $X_k$ and $X_j$ is multiplied by branch gain $a_{kj}$ and signal $a_{kj}X_k$ is delivered at node $X_j$.

**Guidelines to Construct the Signal Flow Graphs:**

The signal flow graph of a system is constructed from its describing equations, or by direct reference to block diagram of the system. Each variable of the block diagram becomes a node and each block becomes a branch. The general procedure is

1. Arrange the input to output nodes from left to right.
2. Connect the nodes by appropriate branches.
3. If the desired output node has outgoing branches, add a dummy node and a unity gain branch.
4. Rearrange the nodes and/or loops in the graph to achieve pictorial clarity.

## 2.9. Mason's Gain Formula:

The relationship between an input variable and an output variable of a signal flow graph is given by the net gain between input and output nodes and is known as overall gain of the system. Masons gain formula is used to obtain the overall gain (transfer function) of signal flow graphs.

Gain P is given by

$$P = \frac{1}{\Delta} \sum_k P_k \Delta_k$$

Where, $P_k$ is gain of $k^{th}$ forward path,

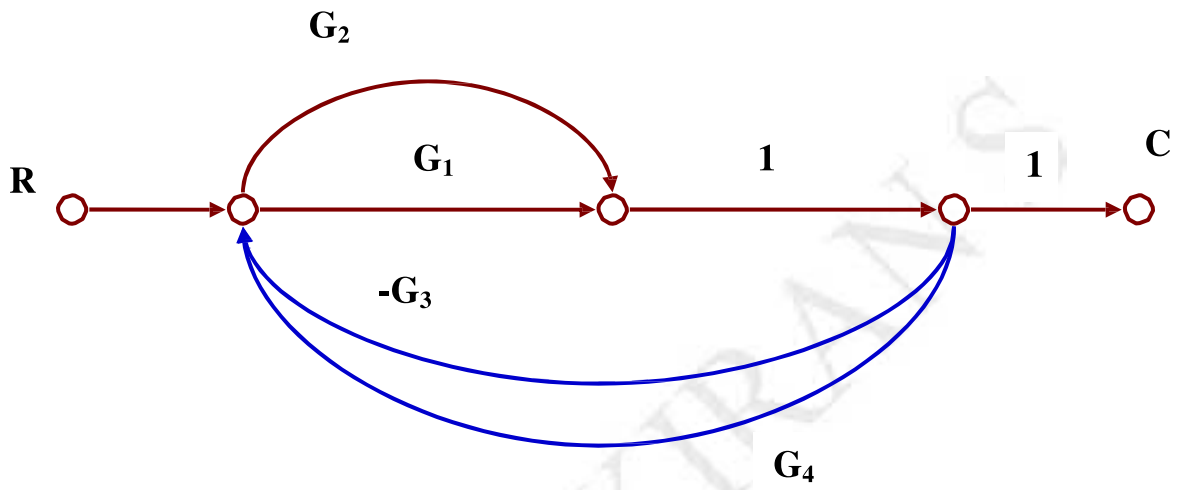
$\Delta$ is determinant of graph

$\Delta$=1-(sum of all individual loop gains) + (sum of gain products of all possible combinations of two non touching loops – sum of gain products of all possible combination of three non touching loops) + ···

$\Delta_k$ is cofactor of $k^{th}$ forward path determinant of graph with loops touching $k^{th}$ forward path. It isobtained from $\Delta$ by removing the loops touching the path $P_k$.

**Example 1**

Obtain the transfer function of C/R of the system whose signal flow graph is shown in Figure




**Solution:**

There are two forward paths:

Gain of path 1 : $P_1=G_1$
Gain of path 2 : $P_2=G_2$

There are four loops with loop gains:
$L_1=-G_1G_3$, $L_2=G_1G_4$, $L_3=-G_2G_3$, $L_4=G_2G_4$

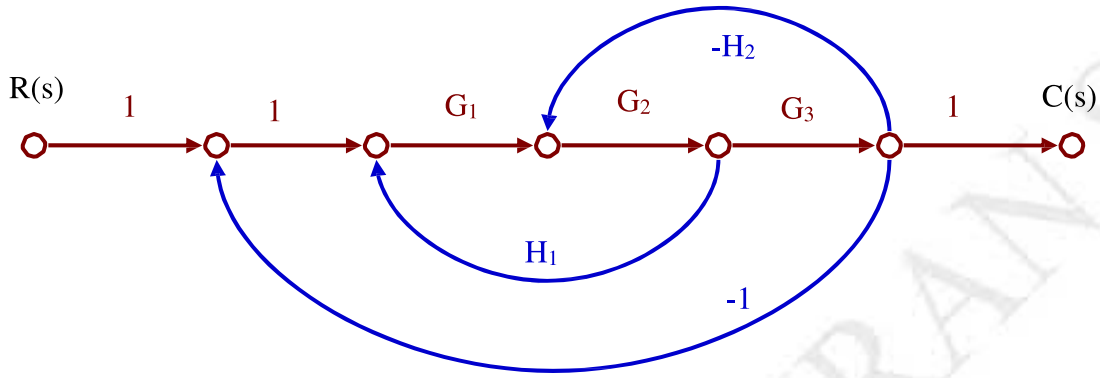
There are no non-touching loops.
$\Delta = 1+G_1G_3-G_1G_4+G_2G_3-G_2G_4$

Forward paths 1 and 2 touch all the loops. Therefore, $\Delta_1= 1$, $\Delta_2= 1$

The transfer function $T = \frac{C(s)}{R(s)} = \frac{P_1\Delta_1 + P_2\Delta_2}{\Delta} = \frac{G_1 + G_2}{1+G_1G_3-G_1G_4+G_2G_3-G_2G_4}$

**Example 2**

Obtain the transfer function of C(s)/R(s) of the system whose signal flow graph is shown in Figure




There is one forward path, whose gain is: $P_1=G_1G_2G_3$

There are three loops with loop gains:

$L_1=-G_1G_2H_1$,

$L2=G_2G_3H_2$,

$L3= -G_1G_2G_3$

There are no non-touching loops.

$\Delta = 1-G_1G_2H_1+G_2G_3H_2+G_1G_2G_3$

Forward path 1 touches all the loops. Therefore, $\Delta_1= 1$.

The transfer function $T = \frac{C(s)}{R(s)} = \frac{P_1\Delta_1}{\Delta}$

Mr. SWARNAKIRAN S

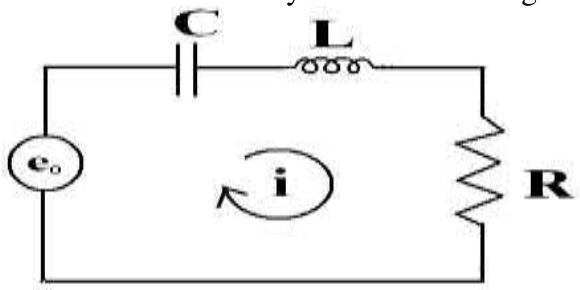
**OUTCOMES:**

At the end of the unit, the students are able to:

- Mathematical modeling of mechanical, electrical, servo mechanism and hydraulic systems.
- To find Transfer function of a system.
- Calculate the gain of the system using block diagram and signal flow graph and to illustrate the response of systems.

**SELF-TEST QUESTIONS:**

1. What mathematical model permits easy interconnection of physical systems?
2. Define the transfer function.
3. What are the component parts of the mechanical constants of a motor‘s transfer function?
4. Derive the transfer function of a Spring - Mass-Damper – system.
5. Differentiate between FI and FV analogy.
6. Obtain Transfer function of Armature controlled DC motor.
7. Derive transfer function for the Electrical system shown in Figure below.




8. Differentiate between Block diagram and Signal flow graph techniques.
9. Explain the rules for constructing Signal flow graph.
10. Reduce the block diagram shown in Figure 1, to its simplest possible form and find its closed loop transfer function.

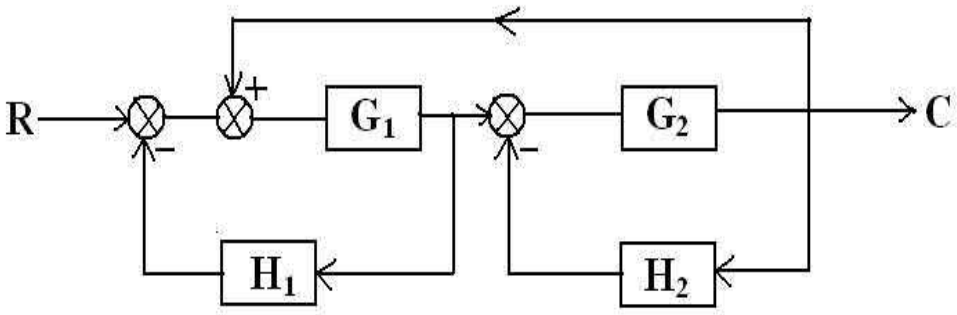



Figure 1

**11.** Find **C(S)/R(S)** for the following system using Mason's gain rule shown in figure 2.

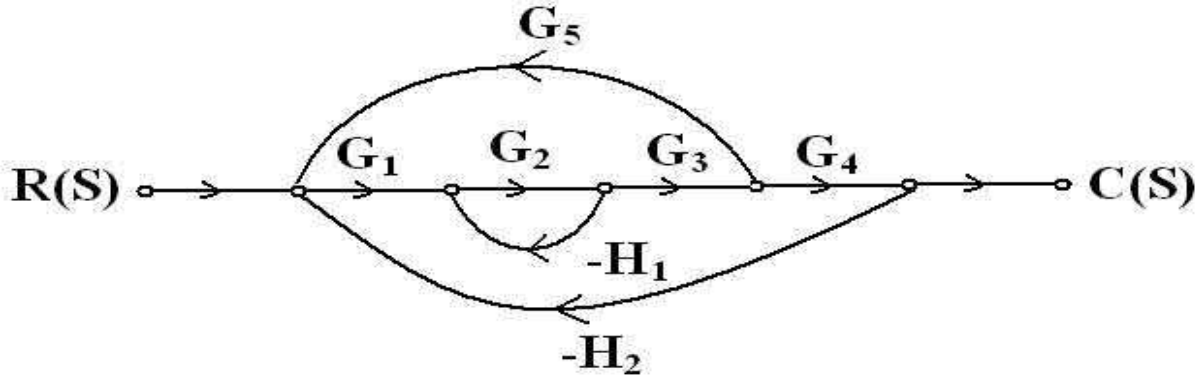



Figure 2

**LIST OF TEXT BOOKS:**

1. Modern control theory, Katsuhiko Ogata, Pearson Education International , Fifth edition.
2. "Control systems Principles and Design", M.Gopal, 3rd Edition, TMH, 2000.

## Reference Books:

1. Control engineering, Swarnakiran S, Sunstar publisher, 2018.
2. Control system engineering, Norman S Nise, John Wiley &Sons, Inc., Sixth edition
3. Modern control systems, Richard C. Dorf, Robert H Bishop, Pearson Education International, Twelfth edition.
4. Automatic control systems, Farid Golnaraghi, Benjamin C Kuo, John Wiley & Sons, Inc., Nineth edition.
5. J.Nagrath and M.Gopal," Control System Engineering", New Age International Publishers, 5th Edition, 2007.
6. "Feedback control systems", Schaum's series, 2001.
7. System dynamics and control, Eronini-Umez, Thomas Asia Pte ltd., Singapore 2002.

**MODULE - 3**

# TRANSIENT AND STEADY STATE RESPONSE ANALYSIS

## LESSON STRUCTURE:


**3.1. Introduction**
**3.2. Time Response**
**3.3. Steady State Response**
**3.4. Routh's-Hurwitz Criterion**
**3.5. Definition of root loci**
**3.6. Analysis using root locus plots**
**3.7. General rules for constructing root locus**


## OBJECTIVES:

- To analyse stability in complex domain and frequency domain systems.
- To educate static and transient behavior of a system.
- To demonstrate stability of the various control systems by applying Routh's stability criterion.
- To study stability by using Root locus plots.

## 3.1. Introduction:

Time is used as an independent variable in most of the control systems. It is important to analyse the response given by the system for the applied excitation, which is function of time. Analysis of response means to see the variation of output with respect to time. The output behavior with respect to time should be within these specified limits to have satisfactory performance of the systems. The stability analysis lies in the time response analysis that is when the system is stable output is finite

The system stability, system accuracy and complete evaluation is based on the time response analysis on corresponding results.

## 3.2. Time Response:

The response given by the system which is function of the time, to the applied excitation is called time response of a control system.

Practically, output of the system takes some finite time to reach to its final value. This time varies from system to system and is dependent on different factors. The factors like friction mass or inertia of moving elements some nonlinearities present etc. Example: Measuring instruments like Voltmeter, Ammeter.

**Classification:**

The time response of a control system is divided into two parts.

1 Transient response ct(t)
2 Steady state response css(t)

$\therefore c(t)=ct(t)+cSS(t)$

Where c(t)= Time Response

Total Response=Zero State Response +Zero Input Response.

## 3.3. Steady State Response:

It is defined the part of the response which remains after complete transient response vanishes from the system output.

. i,e, $\lim_{t \to \infty} c_t(t)=c_{ss}(t)$

The time domain analysis essentially involves the evaluation of the transient and Steady state response of the control system.

For the analysis point of view, the signals, which are most commonly used as reference inputs, are defined as **standard test inputs.**

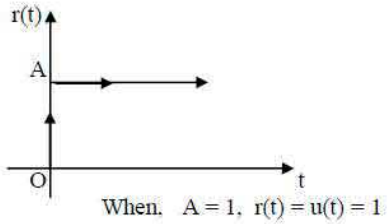
- The performance of a system can be evaluated with respect to these test signals.
- Based on the information obtained the design of control system is carried out. The
- commonly used test signals are
  1. Step Input signals.
  2. Ramp Input Signals.
  3. Parabolic Input Signals.
  4. Impulse input signal.

**1. Step input signal (position function)**

It is the sudden application of the input at a specified time as usual in the figure or instant any us change in the reference input

Example :-

a. If the input is an angular position of a mechanical shaft a step input represent the sudden rotation of a shaft.
b. Switching on a constant voltage in an electrical circuit.
c. Sudden opening or closing a valve.




The step is a signal who‘s value changes from 1 value (usually 0) to another level A in Zero time.

In the Laplace Transform form R(s) = A / S

Mathematically r(t) = u(t)

= 1 for $t \geq 0$

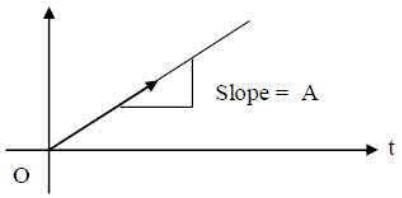
= 0 for $t < 0$

**2. Ramp Input Signal (Velocity Functions):**

It is constant rate of change in input that is gradual application of input as shown in fig (2 b).

r(t)

Ex:- Altitude Control of a Missile



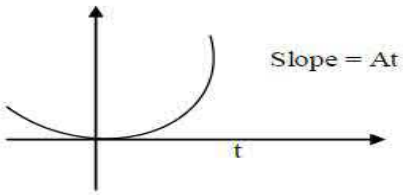

The ramp is a signal, which starts at a value of zero and increases linearly with time.
Mathematically r (t) = At for t ≥ 0
= 0 for t≤ 0.
In LT form R(S) = A
S2
If A=1, it is called Unit Ramp Input

**Parabolic Input Signal (Acceleration function):**

- The input which is one degree faster than a ramp type of input as shown in fig (2 c) or it is an integral of a ramp.
- Mathematically a parabolic signal of magnitude

A is given by $r(t) = \frac{At^2}{2} u(t)$

$$r(t) = \begin{cases} \frac{At^2}{2} & \text{for } t \geq 0 \\ 0 & \text{for } t \leq 0 \end{cases}$$




In LT form $R(S) = \frac{A}{S^3}$

- If A = 1, a unit parabolic function is defined as $r(t) = \frac{t^2}{2} u(t)$

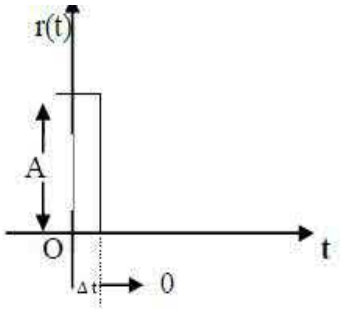
ie., $$r(t) \begin{cases} \frac{t^2}{2} & \text{for } t \geq 0 \\ 0 & \text{for } t \leq 0 \end{cases}$$

In LT for $R(S) = \frac{1}{S} =$

**Impulse Input Signal :**

It is the input applied instantaneously (for short duration of time ) of very high amplitude as shown in fig 2(d)
Eg: Sudden shocks i e, HV due lightening or short circuit.
It is the pulse whose magnitude is infinite while its width tends to zero.

ie., t ⟶ 0 (zero) applied momentarily




Area of impulse = Its magnitude
If area is unity, it is called **Unit Impulse Input** denoted as (δ)
Mathematically it can be expressed as
r(t) = A for t = 0

$= 0$ for $t \neq 0$

In LT form $R(S) = 1$ if $A = 1$

## 3.4. Routh's-Hurwitz Criterion

E.J. Routh (1877) developed a method for determining whether or not an equation has roots with + ve real parts without actually solving for the roots.

A necessary condition for the system to be **STABLE** is that the real parts of the roots of the characteristic equation have - ve real parts. This insures that the impulse response will decay exponentially with time.

If the system has some roots with real parts equal to zero, but none with +ve real parts the system is said to be **MARGINALLY STABLE**.

It determines the poles of a characteristic equation with respect to the left and the right half of the S-plane without solving the equation.

The roots of this characteristic equation represent the closed loop poles. The stability of the system depends on these poles. The necessary, but not sufficient conditions for the system having no roots in the right half S-Plane are listed below.

i. All the co-efficients of the polynomial must have the same sign.
ii. All powers of S, must present in descending order.
iii. The above conditions are not sufficient.

In a vast majority of practical systems. The following statements on stability are quite useful.

i. If all the roots of the characteristic equation have –ve real parts the system is **STABLE**.
ii. If any root of the characteristic equation has a +ve real part or if there is a repeated root on the j -axis, the system is **unstable**.
iii. If condition (i) is satisfied except for the presence of one or more non repeated roots on the j -axis the system is limitedly **STABLE**

In this instance the impulse response does not decay to zero although it is bounded. Additionally certain inputs will produce outputs. Therefore **marginally stable** systems are **UNSTABLE**.

The Routh Stability criterion is a method for determining system stability that can be applied to an nth order characteristic equation of the form

$$s^n + a_{n-1} s^{n-1} + a_{n-2} s^{n-2} + a_{n-3} s^{n-3} + \ldots\ldots\ldots\ldots a_1 s^1 + a^0 = \mathbf{0}$$

The criterion is applied through the use of a Routh Array (Routh table) Defined as follows:

| | | | |
|---|---|---|---|
| $S^n$ | an | an-2 | an-4 |
| Sn-1 | an-1 | an-3 | an-5 |
| Sn-2 | b1 | b2 | b3 |
| Sn-3 | c1 | c2 | c3 |
| Sn-4 | d1 | d2 | |
| . | | | |
| . | | | |
| $S^2$ | e1 | a0 | |
| $S^1$ f1 | | | |
| $S^0$ a0 | | | |

**The ROUTH STABILITY CRITERION is stated as follows,**

All the terms in the first column of Routh's Array should have same sign, and there should not be any change of sign.

This is a necessary and sufficient condition for the system to be stable. On the other hand any change of sign in the first column of Routh's Array indicates,

i. The System is Unstable, and
ii. The Number of changes of sign gives the number of roots lying in the right half of S-Plane

Example : find the stability of the system using Routh's criteria. For the equation $3S^4+10S^3+5S^2+5S+2=0$

| | | | |
|---|---|---|---|
| S4 | 3 | 5 | 2 |
| S3 | 10 | 5 | 0 |
| S3 | (2) | (1) | 0 |
| S2 | 7/2 | 2 | 0 |
| S1 | -1/7 | 0 | |
| S0 | 2 | | |

Here two roots are +ve (2 changes of sign) and hence the system **is unstable.**

## 3.5. Definition of root loci

The root locus of a feedback system is the graphical representation in the complex *s*-plane of the possible locations of its closed-loop poles for varying values of a certain system parameter. The points that are part of the root locus satisfy the angle condition. The value of the parameter for a certain point of the root locus can be obtained using the magnitude condition.

In **root locus technique in control system** we will evaluate the position of the roots, their locus of movement and associated information. These information will be used to comment upon the system performance.

## 3.6. Analysis using root locus plots.

A designer can determine whether his design for a control system meets the specifications if he knows the desired time response of the controlled variable. By deriving the differential equations for the control system and solving them, an accurate solution of the system's performance can be obtained, but this approach is not feasible for other than simple systems. It is not easy to determine from this solution just what parameters in the system should be changed to improve the response. A designer wishes to be able to predict the performance by an analysis that does not require the actual solution of the differential equations.

The first thing that a designer wants to know about a given system is whether or not it is stable. This can be determined by examining the roots obtained from the characteristic equation

$$1 + G_0(s) = 0 \tag{3.1}$$

of the closed loop. The work involved in determining the roots of this equation can be avoided by applying the Hurwitz or Routh criterion. Determining in this way whether the system is stable or unstable does not satisfy the designer, because it does not indicate the degree of stability of the system, i.e., the amount of overshoot and the settling time of the controlled variable for a step input. Not only must the system be stable, but the overshoot must be maintained within prescribed bounds and transients must die out in a sufficiently short time.

The root-locus method described in this section not only indicates whether a system is stable or unstable but, for a stable system, also shows the degree of stability. The root locus is a plot of the roots of the characteristic equation of the closed loop as a function of the gain. This graphical approach yields a clear indication of the effect of gain adjustment with relatively small effort.

With this method one determines the closed-loop poles in the $s$plane - these are the roots of Eq.(5.1) - by using the known distribution of the poles and zeros of the open-loop transfer function $G_0(s)$. If for instance a parameter is varied, the roots of the characteristic equation will move on certain curves in the $s$plane as shown by the example in Figure 3.1. On these curves lie all

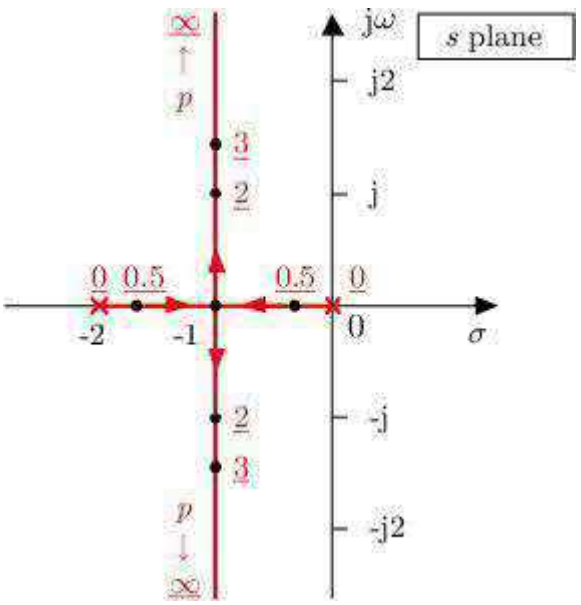



**Figure 3.1:** Plot of all roots of the characteristic equation $s^2 + 2s + p = 0$ for $0 \le p < \infty$.

Values of $p$ are red and underlined.

possible roots of the characteristic equation for all values of the varied parameter from zero to infinity. These curves are defined as the *root-locus plot* of the closed loop. Once this plot is obtained, the roots that best fit the system performance specifications can be selected. Corresponding to the selected roots there is a required value of the parameter which can be determined from the plot. When the roots have been selected, the time response can be obtained. Since the process of finding the root locus by calculating the roots for various values of a parameter becomes tedious, a simpler method of obtaining the root locus is desired. The graphical method for determining the root-locus plot is shown in the following.

An open-loop transfer function with $k$ poles at the origin of the $s$ plane is often described by

$$G_0(s) = \frac{K_0}{s^k} \frac{1 + \beta_1 s + \ldots + \beta_m s^m}{1 + \alpha_1 s + \ldots + \alpha_{n-k} s^{n-k}} \qquad m \le n\,, \tag{3.2}$$

where $K_0$ is the gain of the open loop. In order to represent this transfer function in terms of the open-loop poles and zeros it is rewritten as

$$G_0(s) = k_0 \frac{\prod_{\mu=1}^{m} (s - s_{Z_\mu})}{\prod_{\nu=1}^{n} (s - s_{P_\nu})} = k_0 G(s) \tag{3.3}$$

or

$$G_0(s) = k_0 \frac{\prod_{\mu=1}^{m} (-s_{Z_\mu})}{\prod_{\substack{\nu=1 \\ s_{P_\nu} \neq 0}}^{n-k} (-s_{P_\nu})} \frac{1}{s^k} \frac{\prod_{\mu=1}^{m} \left(1 + \frac{s}{-s_{Z_\mu}}\right)}{\prod_{\substack{\nu=1 \\ s_{P_\nu} \neq 0}}^{n-k} \left(1 + \frac{s}{-s_{P_\nu}}\right)} \tag{3.4}$$

with $k_0 > 0$ and $s_{Z_\nu} \neq s_{P_\nu}$. The relationship between the *factor* $k_0$ and the *open-loop gain* $K_0$ is

$$K_0 = k_0 \frac{\prod_{\mu=1}^{m} (-s_{Z_\mu})}{\prod_{\substack{\nu=1 \\ s_{P_\nu} \neq 0}}^{n-k} (-s_{P_\nu})} \frac{1}{s^k} . \tag{3.5}$$

The characteristic equation of the closed loop using Eq. (5.3) is

$$1 + k_0 G(s) = 0 \tag{3.6}$$

or

$$G(s) = -\frac{1}{k_0} . \tag{3.7}$$

All complex numbers $s_i = s_i(k_0)$, which fulfil this condition for $0 \leq k_0 \leq \infty$, represent the root locus.

From the above it can be concluded that the magnitude of $k_0 G(s)$ must always be unity and its phase angle must be an odd multiple of $\pi$. Consequently, the following two conditions are formalised for the root locus for all positive values of $k_0$ from zero to infinity:

a)

*Magnitude condition*:

$$|G(s)| = \frac{1}{k_0} \tag{3.8}$$

b)

*Angle condition*

$$\varphi(s) = \arg G(s) = \pm 180^\circ (2k + 1) \quad \text{for} \quad \begin{matrix} k = 0, 1, 2, \ldots \\ k_0 \geq 0 \end{matrix} \tag{3.9}$$

In a similar manner, the conditions for negative values of $k_0$ ( $-\infty \leq k_0 < 0$ ) can be determined. The magnitude conditions is the same, but the angle must satisfy the

c)

*Angle condition*

$$\varphi(s) = \arg G(s) = \pm k\, 360^\circ \quad \text{for} \quad \begin{matrix} k = 0, 1, 2, \ldots \\ k_0 < 0 \end{matrix} . \tag{3.10}$$

Apparently the angle condition is independent of $k_o$. All points of the $s$plane that fulfil the angle condition are the loci of the poles of the closed loop by varying $k_o$. The calibration of the curves by the values of $k_o$ is obtained by the magnitude condition according to Eq. 8(3.8). Based upon this interpretation of the conditions the root locus can constructed in a graphical/numerical way.

Once the open-loop transfer function $G_o(s)$ has been determined and put into the proper form, the poles and zeros of this function are plotted in the $s$plane.

- The plot of the locus of the closed loop poles as a function of the open loop gain K, when K is varied from 0 to +00.
- When system gain K is varied from 0 to +oo, the locus is called direct root locus.
- When system gain K is varied from -oo to 0, the locus is called as inverse root locus.
- The root locus is always symmetrical about the real axis i.e. x-axis.
- The number of separate branches of the root locus equals either the number of open loop poles are number of open-loop zeros whichever is greater.
- A section of root locus lies on the real axis if the total number of open-loop poles and zeros to the right of the section is odd.
- If the root locus intersects the imaginary axis then the point of intersection are conjugate. From the open loop complex pole the root locus departs making an angle with the horizontal line.
- The root locus starts from open-loop poles.
- The root locus terminates either on open loop zero or infinity.
- The number of branches of roots locus are:

N if P>Z
and M if P<Z
where N —> No. of poles _P‘
M —> No. of zeros _Z‘

- Centroid is the centre of asymptotes. It is given by (an)

$$\sigma_c = \frac{\Sigma P - \Sigma Z}{N - M}$$

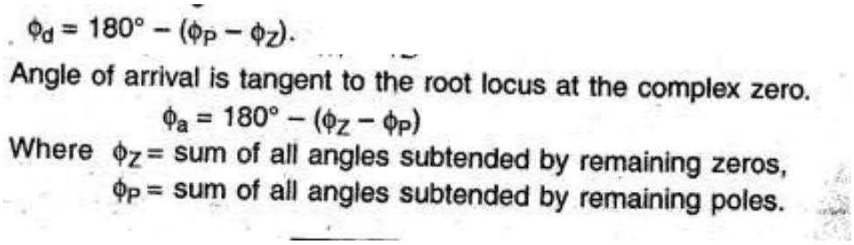
- Angle of asymptotes is denoted by _p

$$\phi = \frac{(2K+1)}{N-M} \times 180^\circ$$

☞ Breakaway/saddle point is the point at which the root locus comes out of the real axis.
To find breakaway point

Put $\frac{dK}{ds} = 0$

- Angle of departure is. tangent to root locus at complex pole


$\phi_d = 180° - (\phi_P - \phi_Z)$.

Angle of arrival is tangent to the root locus at the complex zero.

$\phi_a = 180° - (\phi_Z - \phi_P)$

Where $\phi_Z$ = sum of all angles subtended by remaining zeros,

$\phi_P$ = sum of all angles subtended by remaining poles.

Based on the pole and zero distributions of an open-loop system the stability of the closed-loop system can be discussed as a function of one scalar parameter. The root-locus method shown in this module is a technique that can be used as a tool to design control systems. The basic ideas and its relevancy to control system design are introduced and illustrated. Ten general rules for constructing root loci for positive and negative gain are shortly presented such that they can be easily applied. This is demonstrated by some discussed examples, by a table with sixteen examples and by a comprehensive design of a closed-loop system of higher order.

**Example Problems:**

**Q.1.** Consider the example

$$G_0(s) = \frac{K_0}{s(s+2)} = \frac{k_0}{(s - s_{P_1})(s - s_{P_2})}$$

with $s_{P_1} = 0$, $s_{P_2} = -2$ and $k_0 = K_0$. The poles of the closed-loop transfer function

$$G_W(s) = \frac{K_0}{s^2 + 2s + K_0}$$

are the roots $s_1$ and $s_2$ of the characteristic equation

$$P(s) = s^2 + 2s + K_0 = 0$$

and are given by

$$s_{1,2} = -1 \pm \sqrt{1 - K_0}$$

As $s_1 = s_{P_1} = 0$ and $s_2 = s_{P_2} = -2$ it can be seen that for $K_0 = 0$ the poles of the closed loop transfer function are identical with those of the open-loop transfer function $G_0(s)$. For other values $K_0$ the following two cases are considered:

a) $K_0 \leq 1$: Both roots $s_1$ and $s_2$ are real and lie on the real axis in the range of $-2 \leq \sigma \leq -1$ and $-1 \leq \sigma \leq 0$;

b) $K_0 > 1$: The roots $s_1$ and $s_2$ are conjugate complex with the real part $\mathrm{Re}\, s_{1,2} = -1$, which does not depend on $K_0$, and the imaginary part Im $s_{1,2} = \pm\sqrt{K_0 - 1}$.

The curve has two branches as shown in Figure 6.2.

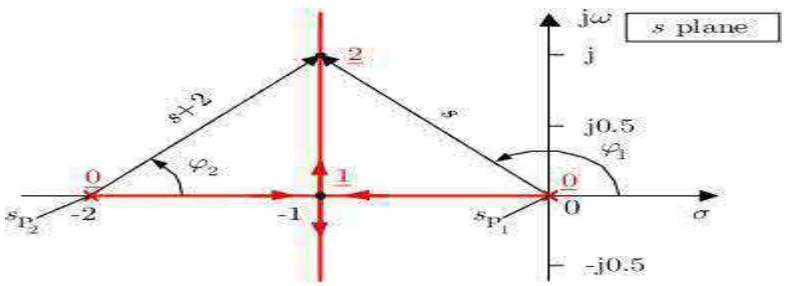



**Figure 5.2:** Root locus of a simple second-order system

At $(s_{P_1} + s_{P_2})/2 = -1$ is the *breakaway point* of the two branches. Checking the angle condition the condition

$$\varphi(s) = \arg\{G(s)\} = \arg\left\{\frac{1}{s(s+2)}\right\} = -\arg s - \arg(s+2) \stackrel{!}{=} \pm 180°(2k+1)$$

must be valid. The complex numbers $s$ and $(s+2)$ have the angles $\varphi_1$ and $\varphi_2$ and the magnitudes $|s|$ and $|s+2|$. The triangle ( $-2,\ 0,\ -1+j$ ) in Figure 6.2 yields the angle condition. Evaluating the magnitude condition according to Eq. (6.8)

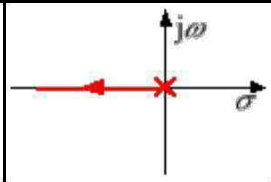
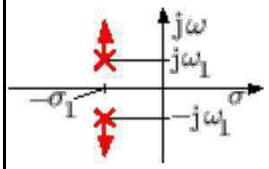
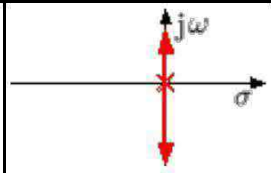
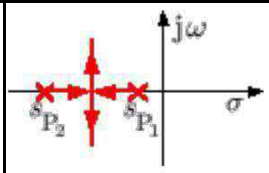
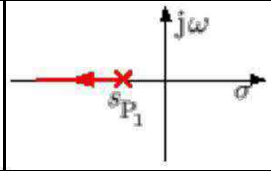
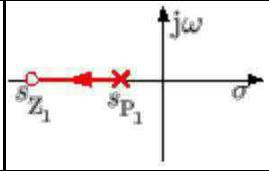
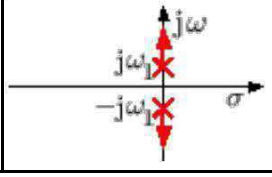
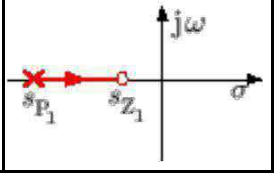
$$|G(s)| = \left|\frac{1}{s(s+2)}\right| = \frac{1}{K_0}$$

one obtains the value $K_0$ on the root locus. E.g. for $s = -1+j$ the gain of the open loop is $K_0 = |s(s+2)|_{s=-1+j} = 2$.

The value of $K_0$ at the breakaway point $s_B = -1$ is $K_0 = |-1(-1+2)| = 1$.

Table 5.1 shows further examples of some 1st- and 2nd-order systems.

**Table 5.1:** Root loci of 1st- and 2nd-order systems

| $G_0(s)$ | root locus | $G_0(s)$ | root locus |
|---|---|---|---|
| $\frac{k_0}{s}$ |  | $\frac{k_0}{(s+\sigma_1)^2+\omega_1^2}$ |  |
| $\frac{k_0}{s^2}$ |  | $\frac{k_0}{(s-s_{P_1})(s-s_{P_2})}$ |  |
| $\frac{k_0}{s-s_{P_1}}$ |  | $\frac{k_0(s-s_{Z_1})}{(s-s_{P_1})}$ $\lvert s_{Z_1}\rvert > \lvert s_{P_1}\rvert$ |  |
| $\frac{k_0}{s^2+\omega_1^2}$ |  | $\frac{k_0(s-s_{Z_1})}{(s-s_{P_1})}$ $\lvert s_{Z_1}\rvert < \lvert s_{P_1}\rvert$ |  |

## 3.7. General rules for constructing root loci

To facilitate the application of the root-locus method for systems of higher order than 2nd, rules can be established. These rules are based upon the interpretation of the angle condition and the analysis of the characteristic equation. The rules presented aid in obtaining the root locus by expediting the manual plotting of the locus. But for automatic plotting using a computer these rules provide checkpoints to ensure that the solution is correct.

Though the angle and magnitude conditions can also be applied to systems having dead time, in the following we restrict to the case of the open-loop rational transfer functions according to Eq. (3.3)

$$G_0(s) = k_0 \frac{(s - s_{Z_1})(s - s_{Z_2}) \ldots (s - s_{Z_m})}{(s - s_{P_1})(s - s_{P_2}) \ldots (s - s_{P_n})}, \quad k_0 \geq 0 \tag{3.11}$$

or

$$G_0(s) = k_0 \frac{b_0 + b_1 a + \ldots + b_{m-1} s^{m-1} + s^m}{a_0 + a_1 s + \ldots + a_{n-1} s^{n-1} + s^n} = k_0 \frac{N_0(s)}{D_0(s)} \tag{3.12}$$

As this transfer function can be written in terms of poles and zeros $s_{P_\nu}$ and $s_{Z_\mu}$ ( $\nu = 1, 2, \ldots n$ ; $\mu = 1, 2, \ldots, m$ ) $G_0(s)$ can be represented by their magnitudes and angles

$$G_0(s) = k_0 \frac{|s - s_{Z_1}| e^{j\varphi_{Z_1}} |s - s_{Z_2}| e^{j\varphi_{Z_2}} \ldots |s - s_{Z_m}| e^{j\varphi_{Z_m}}}{|s - s_{P_1}| e^{j\varphi_{P_1}} |s - s_{P_2}| e^{j\varphi_{P_2}} \ldots |s - s_{P_n}| e^{j\varphi_{P_n}}}$$

or

$$G_0(s) = k_0 \frac{\prod_{\mu=1}^{m} |s - s_{Z_\mu}|}{\prod_{\nu=1}^{n} |s - s_{P_\nu}|} e^{j\left(\sum_{\mu=1}^{m} \varphi_{Z_\mu} - \sum_{\nu=1}^{n} \varphi_{P_\nu}\right)} \tag{3.13}$$

From Eq. (3.8) the *magnitude condition*

$$\frac{\prod_{\mu=1}^{m} |s - s_{Z_\mu}|}{\prod_{\nu=1}^{n} |s - s_{P_\nu}|} = \frac{1}{k_0} \tag{3.14}$$

and from Eq. (3.9) the *angle condition*

$$\varphi(s) = \sum_{\mu=1}^{m} \varphi_{Z_\mu} - \sum_{\nu=1}^{n} \varphi_{P_\nu} = \pm 180^\circ (2k + 1) \quad \text{for} \quad k = 0, 1, 2, \ldots \tag{3.15}$$

follows. Here $\varphi_{Z_\mu}$ and $\varphi_{P_\nu}$ denote the angles of the complex values $(s - s_{Z_\mu})$ and $(s - s_{P_\nu})$, respectively. All angles are considered positive, measured in the counterclockwise sense. If for each point the sum of these angles in the $s$plane is calculated, just those particular points that fulfil the condition in Eq. (3.15) are points on the root locus. This principle of constructing a root-locus curve - as shown in Figure 3.3 - is mostly used for automatic root-locus plotting.

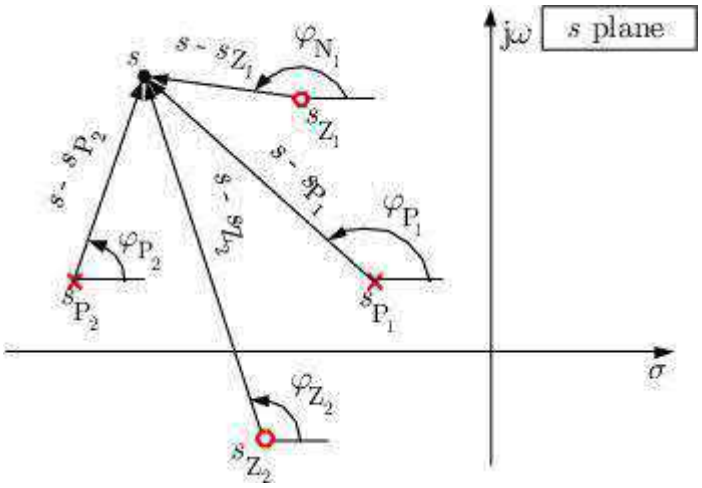



**Figure 3.3:** Pole-zero diagram for construction of the root locus

In the following the most important *rules for the construction of root loci* for $k_0 > 0$ are listed:

**Rule 1 Symmetry**

As all roots are either real or complex conjugate pairs so that the root locus is symmetrical to the real axis.

**Rule 2 Number of branches**

The number of branches of the root locus is equal to the number of poles $n$ of the open-loop transfer function.

**Rule 3 Locus start and end points**

The locus starting points ($k_0 = 0$) are at the open-loop poles and the locus ending points ($k_0 = \infty$) are at the open-loop zeros. $(n - m)$ branches end at infinity. The number of starting branches from a pole and ending branches at a zero is equal to the multiplicity of the poles and zeros, respectively. A point at infinity is considered as an equivalent zero of multiplicity equal to $n - m$.

**Rule 4 Real axis locus**

If the total number of poles and zeros to the right of a point on the real axis is odd, this point lies on the locus.

**Rule 5 Asymptotes**

There are $n - m$ asymptotes of the root locus with a slope of

$$\alpha_k = \arg s = \frac{\pm 180^\circ (2k+1)}{n-m}. \qquad (3.16)$$

For $(n-m)=1,2,3$ and 4 one obtains the asymptote configurations as shown in Figure 3.4.

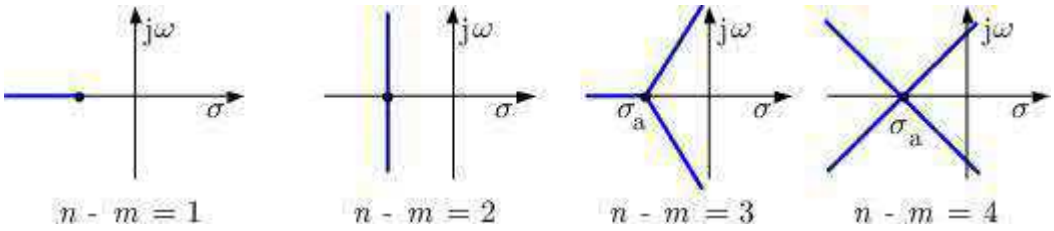



**Figure 5.4:** Asymptote configurations of the root locus

**Rule 6 Real axis intercept of the asymptotes**

The real axis crossing $(\sigma_a, j0)$ of the asymptotes is at

$$\sigma_a = \frac{1}{n-m}\left\{\sum_{\nu=1}^{n} \mathrm{Re}\, s_{P_\nu} - \sum_{\mu=1}^{m} \mathrm{Re}\, s_{Z_\mu}\right\} . \tag{3.17}$$

**Rule 7 Breakaway and break-in points on the real axis**

At least one breakaway or break-in point $(\sigma_B, j0)$ exists if a branch of the root locus is on the real axis between two poles or zeros, respectively. Conditions to find such real points are based on the fact that they represent multiple real roots. In addition to the characteristic equation for multiple roots the condition

$$\frac{d}{ds}[1+G_0(s)] = \frac{d}{ds}G_0(s) = 0 . \tag{3.18}$$

must be fulfilled, which is equivalent to

$$\sum_{\nu=1}^{n} \frac{1}{s - s_{P_\nu}} = \sum_{\mu=1}^{m} \frac{1}{s - s_{Z_\mu}} \tag{3.19}$$

for $s = \sigma_B$. If there are no poles or zeros, the corresponding sum is zero.

**Rule 8 Complex pole/zero angle of departure/entry**

The angle of departure of pairs of poles with multiplicity $r_{P\varrho}$ is

$$\varphi_{P\varrho,D} = \frac{1}{r_{P\varrho}}\left\{-\sum_{\substack{\nu=1 \\ \nu\neq\varrho}}^{n} \varphi_{P_\nu} + \sum_{\mu=1}^{m} \varphi_{Z_\mu} \pm 180^\circ(2k+1)\right\} \tag{3.20}$$

and the angle of entry of pairs of zeros with multiplicity $r_{Z\varrho}$

$$\varphi_{z_\varrho,E} = \frac{1}{r_{z_\varrho}} \left\{ -\sum_{\substack{\mu=1 \\ \mu \neq \varrho}}^{m} \varphi_{z_\mu} + \sum_{\nu=1}^{n} \varphi_{p_\nu} \pm 180°(2k+1) \right\} \quad (3.21)$$

**Rule 9 Root-locus calibration**

The labels of the values of $k_0$ can be determined by using

$$k_0 = \frac{\prod_{\nu=1}^{n} |s - s_{p_\nu}|}{\prod_{\mu=1}^{m} |s - s_{z_\mu}|} \quad (3.22)$$

For $m = 0$ the denominator is equal to one.

**Rule 10 Asymptotic stability**

The closed loop system is asymptotically stable for all values of $k_0$ for which the locus lies in the left-half $s$ plane. From the imaginary-axis crossing points the critical values $k_{0_{crit}}$ can be determined.

The rules shown above are for positive values of $k_0$. According to the angle condition of Eq. (5.10) for negative values of $k_0$ some rules have to be modified. In the following these rules are numbered as above but labelled by a *.

**Rule 3* Locus start and end points**

The locus starting points ($k_0 = 0$) are at the open-loop poles and the locus ending points ($k_0 = -\infty$) are at the open-loop zeros. $(n-m)$ branches end at infinity. The number of starting branches from a pole and ending branches at a zero is equal to the multiplicity of the poles and zeros, respectively. A point at infinity is considered as an equivalent zero of multiplicity equal to $n-m$.

**Rule 4* Real axis locus**

If the total number of poles and zeros to the right of a point on the real axis is even including zero, this point lies on the locus.

**Rule 5* Asymptotes**

There are $n-m$ asymptotes of the root locus with a slope of

$$\alpha_k = \arg s = \frac{\pm 360° k}{n-m} \quad (3.23)$$

**Rule 8* Complex pole/zero angle of departure/entry**

The angle of departure of pairs of poles with multiplicity $r_{P\varrho}$ is

$$\varphi_{P\varrho,D} = \frac{1}{r_{P\varrho}} \left\{ -\sum_{\substack{\nu=1 \\ \nu\neq\varrho}}^{n} \varphi_{P_\nu} + \sum_{\mu=1}^{m} \varphi_{Z_\mu} \pm 360^\circ k \right\} \tag{3.24}$$

and the angle of entry of the pairs of zeros with multiplicity $r_{Z\varrho}$

$$\varphi_{Z\varrho,E} = \frac{1}{r_{Z\varrho}} \left\{ -\sum_{\substack{\mu=1 \\ \mu\neq\varrho}}^{m} \varphi_{Z_\mu} + \sum_{\nu=1}^{n} \varphi_{P_\nu} \pm 360^\circ k \right\} . \tag{3.25}$$

The root-locus method can also be applied for other cases than varying $k_0$. This is possible as long as $G_0(s)$ can be rewritten such that the angle condition according to Eq. (3.15) and the rules given above can be applied. This will be demonstrated in the following two examples.

**Q.2.** Given the closed-loop characteristic equation

$$a_0 + a_1 s + \ldots + a_{n-1} s^{n-1} + s^n = 0 ,$$

the root locus for varying the parameter $a_1$ is required. The characteristic equation is therefore rewritten as

$$1 + a_1 \frac{s}{a_0 + a_2 s^2 + \ldots + s^n} = 0 .$$

This form then correspondents to the standard form

$$1 + G_0(s) = 1 + a_1 \frac{N_0(s)}{D_0(s)} = 0$$

to which the rules can be applied. ■

Q.3.Given the closed-loop characteristic equation

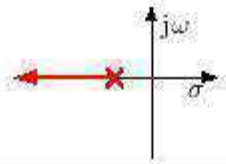
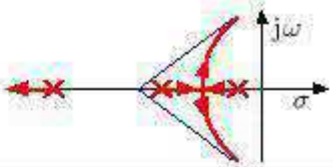
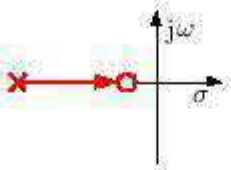
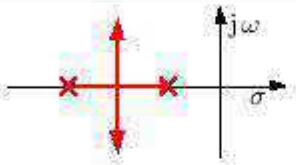
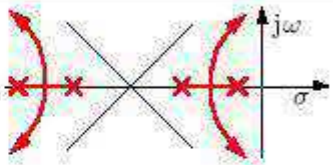
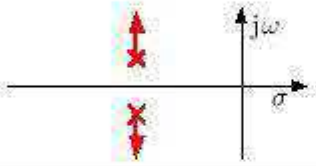
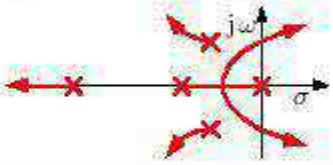
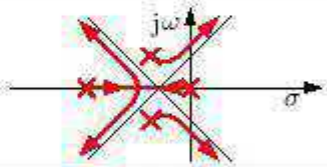
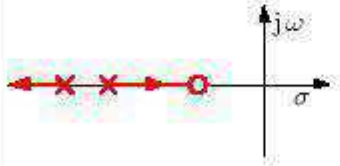
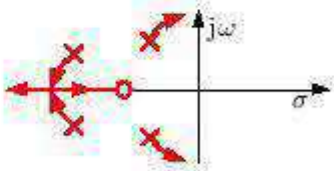
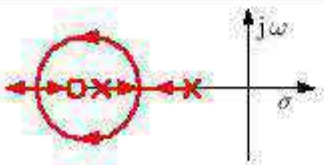
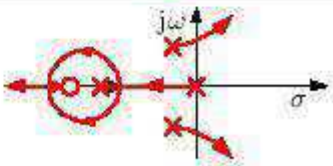
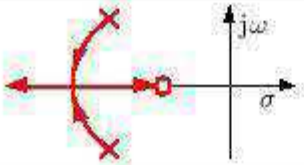
$$s^3 + (3 + \alpha) s^2 + 2s + 4 = 0 ,$$

it is required to find the effect of the parameter $a$ on the position of the closed-loop poles. The equation is rewritten into the desired form

$$1 + a\frac{s^2}{s^3 + 3s^2 + 2s + 4} = 0 .$$

Using the rules 1 to 10 one can easily predict the geometrical form of the root locus based on the distribution of the open-loop poles and zeros. Table 3.2 shows some typical distributions of open-loop poles and zeros and their root loci.

**Table 3.2:** Typical distributions of open-loop poles and zeros and the root loci

| No. | root locus | No. | root locus |
|---|---|---|---|
| 1 |  | 9 |  |
| 2 |  | 10 |  |
| 3 |  | 11 |  |
| 4 |  | 12 |  |
| 5 |  | 13 |  |
| 6 |  | 14 |  |
| 7 |  | 15 |  |
| 8 |  | 16 |  |

For the qualitative assessment of the root locus one can use a physical analogy. If all open-loop poles are substituted by a negative electrical charge and all zeros by a commensurate positive one and if a massless negative charged particle is put onto a point of the root locus, a movement is observed. The path that the particle takes because of the interplay between the repulsion of the poles and the attraction of the zeros lies just on the root locus. Comparing the root locus examples 3 and 9 of Table 3.2 the 'repulsive' effect of the additional pole can be clearly seen.

The systematic application of the rules from section 3.2 for the construction of a root locus is shown in the following non-trivial example for the open-loop transfer function

$$G_0(s) = \frac{k_0(s+1)}{s(s+2)(s^2+12s+40)} \tag{3.26}$$

The degree of the numerator polynomial is $m = 1$. This means that the transfer function has one zero ( $s_{Z_1} = -1$ ). The degree of the denominator polynomial is $n = 4$and we have the four poles ( $s_{P_1} = 0$ , $s_{P_2} = -2$ , $s_{P_3} = -6 + j2$ , $s_{P_4} = -6 - j2$ ). First the poles (x) and the zeros (o) of the open loop are drawn on the $s$plane as shown in Figure 3.5. According to rule 3 these poles are just

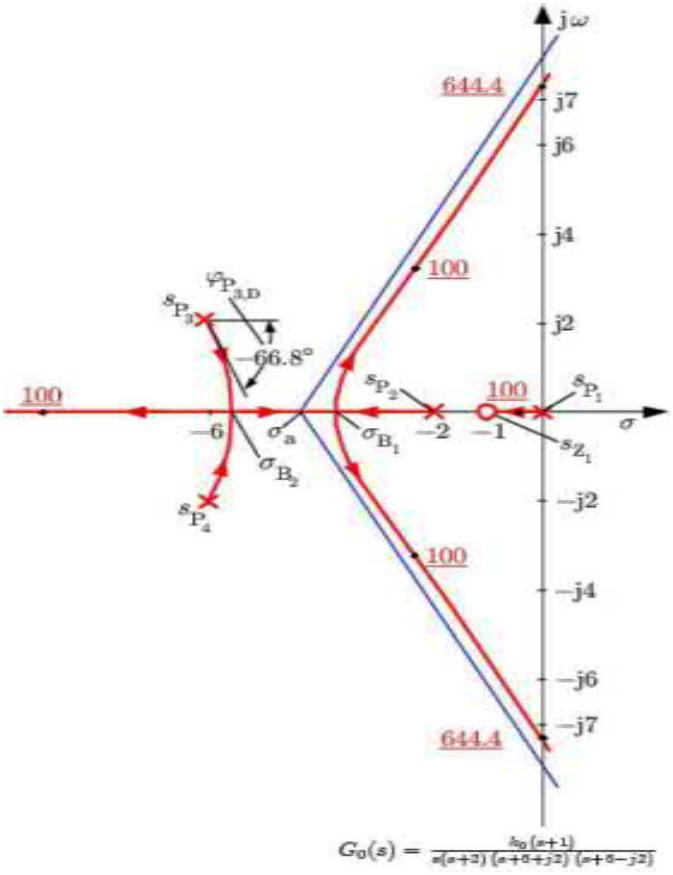


**Figure 3.5:** Root locus of . Values of are in red and underlined.

those points of the root locus where $k_0 = 0$ and the zeros where $k_0 \to \infty$. We have $(n-m) = 3$ branches that go to infinity and the asymptotes of these three branches are lines which intercept the real axis according to rule 6. From Eq. (3.17) the crossing is at

$$\sigma_s = \frac{(0-2-6-6)-(-1)}{3} = -\frac{13}{3} = -4.33 \tag{3.27}$$

and the slopes of the asymptotes are according to Eq. (3.16)

$$\alpha_k = \frac{\pm 180°(2k+1)}{3} = \pm 60°(2k+1) \quad k = 0, 1, 2, \ldots \tag{3.28}$$

i.e. $\alpha_0 = 60°, \quad \alpha_1 = +180°, \quad \alpha_2 = -60°$.

The asymptotes are shown in Figure 3.5 as blue lines. Using Rule 4 it can be checked which points on the real axis are points on the root locus. The points $\sigma$ with $-1 < \sigma < 0$ and $\sigma < -2$ belong to the root locus, because to the right of them the number of poles and zeros is odd. According to rule 7 breakaway and break-in points can only occur pairwise on the real axis to the left of -2. These points are real solutions of the Eq. (3.19). Here we have

$$\frac{1}{s} + \frac{1}{s+2} + \frac{1}{s+6-j2} + \frac{1}{s+6+j2} = \frac{1}{s+1} \tag{3.29}$$

or

$$3s^4 + 32s^3 + 106s^2 + 128s + 80 = 0.$$

This equation has the solutions $s_{B_1} = -3.68$, $s_{B_2} = -5.47$ and $s_{B_{3,4}} = -0.76 \pm j0.866$. The real roots $s_{B_1} = -3.68$ and $s_{B_2} = -5.47$ are the positions of the breakaway and the break-in point.

The angle of departure $\varphi_{P_3,D}$ of the root locus from the complex pole at $s_{P_3} = -6 + j2$ can be determined from Figure 3.6 according to Eq. (3.20):

$$\begin{aligned} \varphi_{P_3,D} &= -90° - 153.4° - 161.6° + 158.2° \pm 180°(2k+1) \\ &= -246.8° + 180° = -66.8°. \end{aligned} \tag{3.30}$$

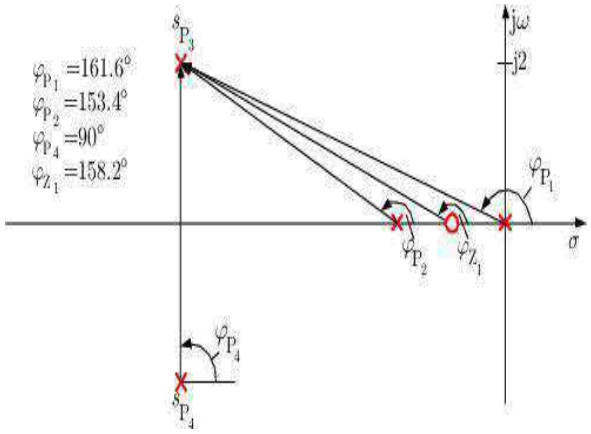



**Figure 5.6:** Calculating the angle of departure $\varphi_{P_3,D}$ of the complex pole $s_{P_3} = -6 + j2$

With this specifications the root locus can be sketched. Using rule 9 the value of $k_O$ can be determined for some selected points. The value at the intersection with the imaginary axis is

$$k_{O,crit} = \frac{7.2 \cdot 7.4 \cdot 7.9 \cdot 11.1}{7.25} = 644.4$$

**OUTCOMES:**

At the end of the module, the students are able to:

- Obtain the time response and steady-state error of the system.
- Knowledge about improvement of static and transient behaviour of a system.
- Determine stability of the various control systems by applying Routh's stability criterion.
- Construct root loci from open loop transfer functions of control systems and Analyze the behaviour of roots with system gain.
- Assess the stability of closed loop systems by means of the root location in s-plane and their effects on system performance.

**SELF-TEST QUESTIONS:**

1. Obtain an expression for time response of the first order system subject to step input.
2. Define
    1) Time response.
    2) Transient response.
    3) Steady state response.
    4) Steady state error.
3. Determine the stability of the system whose characteristic equation is given by $S^4+6S^3+23S^2+40S+50=0$, Using Routh's criterion.
4. Sketch the root locus for $G(S)H(S)=\frac{K}{S(S+2)(S+4)}$ show all details on it.
5. Sketch the root locus for $G(S)H(S)=\frac{10K}{S(S+2)(S+6)}$ show all details on it.
6. Sketch the root locus for $G(S)H(S)=\frac{K(S+1)}{S(S+2)(S+4)}$ show all details on it.

**LIST OF TEXT BOOKS:**

1. Modern control theory, Katsuhiko Ogata, Pearson Education International , Fifth edition.
2. "Control systems Principles and Design", M.Gopal, 3rd Edition, TMH, 2000.

## Reference Books:

1. Control engineering, Swarnakiran S, Sunstar publisher, 2018.
2. Control system engineering, Norman S Nise, John Wiley &Sons, Inc., Sixth edition
3. Modern control systems, Richard C. Dorf, Robert H Bishop, Pearson Education International, Twelfth edition.
4. Automatic control systems, Farid Golnaraghi, Benjamin C Kuo, John Wiley & Sons, Inc., Nineth edition

5. J.Nagrath and M.Gopal," Control System Engineering", New Age International Publishers, 5th Edition, 2007.
6. "Feedback control systems", Schaum's series, 2001.
7. System dynamics and control, Eronini-Umez, Thomas Asia Pte ltd., Singapore 2002.

# MODULE 4

## FREQUENCY DOMAIN ANALYSIS

## LESSON STRUCTURE

**4.1. Nyquist Stability criterion**
**4.2. Nyquist criterion using Nyquist plots**
**4.3. Simplified forms of the Nyquist criterion**
**4.4. The Nyquist criterion using Bode plots**
**4.5. Bode attenuation diagrams**
**4.6. Stability analysis using Bode plots**

## OBJECTIVES:

- To demonstrate Stability Determine Gain & Phase Margins Medium effort.
- To demonstrate applications of the frequency response to analysis of system stability (the Nyquist criterion), relating the frequency response to transient performance specifications.
- To demonstrate frequency response and to determine stability of control system applying using Bode plot.
- To demonstrate to plot graph of amplitude plot, usually in the log-log scale and a phase plot, which is usually a linear-log plot.

### 4.1. Nyquist Stability criterion

This graphical method, which was originally developed for the stability analysis of feedback amplifiers, is especially suitable for different control applications. With this method the closed-loop stability analysis is based on the locus of the open-loop frequency response $G_0(j\omega)$. Since only knowledge of the frequency response $G_0(j\omega)$ is necessary, it is a versatile practical approach for the following cases:

a) For many cases $G_0(j\omega)$ can be determined by series connection of elements whose parameters are known.

b) Frequency responses of the loop elements determined by experiments or $G_0(j\omega)$ can be considered directly.

c) Systems with dead time can be investigated.

d) Using the frequency response characteristic of $G_0(j\omega)$ not only the stability analysis, but also the design of stable control systems can be easily performed.

## Nyquist criterion using Nyquist plots

To derive this criterion one starts with the rational transfer function of the *open loop*

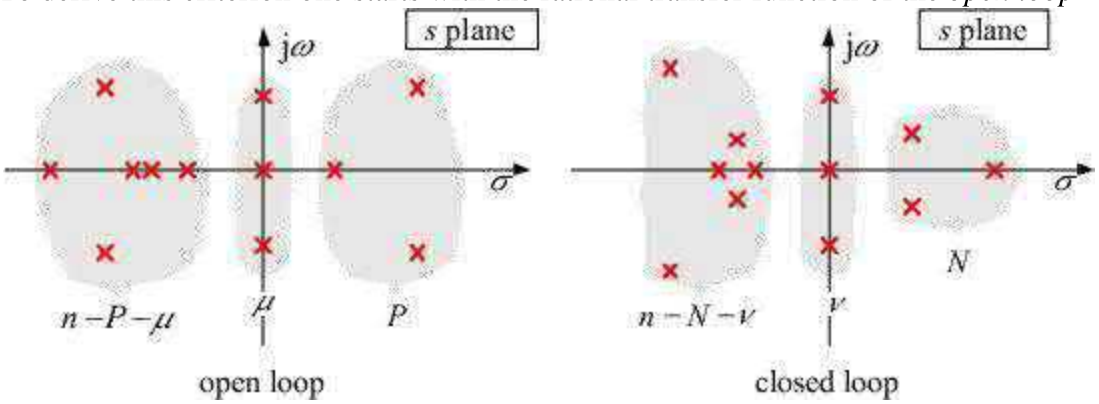



**Figure:** Poles of the open and closed loop in the $s$ plane (multiple poles are counted according to their multiplicity)

To determine $\Delta\varphi_S$, the locus $G'(j\omega) = 1 + G_0(j\omega)$ can be drawn on the Nyquist diagram and the phase angle checked. Expediently one moves this curve by 1 to the left in the $G_0(j\omega)$ plane. Thus for stability analysis of the closed loop the locus $G_0(j\omega)$ of the open loop according to Figure 5.5 has to be drawn.

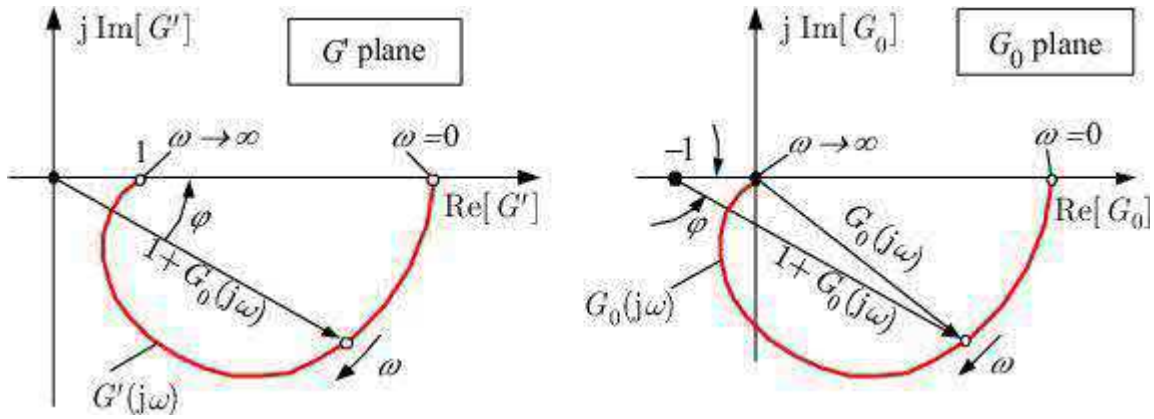



**Figure :** Nyquist diagrams of $G'(j\omega)$ and $G_0(j\omega)$

Here $\Delta\varphi_S$ is the continuous change in the angle of the vector from the so called *critical point* (-1,j0) to the moving point on the locus of $G_0(j\omega)$ for $0 \le \omega \le \infty$. Points where the locus passes through the point (-1,j0) or where it has points at infinity correspond to the zeros and poles of $G'(s)$ on the imaginary axis, respectively. These discontinuities are not taken into account for the derivation of . Figure shows an example of a $G_0(j\omega)$

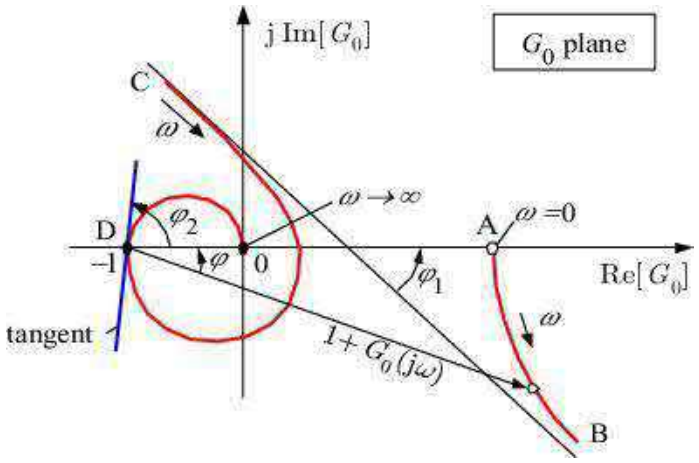



**Figure:** Determination of continuous changes in the angle $\Delta\varphi_S$

where two discontinuous changes of the angle occur. Thereby the continuous change of the angle consists of three parts

$$\Delta\varphi_S = \Delta\varphi_{AB} + \Delta\varphi_{CD} + \Delta\varphi_{DO}$$

$$= -\varphi_1 - (2\pi - \varphi_1 - \varphi_2) - \varphi_2 = -2\pi .$$

The rotation is counter clockwise positive.

As the closed loop is only asymptotically stable for $N = \nu = 0$, then from the *general case of the Nyquist criterion* follows:

The closed loop is asymptotically stable, if and only if the continuous change in the angle of the vector from the critical point (-1,j0) to the moving point of the locus $G_0(j\omega)$ of the open loop is

$$\Delta\varphi_S = (P + \mu/2)\pi .$$

For the case with a *negative* gain $K_0$ of the open loop the locus is rotated by 180° relative to the case with a positive $K_0$. The Nyquist criterion remains valid also in the case of a *dead time* in the open loop.

## 4.2. Simplified forms of the Nyquist criterion

It follows from that for an open-loop stable system, that is $P = 0$ and $\mu = 0$, then $\Delta\varphi_S = 0$. Therefore the Nyquist criterion can be reformulated as follows:

If the open loop is asymptotically stable, then the closed loop is only asymptotically stable, if the frequency response locus of the open loop does neither revolve around or pass through the critical point (-1,j0).

Another form of the simplified Nyquist criterion for $G_0(s)$ with poles at $s = 0$ is the so called 'left-hand rule':

The open loop has only poles in the left-half $s$ plane with the exception of a single or double pole at $s = 0$ (P, I or $I_2$ behaviour). In this case the closed loop is only stable, if the critical point (-1,j0) is on the *left* hand-side of the locus $G_0(j\omega)$ in the direction of increasing values of $\omega$.

This form of the Nyquist criterion is sufficient for most cases. The part of the locus that is significant is that closest to the critical point. For very complicated curves one should go back to the general case. The left-hand rule can be graphically derived from the generalised locus

The orthogonal ( $\sigma, \omega$ )-net is observed and asymptotic stability of the closed loop is given, if a curve with $\sigma < 0$ passes through the critical point (-1,j0). Such a curve is always on the left-hand side of $G_0(j\omega)$.

## 4.3. The Nyquist criterion using Bode plots

Because of the simplicity of the graphical construction of the frequency response characteristics of a given transfer function the application of the Nyquist criterion is often more simple using Bode plots. The continuous change of the angle $\Delta\varphi_S$ of the vector from the critical point (-1,j0) to the locus of $G_0(j\omega)$ must be expressed by the amplitude and phase response of $G_0(j\omega)$. From figure

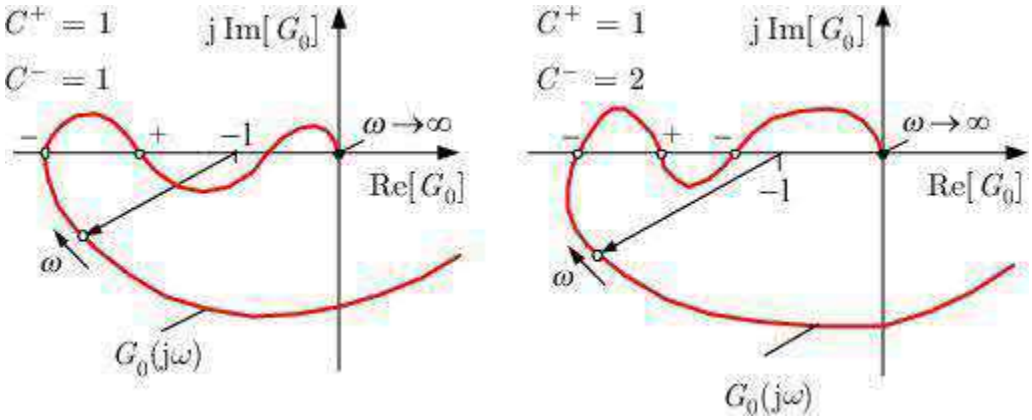



**Figure :** Positive (+) and negative (-) intersections of the locus $G_0(j\omega)$ with the real axis on the left-hand side of the critical point

it can be seen that this change of the angle is directly related to the count of intersections of the locus with the real axis on the left-hand side of the critical point between $(-\infty, -1)$. The Nyquist criterion can therefore also represented by the count of these intersections if the gain of the open loop is positive.

Regarding the intersections of the locus of $G_0(j\omega)$ with the real axis in the range $(-\infty, -1)$, the transfer from the upper to the lower half plane in the direction of increasing $\omega$ values are treated as *positive intersections* while the reverse transfer are *negative intersections* (Figure 5.7). The change of the angle is zero if the count of positive intersections $S^+$ is equal to the count of negative intersections $S^-$. The change of the angle $\Delta\varphi_S$ depends also on the number of positive and negative intersections and if the open loop does not have poles on the imaginary axis, the change of the angle is

$$\Delta\varphi_S = 2\pi(C^+ - C^-)$$

In the case of an open loop containing an integrator, i.e. a single pole in the origin of the complex plane ($\mu = 1$), the locus starts for $\omega = 0$ at $\delta - j\infty$, where an additional $+\pi/2$ is added to the change of the angle. For proportional and integral behaviour of the open loop

$$\Delta\varphi_S = 2\pi(C^+ - C^-) + \mu\pi/2 \qquad \mu = 0, 1$$

is valid. In principle this relation is also valid for $\mu = 2$, but the locus starts forat $\omega = 0$ $-\infty + j\delta$ (Figure 5.8), and this intersection would be counted

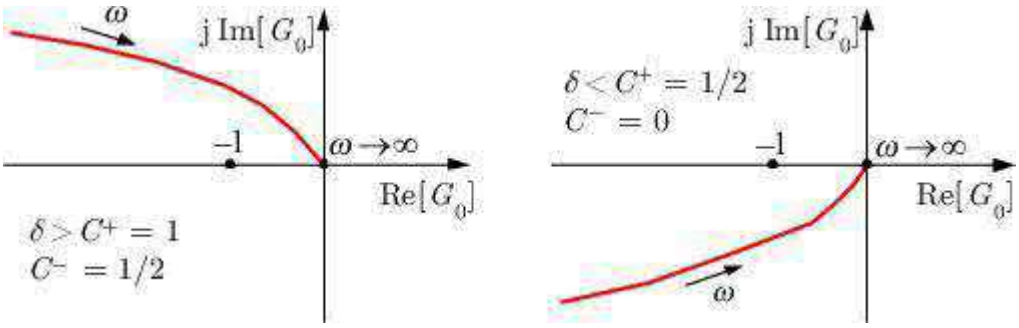



**Figure :** Count of the intersections on the left-hand side of the critical point for $I_2$ behaviour of the open loop

as a negative one if $\delta > 0$, i.e. if the locus for small $\omega$ is in the upper half plane of the real axis. But de facto there is for $\delta > 0$ (and accordingly $\delta < 0$) no intersection. This follows from the detailed investigation of the discontinuous change of the angle, which occurs at $\omega = 0$. As only a continuous change of the angle is taken into account and because of reason of symmetry the start of the locus at $\omega = 0$ is counted as a half intersection, positive for $\delta < 0$ and negative for $\delta > 0$, which is analogous to the definition given above For continuous changes of the angle

$$\Delta\varphi_S = 2\pi(C^+ - C^-) \qquad (\mu = 2)$$

The open loop with the transfer function $G_0(s)$ has $P$ poles in the left-half $s$ plane and possibly a single ($\mu = 1$) or double pole ($\mu = 2$) at $s = 0$. If the locus of $G_0(j\omega)$ has $C^+$ positive and $C^-$ negative intersections with the real axis to the left of the critical point, then the closed loop is only asymptotically stable, if

is valid. For the special case, that the open loop is stable ($P = 0$, $\mu = 0$), the number of positive and negative intersections must be equal.

From this it follows that the difference of the number of positive and negative intersections in the case of $\mu = 0,1$ is an integer and for $\mu = 2$ not an integer. From this follows immediately, that for $\mu = 0,1$ the number $P$ is even, for $\mu = 2$ the number $P+1$ is uneven and therefore in all cases $P$ is an even number, such that the closed loop is asymptotically stable. This is only valid if $D^* \geq 1$.

The Nyquist criterion can now be transferred directly into the representation using frequency response characteristics. The magnitude response $A_0(\omega)_{\mathrm{dB}}$, which corresponds to the locus $G_0(\mathrm{j}\omega)$, is always positive at the intersections of the locus with the real axis in the range of $(-\infty, -1)$. These points of intersection correspond to the crossings of the phase response $\varphi_0(\omega)$ with lines $\pm 180°$, $\pm 540°$ etc., i.e. a uneven multiple of 180°. In the case of a positive intersection of the locus, the phase response at the $\pm(2k+1)\,180°$ lines crosses from below to top and reverse from top to below on a negative intersection as shown in Figure 5.9. In the following these crossings

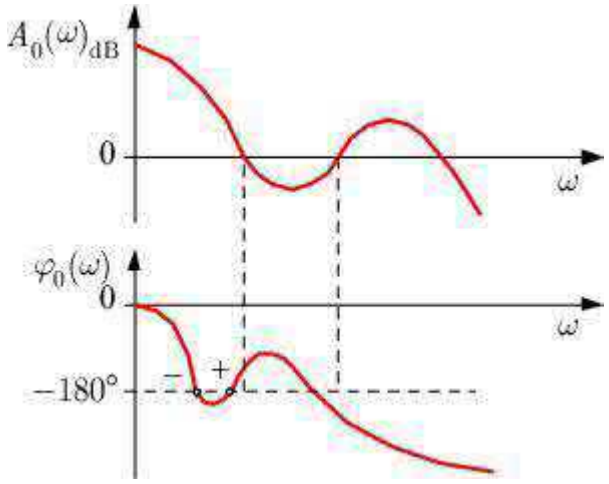



**Figure :** Frequency response characteristics of $G_0(\mathrm{j}\omega) = A_0(\omega)\,\mathrm{e}^{\mathrm{j}\varphi_0(\omega)}$ and definition of positive (+) and negative (-) crossings of the phase response $\varphi_0(\omega)$ with the -180° line

will be defined as positive (+) and negative (-) crossings of the phase response $\varphi_0(\omega)$ over the particular $\pm(2k+1)\,180°$ lines, where $k = 0, 1, 2, \ldots$ may be valid. If the phase response starts at -180° this point is counted as a half crossing with the corresponding sign. Based on the discussions above the Nyquist criterion can be formulated in a form suitable for frequency response

The open loop with the transfer function $G_0(s)$ has $P$ poles in the right-half $s$ plane, and possibly a single or double pole at $s = 0$. $C^+$ are the number of positive and $C^-$ of negative crossings of the phase response $\varphi_0(\omega)$ over the $\pm(2k+1)\,180°$ lines in the frequency range where $A_0(\omega)_{dB} > 0$ is valid. The closed loop is only asymptotically stable, if

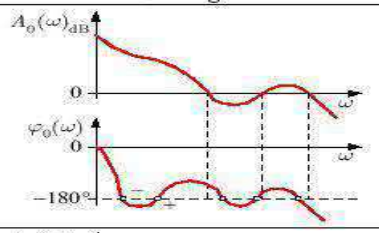
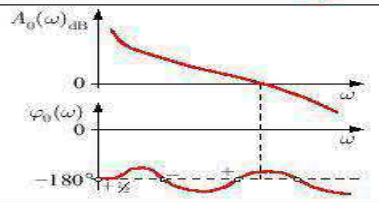
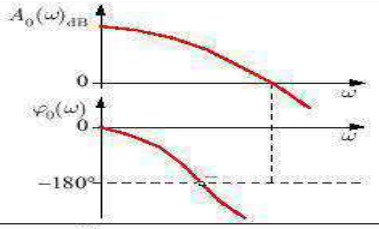
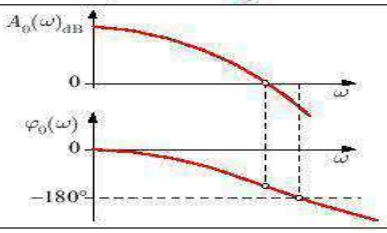
$$D^* = C^+ - C^- = \begin{cases} \frac{P}{2} & \text{for } \mu = 0,1 \\ \frac{P+1}{2} & \text{for } \mu = 2 \end{cases}$$

is valid. For the special case of an open-loop stable system ($P = 0$, $\mu = 0$)

$$D^* = C^+ - C^- = 0$$

must be valid.

**Table 7.1:** Examples of stability analysis using the Nyquist criterion with frequency response characteristics

| No. | Bode Diagram | Stability Analysis |
|---|---|---|
| 1 |  | $\Rightarrow \left.\begin{matrix} S^+ = 1 \\ S^- = 2 \\ D^* = -1 \\ P = 2 \end{matrix}\right\} \Rightarrow D^* \neq P/2$: unstable |
| 2 |  | $\Rightarrow \left.\begin{matrix} S^+ = 3/2 \\ S^- = 1 \\ D^* = 1/2 \\ P = 0 \end{matrix}\right\} \Rightarrow D^* = \frac{P+1}{2}$: stable if 2 poles in the origin |
| 3 |  | $\Rightarrow \left.\begin{matrix} S^+ = 0 \\ S^- = 1 \\ D^* = -1 \\ P = 0 \end{matrix}\right\} \Rightarrow D^* \neq P/2$: unstable |
| 4 |  | $\Rightarrow \left.\begin{matrix} S^+ = 0 \\ S^- = 0 \\ D^* = 0 \\ P = 0 \end{matrix}\right\} \Rightarrow D^* = P/2$: stable |

Finally the 'left-hand rule' will be given using Bode diagrams, because this version is for the most cases sufficient and simple to apply.

The open loop has only poles in the left-half $s$ plane with the exception of possibly one single or one multiple pole at $s = 0$ (P, I or $I_2$ behaviour). In this case the closed loop is only asymptotically stable, if $G_0(j\omega)$ has a phase of $\varphi_0 > -180°$ for the *crossover frequency* $\omega_C$ at $A_0(\omega_C)_{dB} = 0$.

This stability criterion offers the possibility of a practical assessment of the 'quality of stability' of a control loop. The larger the distance of the locus from the critical point the farther is the closed loop from the stability margin. As a measure of this distance the terms gain margin and phase margin are introduced according to Figure below

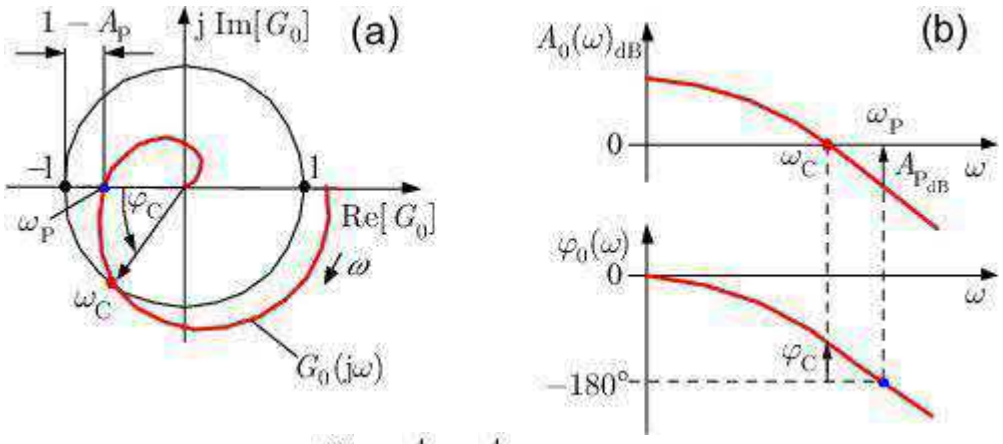



**Figure :** Phase and gain margin $\varphi_C$ and $A_P$ or $A_{P_{dB}}$, respectively, in the (a) Nyquist diagram and (b) Bode diagram

## 4.5. Bode attenuation diagrams

If the absolute value $A(\omega)$ and the phase $\varphi(\omega)$ of the frequency response $G(j\omega) = A(\omega)\, e^{j\varphi(\omega)}$

are separately plotted over the frequency $\omega$, one obtains the

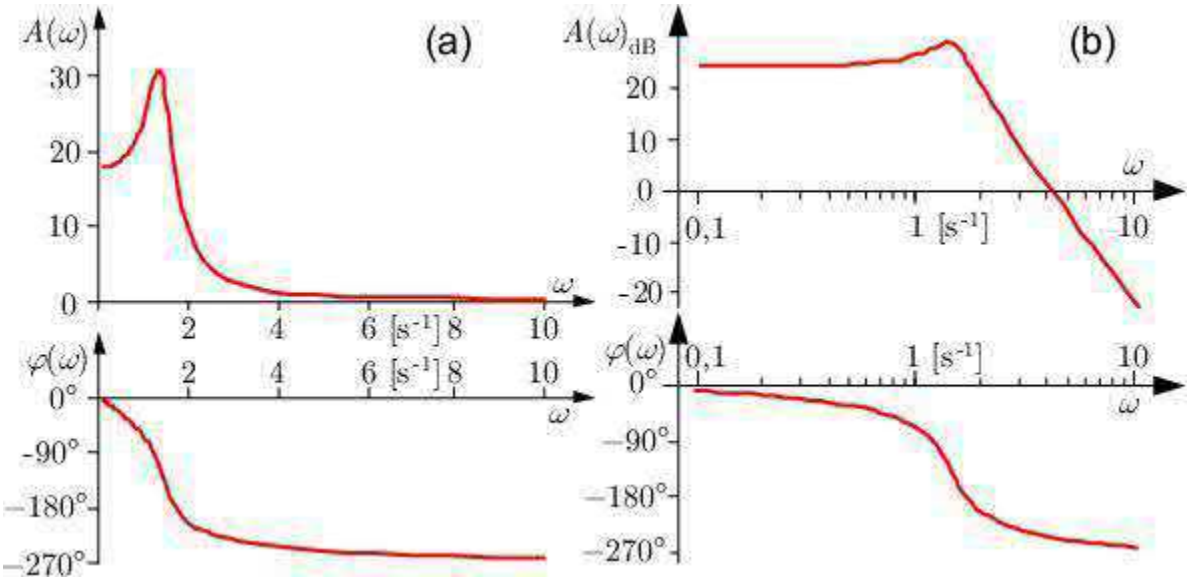



**Figure 6.1:** Plot of a frequency response: (a) linear, (b) logarithmic presentation ($\omega$ on a logarithmic scale) (Bode plot)

*amplitude response* and the *phase response*. Both together are the *frequency response characteristics*. $A(\omega)$ and $\omega$ are normally drawn with a logarithm and $\varphi(\omega)$ with a linear scale.

This representation is called a *Bode diagram* or *Bode plot*. Usually $A(\omega)$ will be specified in decibels [dB] By definition this is

$$A(\omega)_{dB} = 20 \log_{10} A(\omega) \quad [dB]$$

The logarithmic representation of the amplitude response $A(\omega)_{dB}$ has consequently a linear scale in this diagram and is called the *magnitude*.

## 4.6. Stability analysis using Bode plots:

- The magnitude and phase relationship between sinusoidal input and steady state output of a system is known as frequency response.
- The polar plot of a sinusoidal transfer function G (jw) is plot of the magnitude of G (jw) versus the phase angle of G (jw) on polar coordinates as _co‘ varied from zero to infinity.
- The phase margin is that amount, of additional phase lag at the gain crossover frequency required to bring the system to the verge of instability.
- The gain margin is the reciprocal of the magnitude l G(jw) l at the frequency at which the phase angle as _1800.
- The inverse polar plot at G (jw) is a graph of 1/G (jw) as a function of w.
- Bode plot is a graphical representation of the transfer function for determining the

- Bode plot is a combination of two plot - magnitude plot and phase plot
- The transfer function having no poles and zeros in the right -half s-plane are called minimum phase transfer function.
- System with minimum phase transfer function are called minimum phase systems.
- The transfer function having poles and zeros in the right half s-plane are called non-minimum phase transfer functions systems with non-minimum phase transfer function. are called non-minimum phase system.
- In bode plot the relative stability of the system is determined from the gain margin and phase margin. .
- If gain cross frequency is less than phase cross over frequency then gain margin and phase margin both are positive and system is stable.
- If gain cross over frequency is greater than the phase crossover frequency than both gain margin and‘phase margin are negative.
- It gain cross over frequency is equal to me phase cross over trequency me gain marg and phase margin are zero and system is marginally stable.
- The maximum value of magnitude is known as resonant peak.
- The magnitude of resonant peak gives the information about the relative stability of the system.
- The frequency at which magnitude has maximum value is known as resonant frequency.
- Bandwidth is defined a the range of frequencies in which the magnitude of closed loop does not drop —3 db.

## OUTCOMES:

At the end of the module, the students are able to:

- To Determine Gain & Phase Margins effect.
- Applications of the frequency response to analysis of system stability (the Nyquist criterion), relating the frequency response to transient performance specifications.
- Determine stability of control system applying Nyquist stability criterion and using Bode plot.
- Plot a graph of amplitude plot, usually in the log-log scale and a phase plot, which is usually a linear-log plot.

## SELF-TEST QUESTIONS:

1. Apply Nyquist stability criterion for the system with transfer function

   $$G(S)H(S)=\frac{K}{S(S+2)(S+4)}$$ find the stability.

2. The open loop transfer function of a system is given by $$G(S)H(S) = \frac{10(S+10)}{S(S+2)(S+5)}$$.

   Draw Bode diagram, Find Gain cross over frequency (GCF), Phase cross over frequency (PCF), Gain margin (GM), Phase margin (PM). Find stability of the system.

3. The open loop transfer function of a system is given by

   $$G(S)H(S) = \frac{50K}{S(S+10)(S+6)(S+1)}$$

   Draw Bode diagram, Find Gain cross over frequency (GCF), Phase cross over frequency (PCF), Gain margin (GM), Phase margin (PM). Find the value of **K** to have GM=10 decibels.

### LIST OF TEXT BOOKS:


1. Modern control theory, Katsuhiko Ogata, Pearson Education International , Fifth edition.
2. "Control systems Principles and Design", M.Gopal, 3rd Edition, TMH, 2000.


## Reference Books:


1. Control engineering, Swarnakiran S, Sunstar publisher, 2018.
2. Control system engineering, Norman S Nise, John Wiley &Sons, Inc., Sixth edition
3. Modern control systems, Richard C. Dorf, Robert H Bishop, Pearson Education International, Twelfth edition.
4. Automatic control systems, Farid Golnaraghi, Benjamin C Kuo, John Wiley & Sons,

5. J.Nagrath and M.Gopal," Control System Engineering", New Age International Publishers, 5th Edition, 2007.
6. "Feedback control systems", Schaum's series, 2001.
7. System dynamics and control, Eronini-Umez, Thomas Asia Pte ltd., Singapore 2002.

**MODULE 5**

# SYSTEM COMPENSATION AND STATE VARIABLE CHARACTERISTICS OF LINEAR SYSTEMS

**LESSON STRUCTURE:**


**5.1. Introduction:**
**5.2. System Compensation**
**5.3. Basic Characteristics of Lead, Lag and Lag-Lead Compensation:**
**5.4. Lag Compensator**
**5.5. Lead Compensator**
**5.6. Lag-Lead Compensator**
**5.7. Introduction to state concepts:**
**5.8. Matrix representation of state equations**
**5.9. State controllability**
**5.9.1. Kalman test for state controllability**
**5.9.2. Gilbert's test for state controllability**


**OBJECTIVES:**

- In order to obtain the desired performance of the system, we use compensating networks. Compensating networks are applied to the system in the form of feed forward path gain adjustment.
- To demonstrate to compensate a unstable system to make it stable.
- To demonstrate State controllability.

## 5.1. Introduction:

Automatic control systems have played a vital role in the advancement of science and engineering. In addition to its extreme importance in sophisticated systems in Space vehicles, missile- guidance, aircraft navigating systems, etc., automatic control system as become an important and integral part of manufacturing and industrial processes. Control of process parameters like pressure, temperature, flow, viscosity, speed, humidity, etc., in process engineering and tooling, handling and assembling mechanical parts in manufacturing industries among others in engineering field where automatic control systems are inevitable part of the system.

A control system is designed and constructed to perform specific functional task. The concept of control system design starts by defining the output variable( Speed, Pressure, Temperature Etc.,) and then determining the required specification ( Stability, Accuracy, and speed of response). In the design process the designs must first select the control Media and then the control elements to meet the designed ends.

In actual practice several alternative can be analyzed and a final judgment can be made an overall performances and economy.

Systems have been categorized as manual and automatic systems. Based on the type of control needed most systems are categorized as - Manual & Automatic. In applications where systems are to be operated with limited or no supervision, then systems are made automatic and where system needs supervision the system is designed as manual. In the present-day context most of the systems are designed as automatic systems for which one of the important considerations was economics. However, the necessity for the system to be made as an automatic system is to make sure that the system performs with no scope for error which otherwise is prone to a lot of errors especially in the operations. Other classification of a system is based on the input and output relationships. Accordingly, in an Open Loop Control System the output is independent of the input and in a closed loop control system the output is dependant on the input. The term input refers to reference variable and the output is referred to as Controlled variable. Most of the systems are designed as closed loop systems where a feedback path with an element with a transfer function would help in bridging the relationship between the input and the output.

A system can be represented by the block diagram and from a s imple to a complicated system, reduction techniques can be used to obtain the overall transfer function of the system. Overall system Transfer function can also be obtained by another technique using signal flow analysis where the transfer function of the system is obtained from Mason‟s gain formula. Once the system is designed, the response of the system may be obtained based on the type of input. This is studied in two categories of response namely response of the systemic time domain and frequency domain. The system thus conceived and designed needs to be analyzed based on the same domains. At this stage the systems are studied from the point of view of its operational features like Stability, Accuracy and Speed of Response. Development of various systems have been continuous and the history of the same go back to the old WATT‟S

Speed Governor, which was considered as an effective means of speed regulation. Other control system examples are robot arm, Missile Launching and Guidance System, Automatic Aircr aft Landing System, Satellite based digital tracking systems,etc to name a few. In the design of the control systems, three important requirements are considered namely STABILITY, ACCURACY and SPEED OF RESPONSE.

Stable Systems are those where response to input must reach and maintain some useful value with in a reasonable period of time. The designed systems should both be Unstable Systems as unstable control systems produce persistent or even violent oscillations of the output and output will be driven to some extreme limiting value.

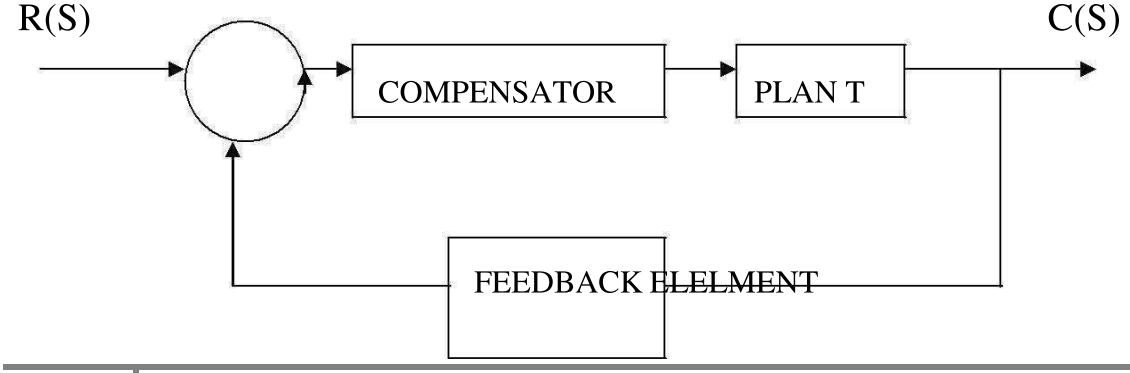
Systems are also designed to meet certain levels of **Accuracy. This is a** relative term with limits based upon a particular application. A time measurement system may be from a simple watch to a complicated system used in the sports arena. But the levels of accuracy are different in both cases. One used in sports arena must have very high levels of sophistication and must be reliable showing no signs of variations. However, this feature of the system is purely based on the system requirement. For a conceived, designed and developed system, the higher the levels of Accuracy expected, higher is the Cost.

The third important requirement comes by way of SPEED OF RESPONSE. System must complete its response to some input within an acceptable period of time. System has no value if the time required to respond fully to some input is far greater than the time interval between inputs

## 5.2. System Compensation

Compensation is the minor adjustment of a system in order to satisfy the given specifications. Specification refers to the objective of a system to perform and obtain the expected output after the system is provided with a proper input. Some of the needs o f the system compensation are as specified.

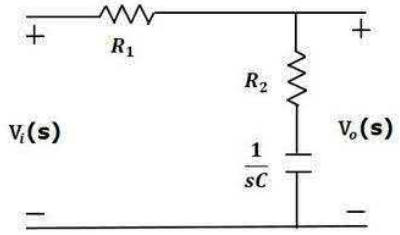
## 5.3. Basic Characteristics Of Lead, Lag And Lag-Lead Compensation:



Lead compensation essentially yields an appropriate improvement in transient resonse and a small imrovement in steady state accuracy. Lag compensation on the other hand, yields an appreciable improvement in steady state accuracy ast the expense of increasing theh transient responsetime. Lag- lead compensation combines the characterisitcs of both lead compensation and lag compensation. The use of a lag- lead compensator raises the order of the system by two (unless cancellation occurs between the zeroes of the lag- lead network and the poles of the uncompensated open- loop transfer function), which means that the system becomes more complex and it is more difficult to control the transient response behavior. The particular situation determines the type of the compensation to be used.

## 5.4. Lag Compensator

The Lag Compensator is an electrical network which produces a sinusoidal output having the phase lag when a sinusoidal input is applied. The lag compensator circuit in the 's' domain is shown in the following figure.




Here, the capacitor is in series with the resistor $R_2$ and the output is measured across this combination.

The transfer function of this lag compensator is –

$$\frac{V_o(s)}{V_i(s)} = \frac{1}{\alpha}\left(\frac{s+\frac{1}{\tau}}{s+\frac{1}{\alpha\tau}}\right)$$

Where,

$$\tau = R_2C$$

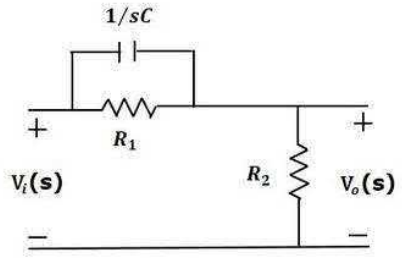
$$\alpha = \frac{R_1+R_2}{R_2}$$

From the above equation, $\alpha$ is always greater than one. We know that, the phase of the output sinusoidal signal is equal to the sum of the phase angles of input sinusoidal signal and the

transfer function. So, in order to produce the phase lag at the output of this compensator, the phase angle of the transfer function should be negative. This will happen when $\alpha>1$.

## 5.5. Lead Compensator

The lead compensator is an electrical network which produces a sinusoidal output having phase lead when a sinusoidal input is applied. The lead compensator circuit in the 's' domain is shown in the following figure.




Here, the capacitor is parallel to the resistor $R1$and the output is measured across resistor $R_2. The transfer function of this lead compensator is –

$$\frac{V_o(s)}{V_i(s)} = \beta\left(\frac{s\tau+1}{\beta s\tau+1}\right)$$

Where,

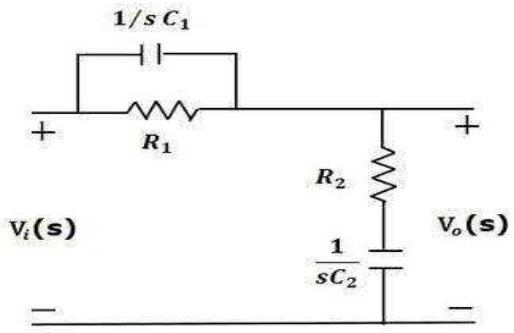
$$\tau = R_1C$$

$$\beta = \frac{R_2}{R_1+R_2}$$

We know that, the phase of the output sinusoidal signal is equal to the sum of the phase angles of input sinusoidal signal and the transfer function. nSo, in order to produce the phase lead at the output of this compensator, the phase angle of the transfer function should be positive. This will happen when $0<\beta<1$. Therefore, zero will be nearer to origin in pole-zero configuration of the lead compensator.

## 5.6. Lag-Lead Compensator

Lag-Lead compensator is an electrical network which produces phase lag at one frequency region and phase lead at other frequency region. It is a combination of both the lag and the lead compensators. The lag-lead compensator circuit in the 's' domain is shown in the following figure.




This circuit looks like both the compensators are cascaded. So, the transfer function of this circuit will be the product of transfer functions of the lead and the lag compensators.

$$\frac{V_o(s)}{V_i(s)} = \beta\left(\frac{s\tau_1+1}{\beta s\tau_1+1}\right)\frac{1}{\alpha}\left(\frac{s+\frac{1}{\tau_2}}{s+\frac{1}{\alpha\tau_2}}\right)$$

We know $\alpha\beta = 1$.

$$\Rightarrow \frac{V_o(s)}{V_i(s)} = \left(\frac{s+\frac{1}{\tau_1}}{s+\frac{1}{\beta\tau_1}}\right)\left(\frac{s+\frac{1}{\tau_2}}{s+\frac{1}{\alpha\tau_2}}\right)$$

Where,

$$\tau_1 = R_1C_1$$

$$\tau_2 = R_2C_2$$

## 5.7. Introduction to state concepts:

As we know from previous chapters evaluation of control system can be broadly classified as Classical method and Modern methods. For Simple Input Output (SIO) systems classical method can be easily adopted and can be analysed by developing mathematical models. But for Multiple Input Multiple Output (MIMO) systems classical methods was quite difficult to analyse and it was time consuming since classical method analysis one loop at a time. Hence Modern method came into existence where the system under consideration can be analysed in time domain format. Modern methods which involves direct time domain analysis and also provides a basis for system optimization is known as state variable approach. State variable models are basically time domain models which involve the analysis and study of linear and nonliner, time invariant or time varying multi input multi output control system.

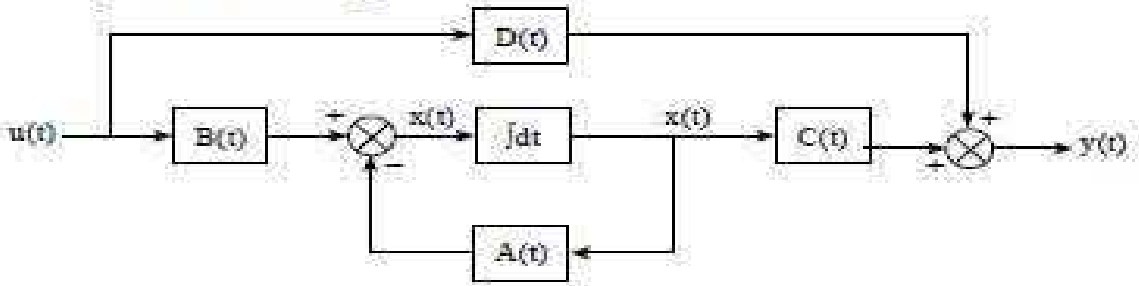
Some of the advantages of state variables analysis are

a. It can be applied to non linear system
b. It can be applied to time invariant system

c. It can be applied to multiple input multiple output system
d. It gives the idea about the internal state of the system.

## 5.8. Matrix representation of state equations

Let us consider block diagram representing the state model for a linear, continuous time control system as shown in figure.




Thus the derivative of each state variable can be expressed in terms of linear combination of system states and input as

$$\dot{x}_1 = a_{11}x_1 + a_{12}x_2 + \ldots + a_{1n}x_n + b_{11}u_1 + b_{12}u_2 + \ldots + b_{1m}u_m$$
$$\dot{x}_2 = a_{21}x_1 + a_{22}x_2 + \ldots + a_{2n}x_n + b_{21}u_1 + b_{22}u_2 + \ldots + b_{2m}u_m \quad \Big\} \rightarrow (1)$$
$$\vdots$$
$$\dot{x}_n = a_{n1}x_1 + a_{n2}x_2 + \ldots + a_{nn}x_n + b_{n1}u_1 + b_{n2}u_2 + \ldots + b_{nm}u_m$$

where the coefficient $a_{ij}$ and $b_{ij}$ are constants. Thus the above set of equations can be represented in matrix form as below.

$$\begin{bmatrix} \dot{x}_1 \\ \dot{x}_2 \\ \vdots \\ \dot{x}_n \end{bmatrix} = \begin{bmatrix} a_{11} & a_{12} & \ldots & a_{1n} \\ a_{21} & a_{22} & \ldots & a_{2n} \\ \ldots & & & \\ a_{n1} & a_{n2} & \ldots & a_{nn} \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \\ \vdots \\ x_n \end{bmatrix} + \begin{bmatrix} b_{11} & b_{12} & \ldots & b_{1m} \\ b_{21} & b_{22} & \ldots & b_{2m} \\ \ldots & & & \\ b_n1 & b_{n2} & \ldots & b_nm \end{bmatrix} \begin{bmatrix} u_1 \\ u_2 \\ \vdots \\ u_m \end{bmatrix} \quad \ldots(2)$$

The above equation can be reduced in matrix from known as "state equation"

$$\boxed{\dot{X}(t) = AX(t) + BU(t)} \rightarrow (3)$$

where
$\dot{X}(t)$ = Derivanuve of state vector of order (n x 1)
$X(t)$ = State vector matrix of order (n x 1)
$U(t)$ = Input vector matrix of order (m x 1)
$A$ = System matrix or evolution matrix of order n x n
$B$ = Input matrix or control matrix of order (n x m)

Similarly the output variables can be expressed as linear combinations of the state variables and input variables at time 't' can be expressed as

$$\left.\begin{aligned} Y_1(t) &= C_{11}x_1(t) + C_{12}x_2(t) + .. + C_{1n}x_n(t) + d_{11}U_1(t) + d_{12}U_2(t) + ... d_{1m}U_m(t) \\ &\cdot \\ &\cdot \\ y_p(t) &= C_{p1}x_1(t) + c_{p2}x_2(t) + ... C_{pn}x_n(t) + d_{p1}U_1(t) + d_{p2}U_2(t) + ... + d_{pm}U_m(t) ...(a) \end{aligned}\right\} ....(4)$$

where the coefficients $C_{ij}$ and $d_{ij}$ are constants. Thus the above equation can be expressed in matrix form as follows,

$$\begin{bmatrix} y_1 \\ y_2 \\ . \\ y_p \end{bmatrix} = \begin{bmatrix} c_{11} & c_{12} & .... & c_{1n} \\ c_{21} & c_{22} & .... & c_{2n} \\ ... & & & \\ c_{p1} & c_{p2} & .... & c_{pn} \end{bmatrix} \begin{bmatrix} x_1(t) \\ x_2(t) \\ . \\ . \\ x_n(t) \end{bmatrix} + \begin{bmatrix} d_{11} & d_{12} & .... & d_{1m} \\ d_{21} & d_{22} & .... & d_{2m} \\ ... & & & \\ d_{p1} & d_{p2} & .... & d_{pm} \end{bmatrix} \begin{bmatrix} u_1(t) \\ u_2(t) \\ . \\ . \\ u_m(t) \end{bmatrix} \quad ...(5)$$

The above equation can be reduced in matrix from known as output equation

$$\boxed{Y(t) = CX(t) + Du(t)} \quad ...(6)$$

where,

$Y(t)$ = Output vector matrix of order (p x 1)

C = Output matrix of order (p x n)

D = Transmission matrix of order (p x n)

## 5.9. State controllability:

In control system analysis, we must be clear with the two conditions for deciding output of a system does the solution of the control system exists at not. They are

1. Is it possible to transfer the system under consideration from any initial state to desired state by the application of suitable control force with the specified time?

2. Is it possible to determine the initial stats of the system if the output vector is known for a finite length of time.

The answer for these questions can be justified by using state controllability and observability. Hence, controllability can be defined as,

The system is said to be completely controllable if it is possible to transfer the system state from any initial state x(t0) to any other desired state x(tf) in a specified finite time interval ($t0 \leq t \leq tp$) by unconstrained control vector U(T).

Otherwise the system is not completely state controllable.

Consider a multiple input linear time invariant system represented by its state equations as

$$\mathbf{x(t) = AX(t) + BU(t)}$$

where, A is (n x n) order state matrix

B is (n x m) order input matrix

U(t) is (mx1) input vector

X(t) is (n x 1) state vector

The state controllability tests can be performed by two methods, they are

**1. Kalman's test for controllability :** This method is applicable for any matrix A either matrix A is canonical form or otherwise.

**2. Gilberth's test for controllability :** This method is based on converting the matrix A into the diagonal canonical form and later it is used to determine the state controllability of the system.

### 5.9.1. Kalman test for state controllability

If the nth order multiple input linear time invariant system represented by state equation as

$$\mathbf{X = AX(t) + BU(t)}$$

where A is (n x n) order matrix then controllability matrix (Qc) of the size n (n x m) can be given as

$$\mathbf{QC = [B\ AB\ A2B\ A3B\ .....\ An\text{-}1\ B]}$$

The system is said to be controllable if the rank of the controllability matrix (Qc) is 'n' then the determined of order (n x n) of any sub matrix of Qc has non zero value. Also if the rank of the controllability matrix (Qc) is less than (n), then the system is not completely state controllable.

## 5.9.2. Gilbert's test for state controllability

Consider a state model of linear time invariant system

$$\dot{X}(t) = AX(t) + BU(t)$$

$$Y(t) = CX(t) + DU(t)$$

where: A, B, C, D state space model

**Case 1 :** If matrix A is an diagonal canonical form, then the transformation matrix is the identity matrix (T = I) also then, If ($A_t$ = A, $B_t$ . B, $C_t$ = C, $d_t$ = d).Gilbert controllability can be stated as the system with distinct eigen values is completely state controllable if and only if no zero eleemnt is presented in the transpose B matrix i.e.,

$$B_t = T^{-1} B \qquad ...(1)$$

**Case 2 :** If matrix A is a not in diagonal canonical form following steps are followed.

**Step 1 :** Find eigen value of matrix A

i.e., $|\lambda I - A| = 0$

where I = Identity matrix

**Step 2 :** Find the transformation matrix

Develop vander mode matrix of A which will be used as transformation matrix.

$$T = V = \begin{bmatrix} 1 & 1 & 1 & .... & 1 \\ \lambda_1 & \lambda_2 & \lambda_3 & .... & \lambda_n \\ \lambda_1^2 & \lambda_2^2 & \lambda_3^2 & ... & \lambda_n^2 \\ .. & .. & ... & & .. \\ \lambda_1^{n-1} & \lambda_2^{n-1} & \lambda_3^{n-1} & ... & \lambda_n^{n-1} \end{bmatrix}$$ known as vander monde matrix.

**Step 3 :** Find the transformed matrix ($A_t$, $B_t$ , $C_t$ , $D_t$) of the diagonal canonical form as below,

$A_t = T^{-1} AT$ => Diagonal matrix

$B_t = T^{-1} B$

$C_t$ CT

$D_t = D$

**Step 4 :** If no row of $\boxed{B_t = T^{-1}B}$ has zero elements, the system is completely state controllable.

**OUTCOMES:**

At the end of the module, the students are able to:

- obtain the desired performance of the system, we use compensating networks. Compensating networks are applied to the system in the form of feed forward path gain adjustment.
- Differentiate different types of compensators.
- Concepts of state controllability.

**SELF-TEST QUESTIONS:**

1. Define compensators. What is the need of compensators in a system.
2. Explain with a sketch Lag compensator.
3. Explain with a sketch Lead compensator.
4. Explain with a sketch Lag-Lead compensator.
5. Explain basic components of Lag - Lead compensator.
6. Obtain State model for the equation $\dddot{y} + 3\ddot{y} + 2\dot{y} + y = r(t)$.
7. Obtain State model for the equation $\dddot{y} + 6\ddot{y} + 12\dot{y} + 8y = 3U(t)$.
8. Find the controllability of linear dynamic time invariant system by Kalman's controllability test.

$$\dot{X} = \begin{bmatrix} -2 & 1 \\ 1 & -2 \end{bmatrix} X + \begin{bmatrix} 1 \\ 0 \end{bmatrix} U.$$

9. Find the controllability of linear dynamic time invariant system by Gilberth controllability test.

$$\dot{X} = \begin{bmatrix} 1 & 1 \\ 0 & -1 \end{bmatrix} X + \begin{bmatrix} 1 \\ 0 \end{bmatrix} U$$

**LIST OF TEXT BOOKS:**

1. Modern control theory, Katsuhiko Ogata, Pearson Education International , Fifth edition.
2. "Control systems Principles and Design", M.Gopal, 3rd Edition, TMH, 2000.

## Reference Books:

1. Control engineering, Swarnakiran S, Sunstar publisher, 2018.
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5. J.Nagrath and M.Gopal," Control System Engineering", New Age International Publishers, 5th Edition, 2007.
6. "Feedback control systems", Schaum's series, 2001.
7. System dynamics and control, Eronini-Umez, Thomas Asia Pte ltd., Singapore 2002.

# ATTENDANCE

ATME College of Engineering

Course Title with Code : Elements of Mechanical Engg

Semester & Section : I & B

| Sl. No. | USN | Student Name | Date | 01 | 02 | 04 | 06 | 08 | 11 | 13 | 15 | 16 | 18 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Month | ← On Line Classes → | | | | | | | | | |
| | | | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| 1 | 4MD20EC001 | ABHISHEK M. | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| 2 | EE003 | AKILESH P | | A | A | A | A | A | A | A | A | A | A |
| 3 | EC006 | ARUNACHALAM G. | | A | A | | A | | | | | | A |
| 4 | EC007 | AZRA AKIL | | A | 1 | 2 | 3 | 4 | A | 5 | 6 | 7 | 8 |
| 5 | EC009 | BHARGAV BHARADWAJ M | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | A | 9 |
| 6 | 20CV008 | CHANDAN K.S. | | A | A | A | A | 1 | 2 | 3 | 4 | 5 | 6 |
| 7 | CV011 | DARSHAN. P. | | A | 1 | A | 2 | 3 | 4 | A | 5 | A | 6 |
| 8 | CV012 | DEEKSHITHA H.V. | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| 9 | EC019 | DIVYASHREE N | | A | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
| 10 | EC021 | HARSHA M.S. | | 1 | 2 | 3 | A | 5 | 6 | 7 | 8 | 9 | 10 |
| 11 | CV014 | KARTHIK. J | | A | A | A | A | A | A | 1 | 2 | 3 | 4 |
| 12 | EE009 | KARTHIK R | | A | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
| 13 | EC023 | KARTHIK M | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| 14 | EC025 | KAVANA K. | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| 15 | EC030 | KIRAN KUMAR K | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| 16 | EC032 | KUSUMA M | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| 17 | EC035 | LIKHITHA V | | A | A | 1 | A | A | A | 2 | 3 | A | A |
| 18 | EC036 | MANOJ N | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| 19 | EE011 | MANU R | | A | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
| 20 | EE012 | NIKHIL KASHYAP M.S. | | 1 | 2 | 3 | A | 5 | 6 | 7 | 8 | 9 | 10 |
| 21 | EC047 | NISHANTH K.N. | | A | 1 | 2 | A | 3 | 4 | 5 | 6 | 7 | 8 |
| 22 | EC048 | NISHCHITHA D GOWDA | | A | A | A | A | A | 1 | 2 | 3 | A | 5 |
| 23 | EC049 | NITHISH K.U. | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | A | 9 |
| 24 | EC050 | NOORALESH C B | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| 25 | EE013 | OMKAR B.N. | | A | 1 | 2 | 3 | 4 | A | 5 | 6 | 7 | 8 |
| | | No. of Abs. | | | | | | | | | | | |
| | | Initials | | | | | | | | | | | |



15 ME 15

A T M E

College of Engineering

# ATTENDANCE

Semester & Section: I I P.

| Sl No. | USN | Student Name | Date / Month |
|---|---|---|---|
| 1 | [illegible] | [illegible] | |
| 2 | [illegible] | [illegible] | |
| 3 | [illegible] | [illegible] | |
| 4 | [illegible] | [illegible] | |
| 5 | [illegible] | [illegible] | |
| 6 | [illegible] | [illegible] | |
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| 11 | [illegible] | [illegible] | |
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| | Initials | | |

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# ATTENDANCE

ATME College of Engineering

Course Title with Code : Elements of Mechanical Engg

Semester & Section : 1 E B

| Sl No. | USN | Student Name | Date / Month (Continued) | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| 26 | EC051 | PAVAN K.S | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| 27 | CU023 | PAVAN M.J | A | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
| 28 | EC053 | PRAJWAL B | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| 29 | EC059 | RUCHITHA K.R | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | A |
| 30 | EC061 | SANJANA MANOHAR N | A | A | A | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 31 | EC016 | ANDARKHALD K.S | A | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
| 32 | EC066 | SOHAN SANJAY KORE | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| 33 | CU024 | SAIKANT SABAR | A | 1 | 2 | 3 | A | 4 | A | A | 5 | A |
| 34 | CU025 | SRINIVASA J.R | 1 | 2 | 3 | 4 | 5 | 6 | A | 7 | 8 | 9 |
| 35 | EC070 | SUCHIVA K.R | A | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
| 36 | CU027 | SYED AHMED ZAFFAR | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| 37 | EC071 | SYED SUFIYAN AHMED | A | A | 1 | 2 | 3 | A | 4 | A | 5 | 6 |
| 38 | EC075 | VARSHI M.A | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| 39 | CU030 | VIKAS M. | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | A | 9 |
| 40 | CU031 | VISHWAS L.G | A | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
| 41 | EC077 | VIVEK KUMAR S. | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| 42 | CU032 | YASHASWINI S.M | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| 43 | EC079 | YOGESH GOUDA M.R | A | A | A | A | 1 | 2 | 3 | 4 | A | 5 |
| | | No. of Abs. | | | | | | | | | | |
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ATME College of Engineering

# ATTENDANCE

Semester & Section : 3 E&I B

Course Title with Code : E&E

| Sl. No. | USN | Student Name | Date / Month | 11 | 12 | 07 | 07 | 10 | 13 | 25 | 26 | 01 | 01 | 08 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | 02 | 02 | 02 | 02 | 02 | 02 | 02 | 02 | 03 | 03 | 03 |
| | | | | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 | 31 | 32 |
| 26 | EC051 | POOJA K.S | | 21 | 22 | 23 | A | 24 | 25 | 26 | 27 | 28 | 29 | 30 |
| 27 | CU023 | POOJA M.J | | 21 | 22 | 23 | 24 | 26 | 26 | 27 | 28 | 29 | 30 | 31 |
| 28 | EC053 | PRAJWAL.B | | A | 22 | 23 | A | 24 | 25 | 26 | 27 | 28 | 29 | A |
| 29 | EC059 | ROOPESHA K.R. | | 20 | 21 | 22 | 23 | 24 | A | A | A | 25 | 26 | 27 |
| 30 | EC061 | SANJANA KUMARI N | | 17 | 18 | 19 | 20 | A | 21 | 22 | 23 | 24 | 25 | 26 |
| 31 | EC016 | SHASHIKALA K.S. | | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 | 31 |
| 32 | EC066 | SOUMYA SANJAY PORE | | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 | 31 |
| 33 | CU024 | SRIKANT PAWAR. | | 15 | 16 | A | A | 17 | 18 | 19 | A | 20 | 21 | 22 |
| 34 | CU025 | SRINIVASA J.R | | 20 | 21 | 22 | 23 | 24 | 25 | 26 | A | A | 27 | 28 |
| 35 | EC070 | SUPRIYA H.R | | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 | 31 |
| 36 | CU027 | SYED AHMED YAHEAR. | | 22 | 23 | A | A | 24 | A | 25 | 26 | 27 | 28 | 29 |
| 37 | EC071 | SYED SUFIYAN AHMED. | | 18 | 19 | 20 | A | 21 | 22 | 23 | 24 | 25 | 26 | 27 |
| 38 | EC075 | VEERTHI. M.D. | | 25 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | A | 30 | 31 |
| 39 | CU030 | VIKAS M. | | 16 | 17 | 18 | 19 | 20 | 21 | 22 | A | A | 23 | A |
| 40 | CU031 | VISHWAS S.G | | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 |
| 41 | EC077 | VIVEK KUMAR S. | | 20 | 21 | 22 | 23 | 24 | 25 | 26 | A | 27 | 28 | 29 |
| 42 | CU032 | YASHASWINI S.M. | | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 | 31 | 32 |
| 43 | EC079 | YOGESH GOWDA M.R | | 13 | 14 | 15 | 16 | 17 | 18 | 19 | A | 20 | 21 | 22 |
| | | | | | | | | | | | | | | |
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| | No. of Abs. | | | 01 | 02 | 06 | 11 | 04 | 06 | 01 | 09 | 06 | 06 | 05 |
| | Initials | | | | | | | | | | | | | |

| 04 | 05 | 06 | 06 | 09 | 10 | 12 | 15 | 18 | 19 | 20 | ice |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 03 | 03 | 03 | 03 | 03 | 03 | 03 | 03 | 03 | 03 | 03 | |
| 33 | 34 | 35 | 36 | 37 | 38 | 39 | 40 | 41 | 42 | 43 | 3 |
| 31 | 32 | A | A | 33 | 34 | 35 | A | 36 | 37 | 38 | |
| 30 | 38 | 39 | 36 | 36 | 37 | 36 | 37 | 38 | 39 | 40 | |
| 30 | 31 | 32 | 33 | 34 | A | 35 | 36 | 37 | 38 | 39 | |
| 28 | 29 | 30 | 31 | 32 | A | 33 | A | A | 34 | 35 | |
| 27 | 28 | 29 | 30 | 31 | 32 | 33 | 34 | 35 | 36 | 37 | |
| 32 | 33 | 34 | 35 | 36 | 37 | 38 | 39 | 40 | 41 | 42 | |
| 32 | 33 | A | A | 34 | 35 | 36 | 37 | 38 | 39 | 40 | |
| 33 | 34 | 28 | 26 | 27 | 28 | 29 | 30 | 31 | 32 | 33 | |
| 29 | A | 30 | 31 | 32 | 32 | A | 34 | 26 | 36 | 37 | |
| 32 | 33 | 34 | 35 | 36 | 37 | 38 | 39 | 40 | 41 | 42 | |
| 30 | 31 | 32 | 33 | 34 | 35 | A | 36 | 37 | 38 | 39 | |
| 28 | 29 | 30 | 31 | 32 | 33 | A | 34 | 35 | 36 | 37 | |
| 32 | 33 | 34 | 35 | 36 | 37 | 38 | 39 | 40 | 41 | 42 | |
| 27 | 34 | 25 | 26 | 27 | A | 28 | 29 | 30 | 31 | 32 | |
| 31 | 32 | 33 | 34 | 35 | 36 | 37 | 38 | 39 | 40 | 41 | |
| A | 30 | 31 | 32 | 33 | 34 | 35 | 36 | 37 | 38 | 39 | |
| 33 | 34 | 35 | 36 | 37 | 38 | 39 | 40 | 41 | 42 | 43 | |
| A | 23 | 24 | 25 | A | 26 | 27 | 28 | A | 29 | 30 | |
| | | | | | | | | | | | |
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| | 9 | 4 | 8 | 2 | 4 | 13 | 03 | 05 | 05 | | |

ATME
College of Engineering

## ATTENDANCE

Course Title with Code : Engineering Graphics (18ELD15)

Semester & Section : 1 E E

| Sl. No. | USN | Student Name | Date | 01 | 04 | 07 | 08 | 11 | 15 | 18 | 21 | 22 | 25 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Month | 01 | 01 | 01 | 01 | 01 | 01 | 01 | 01 | 01 | 01 |
| | AAD20 | | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| 1 | 1RE001 | A K ISWAR GOWDA | | 1 | A | 2 | 3 | A | A | 5 | 6 | 7 | 8 |
| 2 | CS002 | ABUBAKER SIDDIQ | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| 3 | CS005 | ANIRUDHYA N | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| 4 | CS007 | ARJUN J | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| 5 | CS008 | ARJUN SAG | | 1 | A | 2 | 3 | 4 | A | A | 5 | 6 | 7 |
| 6 | CS009 | ARPITHA ARUN | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| 7 | CS013 | BHAVAD M S | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | A |
| 8 | CS014 | ASHIS PRASAD R | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| 9 | CS015 | AVESHA SIDDIQUA | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| 10 | CS016 | BHAVITHA M.K | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| 11 | CS020 | CHETHANKUMAR C M | | A | A | 1 | 2 | 3 | A | A | 5 | 6 | 6 |
| 12 | 1RE004 | GANESH K M | | A | A | A | A | 1 | 2 | 3 | 4 | 5 | 6 |
| 13 | CS025 | GAGGEE J | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| 14 | CS027 | HANIYA AFREEN | | A | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
| 15 | CS028 | HARIPRASAD C S | | A | 1 | 2 | 3 | A | 5 | 6 | 7 | 8 | 9 |
| 16 | CS029 | JEEVAN P | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | A |
| 17 | 1RE006 | JEEVAN P | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| 18 | 1RE007 | KARTHIK M | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| 19 | CS031 | KASHIFA ZEHRA N | | 1 | 2 | A | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
| 20 | CS032 | KAVANA K B | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| 21 | CS035 | LIKITH ABHISHEK K | | A | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
| 22 | CS038 | MANOJAV PRASAD P S | | A | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
| 23 | CS040 | MANU M | | A | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
| 24 | CS041 | MASEERAH FATHIMA | | A | A | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
| 25 | CS045 | MOHAMMED LABEEB | | 1 | 2 | A | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
| | | No. of Abs. | | | | | | | | | 01 | - | |
| | | Initials | | | | | | | | | 08 | VL | |



## ASSESSMENT

ATME
College of Engineering

| | | | | | | | | |

## ATTENDANCE

ATME College of Engineering

Course Title with Code

Semester & Section

Date / Month

| Sl No | USN | Student Name | 01 | 04 | 07 | 08 | 11 | 15 | 18 | 22 | 25 | 29 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | 1 | 2 | 3 | 4 | 5 | 8 | 9 | 11 | 12 | 16 |
| 24 | 1AT22CS001 | ABHISHEK KUMAR SINGH | A | 1 | 2 | 3 | 4 | A | 5 | 6 | 7 | 8 |
| 25 | 1AT22CS002 | ADITYA ANAND | 1 | 2 | A | 3 | A | 5 | 6 | 7 | 8 | 9 |
| 26 | 1AT22CS003 | AKASH S H | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| 27 | 1AT22CS004 | ANAND KUMAR TI | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| 28 | 1AT22CS005 | ANJAN V | 1 | 2 | 3 | 4 | 5 | A | 6 | 7 | 8 | 9 |
| 29 | 1AT22CS006 | ANKITH K P L | 1 | 2 | 3 | A | A | 6 | 7 | 8 | 9 | 10 |
| 30 | 1AT22CS007 | ANUSHA M | A | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
| 31 | 1AT22CS008 | [illegible] | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| 32 | 1AT22CS009 | [illegible] | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | A |
| 33 | 1AT22CS010 | [illegible] | A | 1 | 2 | 3 | 4 | 5 | A | 6 | 7 | 8 |
| 34 | 1AT22CS011 | [illegible] | A | A | A | A | 1 | A | 2 | 3 | 4 | 5 |
| 35 | 1AT22CS012 | [illegible] | 1 | 2 | 3 | 4 | A | 5 | 6 | 7 | 8 | 9 |
| 36 | 1AT22CS013 | [illegible] | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| 37 | 1AT22CS014 | [illegible] | A | A | A | A | 1 | 2 | 3 | 4 | 5 | 6 |
| 38 | 1AT22CS015 | [illegible] | A | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
| 39 | 1AT22CS016 | [illegible] | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| 40 | 1AT22CS017 | [illegible] | A | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
| 41 | 1AT22CS018 | [illegible] | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| 42 | 1AT22CS019 | [illegible] | A | A | A | A | 1 | 2 | 3 | 4 | 5 | 6 |
| 43 | 1AT22CS020 | [illegible] | A | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |

No. of Abs

## ASSESSMENT

ATME College of Engineering

| Sl No | USN | Student Name | Assignments / Internal Test Marks | | | | | | | | SEE Marks | Total Marks |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | AT | A1 | T1 | A2 | T2 | A3 | T3 | T4 | | |
| | | | | 02 | 06 | 09 | 13 | 16 | 20 | | | |
| 24 | 1AT22CS001 | ABHISHEK KUMAR SINGH | | 11 | 6 | 5 | 53 | 60 | 9 | | 26 | |
| 25 | 1AT22CS002 | ADITYA ANAND | | 16 | 8 | 10 | 16 | 19 | 16 | | 40 | |
| 26 | 1AT22CS003 | AKASH S H | | 16 | 8 | 09 | 75 | 85 | 12 | | 36 | |
| 27 | 1AT22CS004 | ANAND KUMAR TI | | 15 | 6 | 49 | 85 | 85 | 14 | | 35 | |
| 28 | 1AT22CS005 | ANJAN V | | 15 | 5 | 34 | 32 | 34 | 6 | | 26 | |
| 29 | 1AT22CS006 | ANKITH K P L | | 12 | 6 | 28 | 51 | 51 | 9 | | 27 | |
| 30 | 1AT22CS007 | ANUSHA M | | 12 | 06 | 0 | 49 | 49 | 8 | | 26 | |
| 31 | 1AT22CS008 | [illegible] | | 13 | 7 | 35 | 58 | 58 | 10 | | 30 | |
| 32 | 1AT22CS009 | [illegible] | | | | | | | | | | |
| 33 | 1AT22CS010 | [illegible] | | 11 | 5 | 24 | 42 | 42 | 7 | | 23 | |
| 34 | 1AT22CS011 | [illegible] | | 14 | 6 | 3 | 60 | 60 | 10 | | 30 | |
| 35 | 1AT22CS012 | [illegible] | | 14 | 7 | 69 | 57 | 69 | 12 | | 33 | |
| 36 | 1AT22CS013 | [illegible] | | 13 | 5 | 0 | 45 | 45 | 8 | | 26 | |
| 37 | 1AT22CS014 | [illegible] | | 15 | 6 | 21 | 0 | 21 | 4 | | 23 | |
| 38 | 1AT22CS015 | [illegible] | | 12 | 7 | 0 | 0 | 0 | 0 | | 19 | |
| 39 | 1AT22CS016 | [illegible] | | 14 | 6 | 60 | 90 | 90 | 15 | | 35 | |
| 40 | 1AT22CS017 | [illegible] | | 16 | 7 | 44 | 70 | 70 | 12 | | 35 | |
| 41 | 1AT22CS018 | [illegible] | | 12 | 5 | 6 | 54 | 54 | 9 | | 26 | |
| 42 | 1AT22CS019 | [illegible] | | 11 | 6 | 0 | 62 | 62 | 10 | | 27 | |
| 43 | 1AT22CS020 | [illegible] | | | | | | | | | | |

ATME College of Engineering

Department of Mechanical Engineering

| DAY / TIME | 9.00 - 10.00 | 10.00 - 11.00 | 11.00 - 11.15 | 11.15 - 12.15 | 12.15 - 1.15 | 1.15 - 2.00 | 2.00 - 2.55 | 2.55 - 3.50 | 3.50 - 4.45 |
|---|---|---|---|---|---|---|---|---|---|
| Mon | 18ME33 | | BREAK | 18ME32 | | LUNCH BREAK | | | |
| Tue | 18ME32 | | | 18ME33 | | | | | |
| Wed | 18ME33 | | | 18ME32 | | | | | |
| Thu | 18ME32 | | | 18ME33 | | | | | |
| Fri | 18ME33 | | | 18ME32 | | | | | |
| Sat | 18ME32 | | | 18ME33 | | | | | |

| Subject Code | Subject Title | Hrs/week | Faculty-in-Charge | Initials |
|---|---|---|---|---|
| 18MAT31 | Transform calculus, Fourier Series and numerical techniques | 6 | | |
| 18ME32 | Mechanics of Materials | 6 | | |
| 18ME33 | Basic Thermodynamics | 6 | | |

Coordinator

HOD

H.O.D.
Department of Mechanical Engineering
ATME College of Engineering, Mysuru

Principal

ATME College of Engineering

Department of Mechanical Engineering

**OFFLINE REVISION CLASS TIME TABLE(BACKLOG SUBJECTS)**

SEM : 5 Sem — ROOM NO. M103

| DAY / TIME | 9.00 -10.00 | 10.00 -11.00 | 11.00 - 11.15 | 11.15 - 12.15 | 12.15 - 1.15 | 1.15-2.00 | 2.00 - 2:55 | 2.55 - 3:50 | 3.50 - 4:45 |
|---|---|---|---|---|---|---|---|---|---|
| Mon | 18ME52 | | BREAK | 18ME54 | | LUNCH BREAK | 18ME53 | | |
| Tue | 18ME53 | | | 18ME52 | | | 18ME54 | | |
| Wed | 18ME54 | | | 18ME53 | | | 18ME52 | | |
| Thu | 18ME52 | | | 18ME54 | | | 18ME53 | | |
| Fri | 18ME53 | | | 18ME52 | | | 18ME54 | | |
| Sat | 18ME54 | | | 18ME53 | | | 18ME52 | | |

| Subject Code | Subject Title | Hrs/week | Faculty In – Charge | Initials |
|---|---|---|---|---|
| 18ME52 | Design of Machine Elements I | 6 | Dr. Srinivasa K/Mr.Rohith S | Dr.SK/RS |
| 18ME53 | Dynamics of Machines | 6 | Dr. Suresh Kumar S/Mr.Yathisha N | Dr.SKS/YN |
| 18ME54 | Turbo Machines | 6 | Dr. M S Govinde Gowda/Dr.C G Ragavendra | Dr.GG/RAG |

Coordinator

HOD
H.O.D.
Department of Mechanical Engineering
ATME College of Engineering, Mysuru

for ATME College of Engineering
07/5/21
Dean (Academics)

PRINCIPAL
ATME College of Engineering
13th KM, Mysuru-Kanakapura-Bangalore Road
Mellahalli, Mysuru-570028

ATME College of Engineering

Department of Mechanical Engineering

## Attendance of Coaching class conducted for failed students (2020-21-oddsem exam)

Semester 3rd Sem Subject: Mechanics of Materials-18ME32

| Sl. No | Student name | 12/8 | 13/8 | 14/8 | 16/8 | 17/8 | 18/8 | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | Adnan Ahmed | A | 1 | 2 | A | 3 | A | | | | | | | | | |
| 2 | Ibrahim Zain Baig | 1 | 2 | 3 | 4 | A | 5 | | | | | | | | | |
| 3 | Sudhanva P | A | 1 | 2 | A | 3 | A | | | | | | | | | |
| 4 | SYED FARDEEN AHMED | 1 | A | 2 | 3 | A | 4 | | | | | | | | | |
| 5 | ABHISHEKP | ~~A~~ | 2 | 3 | 4 | 5 | A | | | | | | | | | |
| 6 | AMAANAFSAL | 1 | 2 | A | 3 | A | 4 | | | | | | | | | |
| 7 | HANNANAHMEDKHAN | A | 1 | 2 | 3 | 4 | A | | | | | | | | | |
| 8 | IDRISKHAN | 1 | 2 | 3 | 4 | A | A | | | | | | | | | |
| 9 | MANOJNPATEL | 1 | A | 2 | A | 3 | 4 | | | | | | | | | |
| 10 | MILANNY | 1 | 2 | 3 | A | 5 | A | | | | | | | | | |
| 11 | MIRASHFAQAHMED | A | 1 | 2 | 3 | A | 4 | | | | | | | | | |
| 12 | NABEELAHMEDN | 1 | A | 2 | 3 | 4 | A | | | | | | | | | |
| 13 | NAVEENRAJUP | 1 | A | 2 | A | 3 | A | | | | | | | | | |
| 14 | PUNITHS | 1 | 2 | 3 | 4 | 5 | A | | | | | | | | | |
| 15 | VARADARAJN | 1 | 2 | A | 3 | 4 | A | | | | | | | | | |
| 16 | VARSHITHS | 1 | 2 | 3 | 4 | A | 5 | | | | | | | | | |
| 17 | BASAVAKIRAN G | 1 | A | 2 | 3 | A | 4 | | | | | | | | | |
| 18 | MANJUNATHA | A | 1 | 2 | A | 3 | 4 | | | | | | | | | |
| 19 | VIKAS M P | 1 | 2 | 3 | 4 | A | A | | | | | | | | | |
| 20 | VINAY KUMAR N V | 1 | A | 2 | 3 | 4 | A | | | | | | | | | |
| | **Faculty Name** | | | | | | | | | | | | | | | |
| | **1 Suresh Kumar s** | | | | | | | | | | | | | | | |
| | **2 Yashwanth N** | | | | | | | | | | | | | | | |

ATME College of Engineering

Department of Mechanical Engineering

## Attendance of Coaching class conducted for failed students (2020-21-oddsem exam)

**Semester 3rd Sem Subject: Basic Thermodynamics-18ME33**

| Sl. No | Student name | 12/8 | 13/8 | 14/8 | 16/8 | 17/8 | 18/8 | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | Adnan Ahmed | P | P | P | A | P | P | | | | | | | | | |
| 2 | Ibrahim Zain Baig | A | A | P | P | A | A | | | | | | | | | |
| 3 | HANNANAHMEDKHAN | A | P | P | P | A | A | | | | | | | | | |
| 4 | IDRISKHAN | P | P | A | A | P | P | | | | | | | | | |
| 5 | MANOJNPATEL | A | A | A | P | P | P | | | | | | | | | |
| 6 | MILANNY | P | P | P | P | A | P | | | | | | | | | |
| 7 | MOHANJ | P | A | P | A | P | A | | | | | | | | | |
| 8 | NAVANEETHG | P | P | P | A | P | P | | | | | | | | | |
| 9 | SHASHANKM | P | P | A | P | A | P | | | | | | | | | |
| 10 | VARADARAJN | A | P | P | A | A | A | | | | | | | | | |
| 11 | BASAVAKIRAN G | A | P | P | A | P | A | | | | | | | | | |
| 12 | JAYANTH J | A | A | P | P | A | A | | | | | | | | | |
| 13 | PRATHEEK M | P | P | A | P | A | A | | | | | | | | | |
| 14 | VINAY KUMAR N V | P | A | A | P | A | P | | | | | | | | | |
| 15 | | | | | | | | | | | | | | | | |
| 16 | | | | | | | | | | | | | | | | |

**Faculty Name**

1 **Ravikumar S**

2 **Payankumar K P**

ATME
College of Engineering

Department of Mechanical Engineering

## Attendance of Coaching class conducted for failed students (2020-21-oddsem exam)

**Semester** 5th Sem **Subject:** Design of Machine Elements-18ME52

| Sl. No | Student name | 12/8 | 13/8 | 14/8 | 16/8 | 17/8 | 18/8 | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | GOWTHAMPRASAD M | A | A | 1 | 2 | 3 | 4 | | | | | | | | | |
| 2 | HRITHIK D | A | A | A | A | A | A | | | | | | | | | |
| 3 | LEELENDRA KUMAR H | A | 1 | A | 2 | 3 | 4 | | | | | | | | | |
| 4 | MOHAMMED SOUBAN | 1 | 2 | 3 | 4 | 5 | 6 | | | | | | | | | |
| 5 | ABHISHEK J K | A | A | A | A | A | A | | | | | | | | | |
| 6 | ASHLESH KUMAR M | A | A | 1 | 2 | 3 | 4 | | | | | | | | | |
| 7 | BHARATH S M | A | A | A | A | A | A | | | | | | | | | |
| 8 | CHANDAN G Y | 1 | 2 | 3 | 4 | 5 | 6 | | | | | | | | | |
| 9 | CHANDAN M | A | A | A | A | A | A | | | | | | | | | |
| 10 | FAZIL AHMED | A | 1 | A | 2 | 3 | A | | | | | | | | | |
| 11 | GOVINDARAJU V | A | A | 1 | 2 | 3 | A | | | | | | | | | |
| 12 | KIRANKUMAR S | A | 1 | A | 2 | 3 | 4 | | | | | | | | | |
| 13 | MAHESH N | A | A | A | A | A | A | | | | | | | | | |
| 14 | MOHAMMED IMRAN M R | A | A | 1 | 2 | 3 | A | | | | | | | | | |
| 15 | ANIRUDH S | A | A | A | A | A | A | | | | | | | | | |
| 16 | PRAJWAL A S | A | 1 | 2 | 3 | 4 | A | | | | | | | | | |
| 17 | SHAMANTH KUMAR M | A | A | A | A | A | A | | | | | | | | | |
| 18 | SUKRUTH U R | A | A | 1 | 2 | 3 | 4 | | | | | | | | | |

**Faculty Name**

1 Dr. Srinivasa K

2 Mr. Rohith S

Contd....

| | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 19 | VIVEK B K | A | A | A | A | A | A | | | | | | | | | | |
| 20 | LIKHITHA S N | A | A | A | A | A | A | | | | | | | | | | |
| 21 | PARVEEZ AHMED | 1 | 2 | 3 | 4 | 5 | 6 | | | | | | | | | | |
| 22 | PRAJWALA S M | A | A | A | A | A | A | | | | | | | | | | |
| 23 | Rithish B | A | A | 1 | 2 | 3 | 4 | | | | | | | | | | |
| 24 | Syed Ibad Hussain | A | A | 1 | 2 | 3 | 4 | | | | | | | | | | |
| 25 | MOHAMMEDJAVEED | A | A | A | A | A | A | | | | | | | | | | |
| 26 | PRAJWAL R | A | A | A | A | A | A | | | | | | | | | | |
| 27 | PRATHAPA K M | 1 | 2 | 3 | 4 | 5 | 6 | | | | | | | | | | |
| 28 | SHARATHKUMAR K S | A | A | A | A | A | A | | | | | | | | | | |
| 29 | SUDHARSHAN B R | 1 | 2 | 3 | 4 | 5 | 6 | | | | | | | | | | |

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## Attendance of Coaching class conducted for failed students (2020-21-oddsem exam)

**Semester 5th Sem** **Subject: Dynamics of Machines-18ME53**

| Sl. No | Student name | 12/8 | 13/8 | 14/8 | 15/8 | 17/8 | 18/8 | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | ADITYA C | A | 1 | A | A | 2 | A | | | | | | | | | |
| 2 | MANOJ M | 1 | A | 2 | A | A | A | | | | | | | | | |
| 3 | BHARATHKUMAR M | A | 1 | 2 | A | A | A | | | | | | | | | |
| 4 | BHUVANESH M | A | 1 | 2 | 3 | 4 | A | | | | | | | | | |
| 5 | GOWTHAM G | 1 | 2 | A | 3 | A | 5 | | | | | | | | | |
| 6 | HRITHIK D | A | 1 | 2 | 3 | A | 5 | | | | | | | | | |
| 7 | LEELENDRA KUMAR H | A | 1 | A | A | A | A | | | | | | | | | |
| 8 | MOHAMMED SOUBAN | 1 | A | 2 | 3 | 5 | 5 | | | | | | | | | |
| 9 | NIKHIL R | 1 | 2 | A | A | A | 3 | | | | | | | | | |
| 10 | ABDUL KHAYAM ALI | A | 1 | A | A | e | A | | | | | | | | | |
| 11 | ABHISHEK J K | A | 1 | 2 | 3 | A | 5 | | | | | | | | | |
| 12 | AKSHATH L | 1 | 2 | A | A | 3 | A | | | | | | | | | |
| 13 | BHARATH S M | 1 | A | 2 | 3 | A | 5 | | | | | | | | | |
| 14 | CHANDAN G Y | 1 | 2 | A | A | 3 | A | | | | | | | | | |
| 15 | DHANANJAYAKUMARA D R | 1 | 2 | A | A | A | 3 | | | | | | | | | |
| 16 | FAZIL AHMED | A | 1 | 2 | A | A | 3 | | | | | | | | | |
| 17 | M C KARTHIK | 1 | A | 2 | 3 | A | A | | | | | | | | | |
| 18 | ANIRUDH S | A | 1 | 2 | A | 3 | A | | | | | | | | | |
| | **Faculty Name** | | | | | | | | | | | | | | | |
| | **1 Dr. Suresh Kumar S** | | | | | | | | | | | | | | | |
| | **2 Mr. Yathisha N** | | | | | | | | | | | | | | | |

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|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 19 | SUKRUTH U R | A | 1 | 2 | A | 3 | A | | | | | | | | | | |
| 20 | LIKHITHA S N | 1 | A | 2 | 3 | 4 | 5 | | | | | | | | | | |
| 21 | PRAJWALA S M | 1 | A | 2 | A | A | A | | | | | | | | | | |
| 22 | Rithish B | A | 1 | 2 | 4 | 3 | 4 | | | | | | | | | | |
| 23 | SUJAY N RAJ | 1 | A | 2 | A | 3 | A | | | | | | | | | | |
| 24 | Syed Ibad Hussain | A | A | 1 | 2 | A | A | | | | | | | | | | |
| 25 | ARPITHA K S | 1 | 2 | A | 3 | A | 4 | | | | | | | | | | |
| 26 | MOHAMMED NOUMAN | A | 1 | 2 | A | 3 | 4 | | | | | | | | | | |
| 27 | MOHAMMEDJAVEEDAHMED | A | 1 | 2 | A | 3 | 4 | | | | | | | | | | |
| 28 | NARASIMHA S | 1 | A | 2 | A | A | A | | | | | | | | | | |
| 29 | PRAJWAL R | 1 | A | A | 2 | A | 3 | | | | | | | | | | |
| 30 | PRAVEEN B M | 1 | A | 2 | A | 3 | 4 | | | | | | | | | | |
| 31 | PRAVEEN S K | A | A | 1 | A | 2 | 3 | | | | | | | | | | |
| 32 | RAJASHEKARA K P | 1 | 2 | A | 3 | A | A | | | | | | | | | | |
| 33 | SHARATHKUMAR K S | 1 | 2 | A | A | A | 3 | | | | | | | | | | |
| 34 | SHIVAPRASAD K S | A | 1 | 2 | 3 | A | 4 | | | | | | | | | | |
| 35 | SUHAS RAO N S | 1 | A | 2 | 3 | A | A | | | | | | | | | | |

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## Attendance of Coaching class conducted for failed students (2020-21-oddsem exam)

**Semester 5th Sem Subject: Turbo Machines-18ME54**

| Sl. No | Student name | 12/8 | 13/8 | 14/8 | 16/8 | 17/8 | 18/8 | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | ADITYA C | A | A | 1 | 2 | 3 | 4 | | | | | | | | | |
| 2 | AMARTYA K GOWDA | 1 | A | 2 | 3 | A | 4 | | | | | | | | | |
| 3 | ANILKUMAR B M | A | 1 | 2 | 3 | 4 | 5 | | | | | | | | | |
| 4 | MANOJ M | A | A | A | A | A | A | | | | | | | | | |
| 5 | BHARATHKUMAR M | A | A | 1 | 2 | A | A | | | | | | | | | |
| 6 | LEELENDRA KUMAR H | A | A | A | A | A | A | | | | | | | | | |
| 7 | MOHAMED AFAN JALEEL | A | 1 | 2 | A | A | A | | | | | | | | | |
| 8 | MOHAMMED SOUBAN | A | 1 | 2 | A | A | 3 | | | | | | | | | |
| 9 | NAGADARSHAN M | A | 1 | 2 | 3 | 4 | 5 | | | | | | | | | |
| 10 | ABDUL KHAYAM ALI | A | A | A | A | A | A | | | | | | | | | |
| 11 | ABHISHEK J K | A | A | A | A | A | A | | | | | | | | | |
| 12 | AKSHATH L | A | 1 | A | A | A | A | | | | | | | | | |
| 13 | ASHLESH KUMAR M | 1 | 2 | 3 | A | 4 | 5 | | | | | | | | | |
| 14 | BHARATH S M | A | 1 | 2 | A | A | 3 | | | | | | | | | |
| 15 | CHANDAN G Y | A | 1 | 2 | 2 | A | 4 | | | | | | | | | |
| 16 | CHANDAN M | A | A | A | A | A | A | | | | | | | | | |
| 17 | CHANDAN N | 1 | A | 2 | 3 | 4 | 5 | | | | | | | | | |
| 18 | CHETHAN S | A | A | A | A | A | A | | | | | | | | | |

**Faculty Name**

**1 Dr. M S Govinde Gowda**

**2 Mr. Raghu**

Contd....

| | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 19 | DHANANJAYAKUMARA D R | A | A | A | A | A | A | | | | | | | | | | | |
| 20 | FAZIL AHMED | A | A | A | A | A | A | | | | | | | | | | | |
| 21 | GOVINDARAJU V | A | A | A | A | A | A | | | | | | | | | | | |
| 22 | KISHORE R | A | A | A | A | A | A | | | | | | | | | | | |
| 23 | M C KARTHIK | A | 1 | 2 | 3 | A | A | | | | | | | | | | | |
| 24 | MAHESH N | A | 1 | 2 | 3 | A | A | | | | | | | | | | | |
| 25 | MANOJKUMARA S L | A | A | A | A | A | A | | | | | | | | | | | |
| 26 | SHAMANTH KUMAR M | A | A | A | A | A | A | | | | | | | | | | | |
| 27 | SUKRUTH U R | A | 1 | 2 | 3 | A | A | | | | | | | | | | | |
| 28 | VIVEK B K | A | 1 | 2 | A | A | A | | | | | | | | | | | |
| 29 | LIKHITHA S N | A | 1 | 2 | 3 | A | 5 | | | | | | | | | | | |
| 30 | PARVEEZ AHMED | 1 | 2 | 3 | 4 | 5 | 6 | | | | | | | | | | | |
| 31 | PETER A X | 1 | 2 | 3 | 4 | 5 | 6 | | | | | | | | | | | |
| 32 | PRIYANKA S V | A | 1 | 2 | 3 | A | A | | | | | | | | | | | |
| 33 | Rithish B | A | A | A | A | A | A | | | | | | | | | | | |
| 34 | ANUSHREE A S | A | 1 | 2 | 3 | 4 | 5 | | | | | | | | | | | |
| 35 | ARPITHA K S | A | 1 | 2 | 3 | A | 5 | | | | | | | | | | | |
| 36 | MOHAMMEDJAVEEDAHMED | A | A | A | 1 | 2 | A | | | | | | | | | | | |
| 37 | MONISH N S | A | A | A | A | A | A | | | | | | | | | | | |
| 38 | NAVEENA H M | A | A | A | 1 | A | A | | | | | | | | | | | |
| 39 | PAVAN KUMAR B | A | A | A | A | A | A | | | | | | | | | | | |
| 40 | PRADVIN S G | A | A | A | A | A | A | | | | | | | | | | | |
| 41 | PRAJWAL R | A | A | A | A | A | A | | | | | | | | | | | |
| 42 | PRARTHANA B | A | 1 | 2 | 3 | 4 | 5 | | | | | | | | | | | |
| 43 | PRATHAPA K M | A | A | A | A | A | A | | | | | | | | | | | |
| 44 | PRAVEEN S K | A | A | A | A | A | A | | | | | | | | | | | |
| 45 | RAJASHEKARA K P | A | Posted in R V | | | | | | | | | | | | | | | |
| 46 | SHARATHKUMAR K S | A | 1 | 2 | A | A | A | | | | | | | | | | | |
| 47 | SHIVAPRASAD K S | A | A | A | A | A | A | | | | | | | | | | | |
| 48 | SHREEJITH K M | A | 1 | 2 | 3 | 4 | A | | | | | | | | | | | |
| 49 | SRINIVAS S PAVAR | A | 1 | 2 | 3 | A | A | | | | | | | | | | | |
| 50 | SUDEEP D N | A | 1 | 2 | 3 | 4 | A | | | | | | | | | | | |
| 51 | SUJAN UDUPA B P | A | A | A | A | A | A | | | | | | | | | | | |
| | | 4 | 4 | 4 | 4 | 4 | 4 | | | | | | | | | | | |

ATME
College of Engineering

Department of Mechanical Engineering

## Attendance of Coaching class conducted for failed students (2020-21-oddsem exam)

**Semester 3rd Sem  Subject: TFNT(Maths-III)-18ME31**

| Sl. No | Student name | 12/8 | 13/8 | 14/8 | 16/8 | 17/8 | 18/8 | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | Sudhanva P | 1 | A | 2 | 3 | A | 4 | | | | | | | | | |
| 2 | SYED FARDEEN AHMED | 1 | 2 | 3 | 4 | A | 5 | | | | | | | | | |
| 3 | ABHISHEKP | 1 | 2 | A | 3 | A | 4 | | | | | | | | | |
| 4 | CHANDRASHEKARKS | A | 1 | 2 | 3 | 4 | A | | | | | | | | | |
| 5 | IDRISKHAN | A | 1 | 2 | 3 | 4 | 5 | | | | | | | | | |
| 6 | MANOJNPATEL | A | 1 | 2 | 3 | A | 4 | | | | | | | | | |
| 7 | MILANNY | 1 | A | 2 | A | 3 | 4 | | | | | | | | | |
| 8 | MIRASHFAQAHMED | 1 | A | A | 2 | 3 | 4 | | | | | | | | | |
| 9 | NABEELAHMEDN | 1 | 2 | 3 | 4 | 5 | 6 | | | | | | | | | |
| 10 | NAVANEETHG | A | A | A | 1 | 2 | 3 | | | | | | | | | |
| 11 | PADMANABHAK | A | A | 1 | 2 | A | 3 | | | | | | | | | |
| 12 | PRAJWALS | 1 | 2 | 3 | A | 4 | 5 | | | | | | | | | |
| 13 | SHASHANKM | A | 1 | 2 | 3 | A | A | | | | | | | | | |
| 14 | SHIVALIS | 1 | 2 | A | 3 | A | 4 | | | | | | | | | |
| 15 | VARADARAJN | 1 | 2 | A | 3 | 4 | A | | | | | | | | | |
| 16 | VARSHITHS | 1 | A | 2 | 3 | A | 4 | | | | | | | | | |
| 17 | ARJUN SHIVA KUMAR | A | 1 | A | 2 | 3 | 4 | | | | | | | | | |
| 18 | BASAVAKIRAN G | A | 1 | 2 | 3 | 4 | A | | | | | | | | | |

**Faculty Name**

1 **Mrs. Banu Priya**

2 Mrs. Sowmya. K

Contd....

| | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 19 | CHAITHRA SHREE S M | A | A | 1 | A | 2 | 3 | | | | | | | | | | |
| 20 | HITESH C | 1 | 2 | 3 | A | 4 | 5 | | | | | | | | | | |
| 21 | JAYANTH J | 1 | 0 | 2 | 3 | A | 4 | | | | | | | | | | |
| 22 | MANJUNATHA | A | 1 | 2 | A | 3 | 4 | | | | | | | | | | |
| 23 | MANOJ T G | 1 | 2 | A | 3 | 4 | 5 | | | | | | | | | | |
| 24 | MOHAN KUMAR B M | 1 | 2 | A | 3 | A | 4 | | | | | | | | | | |
| 25 | PRATHEEK M | 1 | 2 | 3 | A | A | 4 | | | | | | | | | | |
| 26 | RAVI R | 1 | A | A | 2 | 3 | 4 | | | | | | | | | | |
| 27 | VIKAS M P | A | 1 | 2 | 3 | 4 | A | | | | | | | | | | |
| 28 | VINAY KUMAR N V | A | A | 1 | 2 | 3 | A | | | | | | | | | | |
| 29 | YOGESH R | 1 | 2 | 3 | A | 4 | A | | | | | | | | | | |

ATME College of Engineering

Department of Mechanical Engineering

| Semester | 3 |
|---|---|
| Department | MECHANICAL |

**Regular Exam held during Feb/Mar 2021 (ARV)**

| SL | Course name with code | Name of the faculty handled | No. of students appeared | No. of students passed | No. of fails | Pass % |
|---|---|---|---|---|---|---|
| 1 | Mathematics, 18MAT31 | Ms.Banupriya J (A) / Mr.Sudhakar N (B) | 73 | 46 | 27 | 63 |
| 2 | Mechanics of Materials, 18ME32 | Mr. Yashwanth N (A) / Mr. Suresh Kumar S (B) | 72 | 52 | 20 | 72 |
| 3 | Basic Thermodynamics, 18ME33 | Mr. Pavan Kumar K P (A) / Mr. Ravikumar S (B) | 73 | 61 | 12 | 84 |
| 4 | Material Science, 18ME34 | Mr. Devaraj M R (A) / Mr. Deepak MVS (B) | 73 | 65 | 8 | 89 |
| 5 | Metal cutting and forming 18ME35A | Mr. Niranjan Kumar V S (A) | 36 | 27 | 9 | 75 |
| 6 | Metal Casting and Welding, 18ME35B | Dr. Chethan S (B) | 37 | 36 | 1 | 97 |
| 7 | Computer Aided Machine Drawing, 18ME36A | Mr. Rohith S (A) | 36 | 35 | 1 | 97 |

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## Arrear Exam held during Aug/Sep 2021

| SL | Course name with code | Name of the faculty engaged special class | No of students appeared (Failed during regular exam) | No. of students passed | No. of fails | Pass % | Overall Pass % |
|---|---|---|---|---|---|---|---|
| 1 | Mathematics, 18MAT31 | Ms.Banupriya J (A) / Mr.Sudhakar N (B) | 27 | 10 | 17 | 37 | 77 |
| 2 | Mechanics of Materials, 18ME32 | Mr. Yashwanth N (A) / Mr. Suresh Kumar S (B) | 19 | 10 | 9 | 53 | 87 |
| 3 | Basic Thermodynamics, 18ME33 | Mr. Pavan Kumar K P (A) / Mr. Ravikumar S (B) | 11 | 7 | 4 | 64 | 94 |
| 4 | Material Science, 18ME34 | Mr. Devaraj M R (A) / Mr. Deepak MVS (B) | 7 | 2 | 5 | 29 | 93 |
| 5 | Metal cutting and forming 18ME35A | Mr. Niranjan Kumar V S (A) | 7 | 5 | 2 | 71 | 94 |
| 6 | Metal Casting and Welding, 18ME35B | Dr. Chethan S (B) | 1 | 1 | 0 | 100 | 100 |
| 7 | Computer Aided Machine Drawing, 18ME36A | Mr. Rohith S (A) | 1 | 1 | 0 | 100 | 100 |

H.O.D
Department of Mechanical Engineering
ATME College of Engineering, Mysuru

ATME College of Engineering

Department of Mechanical Engineering

| Semester | 5 |
|---|---|
| Department | MECHANICAL |

**Regular Exam held during Feb/Mar 2021 (ARV)**

| SL | Course name with code | Name of the faculty handled | No. of students appeared | No. of students passed | No. of fails | Pass % |
|---|---|---|---|---|---|---|
| 1 | Management and Economics, 18ME51 | Mr. Ramanuja C M (A) / Mr. Niranjan Kumar V S (B) | 129 | 118 | 11 | 91 |
| 2 | Design of Machine Elements I, 18ME52 | Dr. Srinivasa K (A) / Mr. Rohith S (B) | 127 | 103 | 24 | 81 |
| 3 | Dynamics of Machines, 18ME53 | Mr. Suresh Kumar S (A) / Mr. Yathisha N (B) | 128 | 99 | 29 | 77 |
| 4 | Turbo Machines, 18ME54 | Dr. M S Govinde Gowda (A) / Mr. Raghu (B) | 126 | 79 | 47 | 63 |
| 5 | Fluid Power Engineering, 18ME55 | Mr. Raghu (A) / Mr. Pavan Kumar K P (B) | 127 | 126 | 1 | 99 |
| 6 | Operations Management, 18ME56 | Dr. Chethan S (A) / Dr. Rathnakar G (B) | 129 | 123 | 6 | 95 |

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## Arrear Exam held during Aug/Sep 2021

| SL | Course name with code | Name of the faculty engaged special class | No of students appeared (Failed during regular exam) | No. of students passed | No. of fails | Pass % | Overall Pass % |
|---|---|---|---|---|---|---|---|
| 1 | Management and Economics, 18ME51 | Mr. Ramanuja C M (A) / Mr. Niranjan Kumar V S (B) | 10 | 9 | 1 | 90 | 99 |
| 2 | Design of Machine Elements I, 18ME52 | Dr. Srinivasa K (A) / Mr. Rohith S (B) | 21 | 9 | 12 | 43 | 90 |
| 3 | Dynamics of Machines, 18ME53 | Mr. Suresh Kumar S (A) / Mr. Yathisha N (B) | 24 | 15 | 9 | 63 | 93 |
| 4 | Turbo Machines, 18ME54 | Dr. M S Govinde Gowda (A) / Mr. Raghu (B) | 43 | 30 | 13 | 70 | 89 |
| 5 | Fluid Power Engineering, 18ME55 | Mr. Raghu (A) / Mr. Pavan Kumar K P (B) | 1 | 1 | 0 | 100 | 100 |
| 6 | Operations Management, 18ME56 | Dr. Chethan S (A) / Dr. Rathnakar G (B) | 4 | 3 | 0 | 75 | 99 |

Department of Mechanical Engineering
ATME College of Engineering, Mysuru

CBCS SCHEME

USN | | | | | | | | | | |

18ME32

# Third Semester B.E. Degree Examination, Jan./Feb. 2021
## Mechanics of Materials

Time: 3 hrs. Max. Marks: 100

**Note:** ***Answer any FIVE full questions, choosing ONE full question from each module.***

Important Note : 1. On completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages.
2. Any revealing of identification, appeal to evaluator and /or equations written eg, 42+8 = 50, will be treated as malpractice.

### Module-1

1 a. A mild steel bar of 25mm diameter and 200mm gauge length has an extension of 0.15mm under a load of 75kN. Load at elastic limit is 160kN and maximum load is 250kN. Total extension is 55mm. Diameter at failure is 18.5mm. Find i) Elastic limit ii) Young's modulus iii) Percentage elongation iv) Percentage reduction in area. **(06 Marks)**

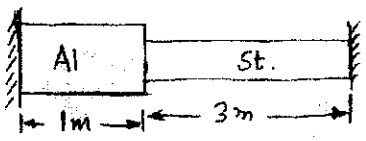
b. A tapered bar of length 'L' having rectangular cross – section of constant thickness 't' is subjected to a tensile force P. Find extension of the bar. **(08 Marks)**

c. Draw typical stress – strain curve for i) Mild steel ii) Aluminum and iii) Brittle material. **(06 Marks)**

**OR**

2 a. A composite bar is rigidly fitted at the support A and B as shown in Fig. Q2(a). Determine the reactions at the supports when temperature rises by $20^0$C. $E_{Al}$ = 70 GPa , $E_{St}$ = 200 GPa $\alpha_{Al} = 11 \times 10^{-6}/^0$C and $\alpha_{St} = 12 \times 10^{-6}/^0$C. **(08 Marks)**

Fig. Q2(a)



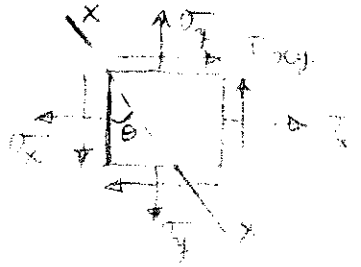

b. Define 'Bulk modulus'. Obtain an expression relating Young's modulus , Bulk modulus and Poisson's ratio. **(06 Marks)**

c. A 500mm long bar has rectangular cross – section 200mm × 40mm. This bar is subjected to
i) 40 kN tensile force on 20mm × 40mm faces
ii) 200 kN compressive force on 20mm × 500mm faces and
iii) 300 kN tensile force on 40mm × 500mm faces.
Find change in volume if E = 200 GPa and μ = 0.3. **(06 Marks)**

### Module-2

3 a. Obtain expressions for normal and shear stress acting on a plane XX shown in Fig. Q3(a). **(10 Marks)**

Fig. Q3(a)




b. Draw Mohr's circle and find
i) Maximum shear stress if $\sigma_x$ = 40 MPa , $\sigma_y$ = 20 MPa and $\tau_{xy}$ = 0.
ii) Principal stresses if $\sigma_x$ = 0 , $\sigma_y$ = 0 and $\tau_{xy}$ = 25 MPa. **(10 Marks)**

**OR**

4 a. A thin cylinder of internal radius $r_i$ , thickness t , length 'ℓ' is subjected to internal pressure $p_i$, find i) expressions for hoop stress and longitudinal stress ii) expression for volumetric strain. **(10 Marks)**

b. A thick cylinder of outside diameter 300mm and thickness 50mm is subjected to an internal pressure of 40N/mm$^2$ and an external pressure of 2.5N/mm$^2$. Find maximum and minimum values of hoop stress and radial stress, Plot the stress variations across the cylinder section. **(10 Marks)**

## Module-3

5 a. Obtain expressions relating load, shear force and bending moment. **(06 Marks)**

b. Draw the bending moment and shear force diagrams for the beam shown in Fig. Q5(b) indicating values at important sections. Also find the positions of i) Maximum bending moment ii) Maximum shear force and iii) Point of contraflexure. **(14 Marks)**

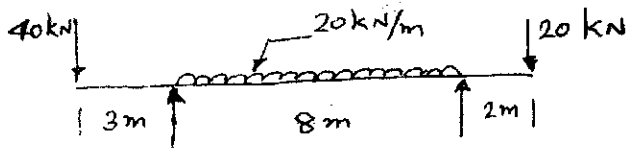



Fig. Q5(b)

**OR**

6 a. Stating the assumptions of Pure bending theory, derive

$$\frac{M}{I} = \frac{\sigma}{Y} = \frac{E}{R}.$$ **(10 Marks)**

b. A wooden beam 10m long , 360mm deep and 300 mm wide is simply supported and loaded with uniformly distributed load for the entire length. Maximum stress intensity of the material is 60MPa. Find the safe udl if factor of safety = 6. **(10 Marks)**

## Module-4

7 A solid circular shaft is subjected to a bending moment of 9000 N-m and a twisting moment of 12000N-m. In a tensile test of the same material, it gave the following details :
Stress at yield point = 300Mpa ; Modulus of elasticity = 200GPa ; Poisson's ratio = 0.25.
Assuming factor of safety = 3, find the least diameter required according to i) Maximum Principal stress theory ii) Maximum Shear stress theory. **(20 Marks)**

**OR**

8 a. State the assumptions of 'Pure torsion' theory and prove

$$\frac{\tau_{max}}{r_0} = \frac{\tau}{r} = \frac{G\theta}{L}.$$ **(08 Marks)**

b. A hollow circular shaft with a 250mm external diameter and thickness of metal 25mm transmits power at 180 rpm. The angle of twist over a length of 3m was found to be 0.72$^0$. Calculate the power transmitted and the maximum shear stress induced. Modulus of rigidity = 84 GPa. **(12 Marks)**

## Module-5

9 a. Obtain an expression for Euler's critical load for a long column with both ends pinned. **(10 Marks)**

b. State the assumptions made in Euler's theory and explain limitations of Euler's estimation of critical load. **(10 Marks)**

**OR**

10 a. What is Strain Energy? Explain in brief. **(05 Marks)**

b. Obtain an expression for strain energy due to shear stresses. **(05 Marks)**

c. Determine the ratio of strain energy stored in two bars of the same material shown in Fig. Q10 (c), if the gradually applied load is same. **(10 Marks)**

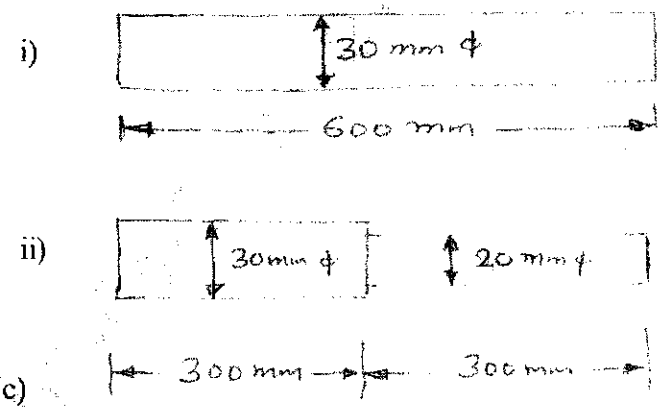



Fig. Q10(c)

* * * * *

CBCS SCHEME

USN | | | | | | | | | | |

18ME33

# Third Semester B.E. Degree Examination, Jan./Feb. 2021
## Basic Thermodynamics

Time: 3 hrs. Max. Marks: 100

***Note:*** **1.** ***Answer any FIVE full questions, choosing ONE full question from each module.***
**2.** ***Use of thermodynamic data handbook is permitted.***

Important Note : 1. On completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages.
2. Any revealing of identification, appeal to evaluator and /or equations written eg, 42+8 = 50, will be treated as malpractice.

### Module-1

1 a. Explain microscopic and macroscopic approaches to thermodynamics. **(06 Marks)**

b. State and explain Zeroth law of thermodynamics. What is diathermal and adiabatic wall? **(06 Marks)**

c. The temperature t on a Celsius thermometer scale is defined in terms of property P by the relation $P = e^{\frac{(t-B)}{A}}$ where A and B are constants. At ice point and steam points the value of P is 1.86 and 6.81 respectively. Find the value of 't' for P = 2.5. **(08 Marks)**

**OR**

2 a. With examples distinguish between:
(i) Intensive and extensive property
(ii) Point and path function
(iii) Thermodynamic equilibrium **(10 Marks)**

b. In 1709m Newton proposed a linear temperature scale where ice point and normal human body temperature are maintained as two fixed points of 0°N ad 12°N respectively. The temperature of human body on the Celsius scale is 36°C. Obtain relation between Newton scale and Celsius scale. **(10 Marks)**

### Module-2

3 a. Obtain the expression for displacement adiabatic work. **(06 Marks)**

b. Define heat and work with reference to thermodynamic point of view and also the sign convention of heat and work. **(06 Marks)**

c. A cylinder contains 1 kg of certain fluid at an initial pressure of 20 bar. The fluid is allowed to expand reversibly behind a piston according to law $PV^2$ = constant until the volume is doubled. The fluid is then cooled reversibly at constant pressure until the piston regains its original position. Heat is then supplied reversibly with the piston firmly locked in position until the pressure rises to its original value of 20 bar. Calculate the net work done by the fluid for an initial volume of 0.05 $m^3$. **(08 Marks)**

**OR**

4 a. Apply steady flow energy equation to each of the following:
(i) Boiler (ii) Nozzle (iii) Centrifugal pump
(iv) Throttling device (v) Turbine **(10 Marks)**

b. The working fluid in a steady flow process flows at the rate of 220 kg/min. the fluid rejects 100 kJ/s of heat passing through the system. The fluid enters at a velocity of 320 m/s, pressure of 6 bar, internal energy 2000 kJ/kg, specific volume of 0.36 $m^3$/kg and leaves the system at a velocity of 140 m/s, pressure of 1.2 bar, internal energy 1400 kJ/kg, specific volume of 1.3 $m^3$/kg. Determine the power output in MW. The change in potential energy is neglected. **(10 Marks)**

## Module-3

5 a. Prove that Kelvin-Planck statement and clausius statements of second law of thermodynamic are equivalent. **(10 Marks)**

b. A reversible heat engine operates between two reservoirs at temperature of 600°C and 40°C. The engine drives a reversible refrigerator which operates between reservoirs at temperature of 40°C and –20°C. The heat transfer to the heat engine is 2000 kJ and net work output of combined engine refrigerator plant is 360 kJ. Evaluate the heat transfer to the refrigerant and net heat transfer to the reservoir at 40°C. **(10 Marks)**

**OR**

6 a. Show that entropy is a property of the system. **(04 Marks)**

b. Derive the maximum work attainable from a finite body and a thermal energy reservoir. **(10 Marks)**

c. A lump of steel of mass 10 kg at 627°C is dropped in 100 kg of oil at 30°C. The specific heats of steel and oil are 0.5 kJ/kgK and 3.5 kJ/kgK respectively. Calculate the entropy change of steel, the oil and the universe. **(06 Marks)**

## Module-4

7 a. Explain the concept of available and unavailable energy. **(04 Marks)**

b. Write Maxell relations and explain the terms involved. **(06 Marks)**

c. A vessel of volume 0.04 $m^3$ contains a mixture of saturated water and saturated steam of a temperature of 250°C. The mass of liquid present is 9 kg. Find the pressure, mass, specific volume, enthalpy and internal energy. **(10 Marks)**

**OR**

8 a. With a neat sketch, explain the working of combined separating and throttling calorimeter. **(10 Marks)**

b. Steam at 10 bar and dry state is cooled under constant pressure until it becomes 0.85 dry. Using steam tables, find the work done, change in enthalpy, heat transferred and change in entropy. **(10 Marks)**

## Module-5

9 a. Determine the Vander Waal's constant in terms of critical properties. **(08 Marks)**

b. Explain the following:
(i) Generalized compressibility chart
(ii) Law of corresponding state
(iii) Compressibility factor **(04 Marks)**

c. Determine the pressure exerted by carbon dioxide in a container of 1.5 $m^3$ capacity when it contains 5 kg at 27°C using (i) Ideal gas equation (iii) Vander Waal's equation. Take Vander Waal's constant for $CO_2$ as a = 364.3 $kNm^4/kgmol^2$, b = 0.0427 $m^3/kgmol$. **(08 Marks)**

**OR**

10 a. Explain Dalton's law if partial pressure and Amagat's law of additive volumes with reference to ideal gas mixture. **(08 Marks)**

b. Derive an expression for internal energy and enthalpy of gaseous mixtures. **(04 Marks)**

c. A mixture of gases contains 1 kg of $CO_2$ and 1.5 kg and $N_2$. The pressure and temperature of the mixture are 3.5 bar and 27°C. Determine for the mixture :
(i) The mass and mole fraction of each constituent gas
(ii) Average molecular weight
(iii) The partial pressure **(08 Marks)**

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CBCS SCHEME

USN | | | | | | | | | | |

18ME34

# Third Semester B.E. Degree Examination, Jan./Feb. 2021
## Material Science

Time: 3 hrs. Max. Marks: 100

**Note:** ***Answer any FIVE full questions, choosing ONE full question from each module.***

Important Note : 1. On completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages.
2. Any revealing of identification, appeal to evaluator and /or equations written eg, 42+8 = 50, will be treated as malpractice.

### Module-1

1 a. Calculate APF for FCC crystal structure. **(06 Marks)**

b. Discuss briefly point and line imperfections in crystals. **(06 Marks)**

c. What is Fick's law of diffusion? Explain the factors affecting diffusion. **(08 Marks)**

**OR**

2 a. With a stress – strain diagram for mild steel. Explain yield strength, ductility , toughness and ultimate tensile strength. **(06 Marks)**

b. Show that $\epsilon' = \ln(1 + \epsilon)$. **(04 Marks)**

c. A plain – carbon steel rod is subjected to a tensile load of 7000 kg. Assume no change in volume during extension, determine engineering stress, engineering strain , true stress and true - strain. The initial diameter of the rod is 13mm and the specimen under load is 12mm. **(10 Marks)**

### Module-2

3 a. Discuss Type I , Type II and Type III fractures. **(10 Marks)**

b. What is Fatigue? Explain fatigue testing with a sketch. **(06 Marks)**

c. Explain three stages of Creep process. **(04 Marks)**

**OR**

4 a. What is a Solid solution? Discuss Hume – Rothary rules for formation of Solid - solution. **(05 Marks)**

b. Draw a neat Iron – Carbon equilibrium diagram and label all phases and write invariant reactions like eutectoid , eutectic and peritectic reactions. **(10 Marks)**

c. Derive an expression for critical radius in homogeneous nucleation and discuss the significance of this critical radius. **(05 Marks)**

### Module-3

5 a. Explain Annealing , Normalizing and Hardening heat treatment processes. **(06 Marks)**

b. With the help of TTT and CCT diagrams, explain mar tempering and give one industrial application. **(10 Marks)**

c. What is Hardenability? Discuss various factors affecting hardenability. **(04 Marks)**

**OR**

6 a. Discuss 'Nitriding' and 'Flame – hardening' processes. **(08 Marks)**

b. With Aℓ - Cu phase diagram, explain age – hardening process. **(08 Marks)**

c. Explain properties, composition and uses of Gray Cast Iron. **(04 Marks)**

### Module-4

7 a. Give a broad classification of composites. **(04 Marks)**

b. Discuss various applications of composites. **(06 Marks)**

c. Explain 'Pultrusion process' for manufacturing composites. **(10 Marks)**

**OR**

8 a. Discuss 'Characterization of Composites'. **(06 Marks)**

b. Explain 'Filament winding process' for producing FRPs. **(08 Marks)**

c. Calculate the modulus of elasticity, tensile strength and the fraction of the load carried by the fibre for the following composite material stresses under iso strain condition. The composite consists of a continuous glass fibre – reinforced epoxy resin produced by using 60% by volume of E – glass fiber having a modulus of elasticity of $72400 \times 10^6$ N/m$^2$ and a tensile strength of $2400 \times 10^6$ N/m$^2$ and a hardened epoxy resin with a modulus of elasticity of $3100 \times 10^6$ N/m$^2$ and a tensile strength of $60 \times 10^6$ N/m$^2$. **(06 Marks)**

## Module-5

9 a. Explain types and properties of Ceramics. **(08 Marks)**

b. Explain 'Injection and Moulding' process for producing polymers. **(06 Marks)**

c. List out various applications of ceramics and polymers. **(06 Marks)**

**OR**

10 a. What are Smart Materials? Discuss the functioning of shape memory alloy. **(08 Marks)**

b. Explain biological and other applications of SMA. **(06 Marks)**

c. What are the factors to be considered for the Selection of materials? Discuss. **(06 Marks)**

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ATME College of Engineering

Department of Mechanical Engineering

## Webinar conducted details-2020-21

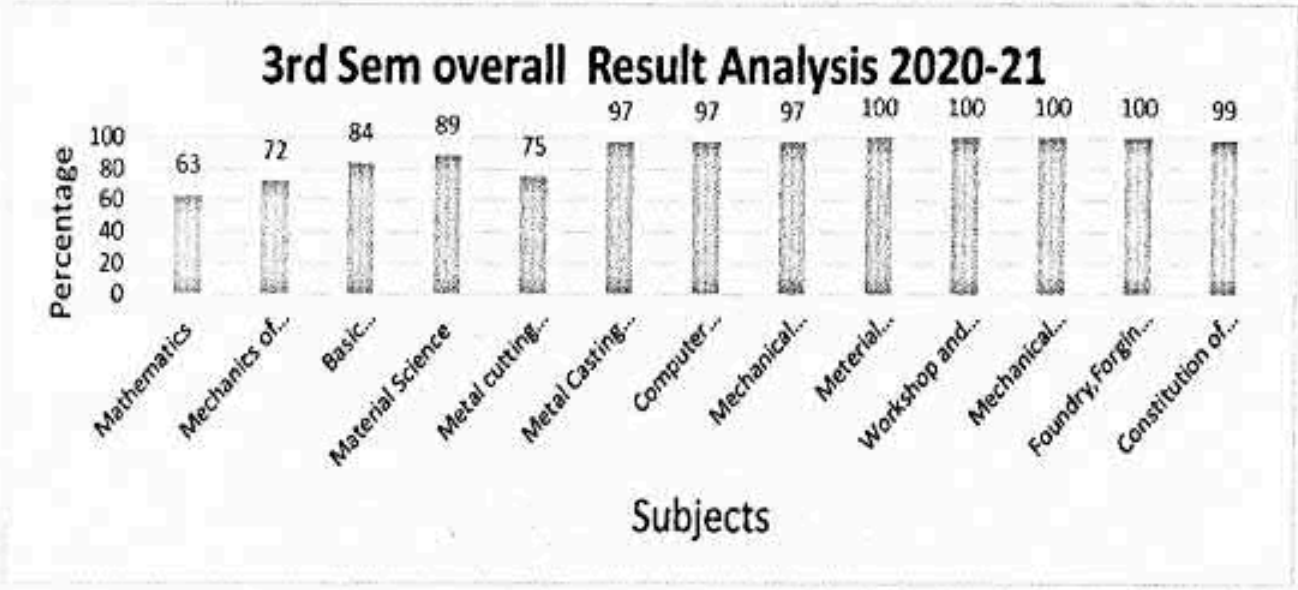
| Sl. No. | Date | Title | Resource Person |
|---|---|---|---|
| 1 | 06-01-2021 | **"Standardization in Industry"** | **Mr. N. Srinivasa Murthy,** Senior Manager-**Bosch Ltd.** Bangalore |
| 2 | 14-10-2020 | National Webinar on **"Latest Technologies in Manufacturing & Area of Focus for Today's Engineering Students"** | **Mr. R. NANJUNDA NAIKA,** Asst. General Manager Head – Service Training Centre, **M/s BEML Limited,** Truck Division, Mysuru. |
| 3 | 25-09-2020 | **"Tolerance Stack up Analysis"** | **Mr. Vinayak Naik,** Sr. Engineer **Midea America Research Center** 2700 Chestnut Station Ct. Louisville, KY 40229, **USA** |
| 4 | 01-09-2020 | **"Effective Presentation Skills"** | **Mr. MuralidharGovindaswamy** Consultant Company: **Royal KPN N.V, Wilhelminakade Rotterdam The Netherlands** |
| 5 | 29-08-2020 | **"Best Career options and Preparedness after Engineering"** | **Mr.Anilkumar** Dy. Project Manager **National Building Construction Corporation (NBCC)** Govt. of India Enterprise Central Govt. complex NBCC Bhavan **New Delhi-110003** |
| 6 | 21/12/2020 | Webinar series On technical domain | webinar on Machine Learning for MechanicalEngineering Students **Dr.Prajna M R** Associate Professor, Department of C S & E,K V G College of Engineering. |
| 7 | **5/8/2021** | **Technical talk( Overview of NVH Technology and CNC technology)** | **Mr. Praveen and Pavan Kumar GTTC Mysuru** |
| 8 | **14/8/2021** | **Webinar** "Hybrid Electric Vehicle Technology" by Toyota Kirloskar Motor Pvt. Ltd | **Mr.Ashwin D souza**Toyota Kirloskar Motor Pvt. Ltd, Bangalore |

H.O.D
Department of Mechanical Engineering
ATME College of Engineering, Mysuru

## Result analysis of Odd Semester- Academic Year- 2020-21

| Class | No. of Students | No. of Pass | FCD | FC | SC | Pass % |
|---|---|---|---|---|---|---|
| 3rd semester | | | | | | |
| Regular | 36 | 13 | 4 | 8 | 1 | 36 |
| Lateral | 37 | 25 | 7 | 18 | 0 | 68 |
| Overall | 73 | 38 | 11 | 26 | 1 | 52 |
| 5th semester | 132 | 68 | 13 | 52 | 3 | 52 |
| 7th semester | 102 | 92 | 85 | 7 | 0 | 90 |

**3rd Semester Course wise result**

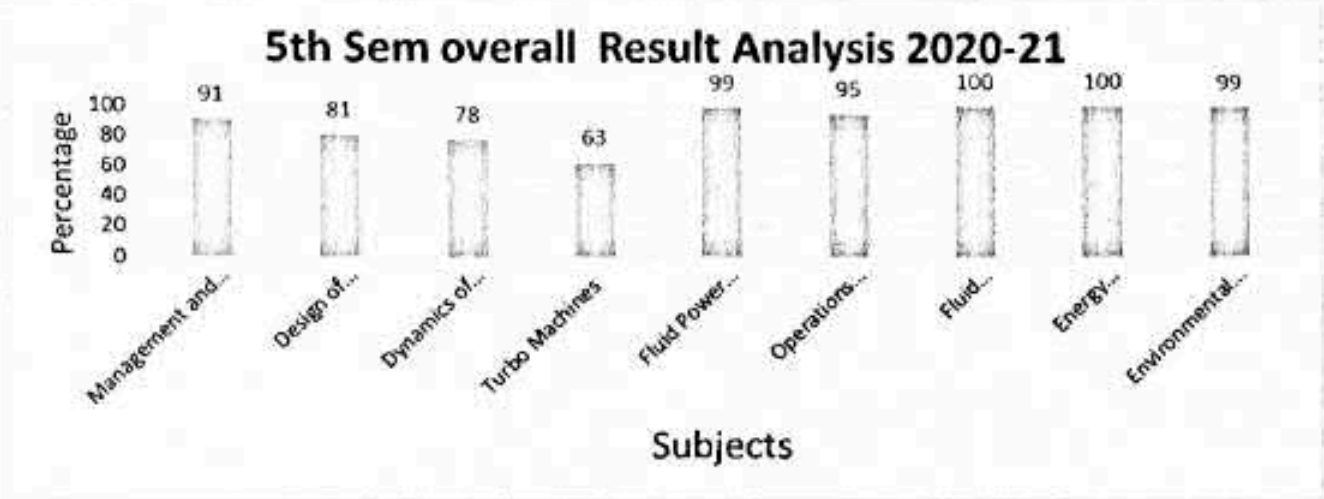



Result Analysis Coordinator

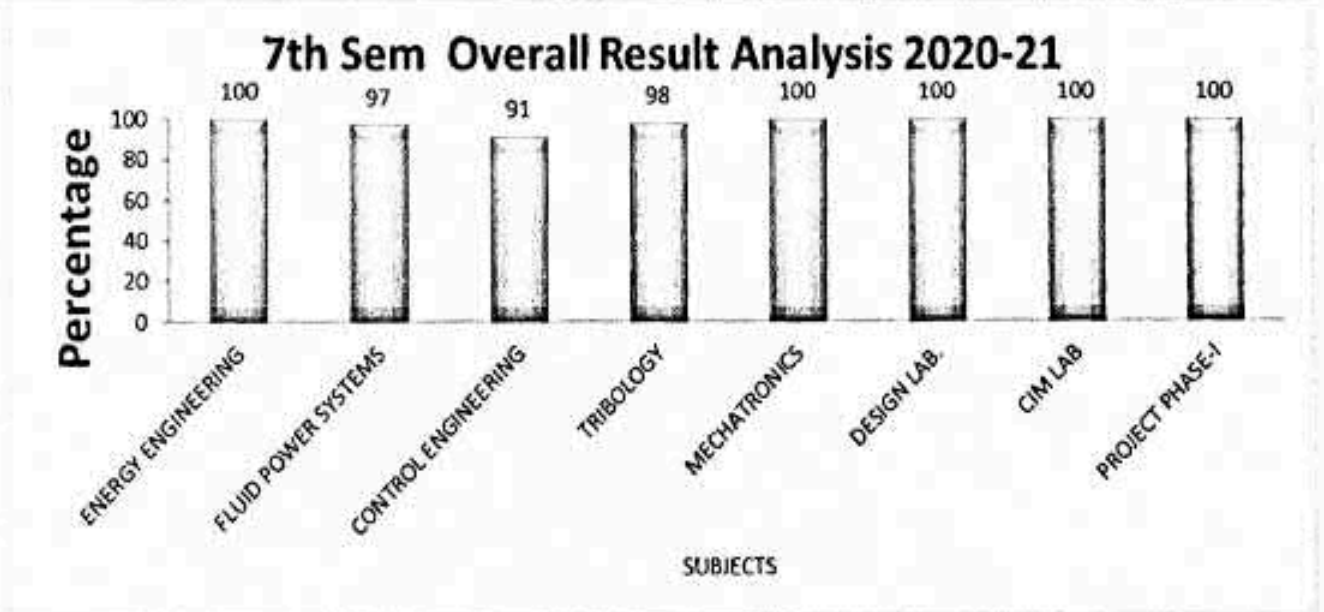
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ATME College of Engineering
Mysuru - 570028

**5th Semester Course-wise Result**




7th Semester Course-wise Result




Result Analysis Coordinator

HoD
HOD
Department of Mechanical Engineering
ATME College of Engineering
Mysuru - 570028

| WEEK 1 | | MONDAY DATE | TUESDAY DATE | WEDNESDAY DATE |
|---|---|---|---|---|
| ACTIVITY | Class Hours | | | |
| | Others | | | |
| **WEEK 2** | | **MONDAY 2021 DATE 04** | **TUESDAY 2021 DATE 05** | **WEDNESDAY DATE 06** |
| ACTIVITY | Class Hours | I-B: EME<br>Hello electrical, wind Hydel Energy<br>I-E: Eng. Graphics.<br>Lines, Types, Dimension | III-A: MC Shop.<br>Offline mode:<br>Both morning & Aft...<br>facing, turning, Step turning, knurling Thread & milling. | II-B: EME<br>Global warming & Ozone layer depletion |
| | Others | NBA mock Insp<br>ECE Department | | NBA mock verification CSE "ME" |
| **WEEK 3** | | **MONDAY 2021 DATE 11** | **TUESDAY DATE 12** | **WEDNESDAY DATE 13** |
| ACTIVITY | Class Hours | I-B: EME<br>Laws of Thermodynamics.<br>I-B: Eng. Graphics.<br>Projection of points | NO CLASS | I-B: EME<br>Steam & its Properties. |
| | Others | Webinar on "Faculty Entrepreneurship Opportunities" | Finished preparation of Project Rubrics Phase-I | NBA Cr.3 verification regarding attainment of CO's. |

# WORK DONE DIARY

ATME College of Engineering

| WEEK 1 | | THURSDAY DATE | FRIDAY 2021 DATE 01 | SATURDAY 2021 DATE 02 |
|---|---|---|---|---|
| ACTIVITY | Class Hours | | I-K: Introduction to the Engineering Graphics course.<br>I-K: Introduction to the EME course. | I-B: Introduction, Energy sources ED Renewable & Non-Ren.<br>III-A: PE&Hop lab<br>Syllabus Class: Lathe work, Fitting Marking & Plate bending |
| | Others | | | |

| WEEK 2 | | THURSDAY DATE 07 | FRIDAY DATE 08 | SATURDAY DATE 09 |
|---|---|---|---|---|
| ACTIVITY | Class Hours | III-A: PE&Hop<br>Milling, Slot cutting done effectively.<br>Lathe work taught.<br>I-K: Engg Graphics<br>Int. to Solidedge SW4 | I-K: Engg Graphics<br>Projection concepts, Planes, projection of points.<br>I-B: EME<br>Introduction of Thermodynamics. | LIBRARY |
| | Others | NBA meet Verification EEE Dept. | NBA meet Verification CV Dept. | |

| WEEK 3 | | THURSDAY DATE 14 | FRIDAY DATE 15 | SATURDAY DATE 16 |
|---|---|---|---|---|
| ACTIVITY | Class Hours | PONGAL<br>SANKRANTHI<br>HOLIDAY | I-K: Engg Graphics<br>Projection of points problems.<br>I-B: EME<br>Problems on Steam | I-B: EME<br>Problems on Heat & work |
| | Others | | | |

| WEEK 4 | | MONDAY DATE 18 | TUESDAY 2021 DATE 19 | WEDNESDAY 20 DATE |
|---|---|---|---|---|
| ACTIVITY | Class Hours | I-B: Revision of mod-I, Energy & resources.<br>I-F: Engg. Graphics. lab, Tools, layout & Solid edge ST4 | I-E: EGDL<br>Introduction, projection of points. lab work- Intro to layout<br>III- A2: Workshop:<br>Thread cutting Demo | I-B: FME<br>Revision of Thermo-dynamics, Steam problems on Steam |
| | Others | Meeting with Dean Academics regarding FDP on NEP-2020 | | * updation of lesson plan.<br>* Details regarding MOU's & format to Principal. |

| WEEK 5 | | MONDAY 25 DATE | TUESDAY 26 DATE | WEDNESDAY 27 DATE |
|---|---|---|---|---|
| ACTIVITY | Class Hours | I-B: FME:<br>Turbines, Introduction Classification. Pelton wheel.<br>I-E: EGDL<br>Lines. | REPUBLIC DAY. | I-B: FME<br>Turbines: Francis turbine, kaplan turbine. |
| | Others | FDP work, Certificate & Feedback preparation | — | FDP related work & meeting with Dean. |

| FEB WEEK 6 | | MONDAY 01 DATE | TUESDAY 02 DATE | WEDNESDAY 03 DATE |
|---|---|---|---|---|
| ACTIVITY | Class Hours | I-Internal Assessment<br>* Presented NBA presentation in Dean's Hall. | I- Internal Assessment | I-B: Centrifugal & Reciprocating pump. Cavitation & Priming in pumps. |
| | Others | * VTU Resume billing.<br>* preparation of NEP PPT. | | * Day-2 ; FDP on NEP-2020<br>* Feedback & certificates for Ext. participants are mailed. |

# WORK DONE DIARY

ATME College of Engineering

| WEEK 4 | | THURSDAY 21 DATE | FRIDAY 22 DATE | SATURDAY 23 DATE |
|---|---|---|---|---|
| ACTIVITY | Class Hours | I-B: EME<br>Boilers, Diff between WTB & FTB, Lancashire boiler. | I-B: EME<br>Babcock & Wilcox boiler, Boiler mountings & Accessories.<br>I-B: Engg Graphics.<br>Problems on lines. | WEEK-OFF |
| | Others | *Discussion with Dean Academics in Dept (IQAC)<br>*NBA meeting with Dean & Coordinators. | *Completed assignment & MCQ's, Week 5 Observations & APPIT: TTHE | - |

| WEEK 5 | | THURSDAY 28 DATE | FRIDAY 29 DATE | SATURDAY 30 DATE |
|---|---|---|---|---|
| ACTIVITY | Class Hours | I-B: EME:<br>Pumps, classification of pumps | ONE DAY FDP on NEP-2020<br>- | I - INTERNAL ASSESSMENT |
| | Others | NEP-2020 FDP work. | to Coordinator work. | *Resume. billing<br>*NBA PPT preparation. |

| WEEK 6 | | THURSDAY 04 DATE | FRIDAY 05 DATE | SATURDAY 06 DATE |
|---|---|---|---|---|
| ACTIVITY | Class Hours | I-B: Mod 3: I.C. Engine<br>Classification of I.C. Engine.<br>Nomenclature of an I.C. Engine. | I-B: Mod 3.<br>4-Stroke petrol Engine<br>4-Stroke Diesel Engine<br>E: Planes:<br>Introduction, Planes - Aerofoil Lamina lab work. | WEEK OFF |
| | Others | ISO Audit for 2021-22 | Bluebook Valuation. | |

| WEEK 7 | | MONDAY 08/02 DATE | TUESDAY 09/02 DATE | WEDNESDAY 10/02 DATE |
|---|---|---|---|---|
| ACTIVITY | Class Hours | I-B: Two Stroke petrol Engine & performance Characteristics | I.E.: Projections of Planes. (Triangle+ Rectangle+ pentagon) Theory Class. MC Shop lab: Explanation of Thread Cutting. | E-B: Performance & Direct Engine, Advanced Engine. Numerical problems. |
| | Others | *Bluebook valuation * meeting with Dean Academics regarding NBA. | * N.B.A. coordinators meeting with Dean Academics. | * NBA Guideline modification * mc shop manual updation. |
| **WEEK 8** | | **MONDAY 15/02 DATE** | **TUESDAY 16/02 DATE** | **WEDNESDAY 17/02 DATE** |
| ACTIVITY | Class Hours | ON MEDICAL LEAVE (Lower Back Ache) | ON MEDICAL LEAVE (Lower Back Ache) | IB: Vapour absorption, Air conditioner, Ref properties. IB: Application of Refrigeration, Refrigeration Lathe & Milling MC tool |
| | Others | | | NAAC work. 2019-20 CO-PO-PSO mapping in Excell. PO: Direct+Indirect+Overall PO 2019-20 Batch. |
| **WEEK 9** | | **MONDAY 22/02 DATE** | **TUESDAY 23/02 DATE** | **WEDNESDAY 24/02 DATE** |
| ACTIVITY | Class Hours | II- I.A Internals * Record valuation | II-I.A Internals * Lab. I.A for III-A2 batch. Machine Shop. * L.C.R. Updation. | II- I.A Internals. S.A.-finalization. Engineering Graphics Class 11.15-1.00 2.00-4.00. |
| | Others | *O.P preparation * I.A. Invigilation Duty | *meeting with Dean Academics regarding files. | |

# WORK DONE DIARY

ATME College of Engineering

| WEEK 7 | | THURSDAY 11/02 DATE | FRIDAY 12/02 DATE | SATURDAY 13/02 DATE |
|---|---|---|---|---|
| ACTIVITY | Class Hours | I-B: I.C. Engine problems, Introd. to Refrigeration. | I B: Refrigeration, Definitions, concept & Vapour compression ref. System. I-E: Lab Session. Triangular lamina problems. | TUESDAY TT: I-E: Theory EGDL Class. Pentagonal & Hexagonal lamina. Mc-Shop: Repetation Class |
| | Others | * N.B.A guidelines (CO-attainment). Cr.3. PPT. | * Updation of Cr. 3 file. | * Meeting with Dean Academics on Eng. Graphics. (2-3pm) * HoD. meeting (4-5pm) |
| WEEK 8 | | THURSDAY 18/02 DATE | FRIDAY 19/02 DATE | SATURDAY 20/02 DATE |
| ACTIVITY | Class Hours | I-B: Lathe machine tool, Lathe operations | I-B: Milling machine & milling operations I-E: Hexagon & Circullect lamina problems (Theory) lab - pentagon & Hexagon lamina problems. | WEEK-OFF |
| | Others | * Course Exit Survey (19-22) * CO-PO-PSO (21-22) NAAC. | | |
| WEEK 9 | | THURSDAY 25/02 DATE | FRIDAY 26/02 DATE | SATURDAY 27/02 DATE |
| ACTIVITY | Class Hours | I-B: Machine Shop Demonstration. | I-E: Sq. prism problem in Class, completion of Planes. I-B: completion of module-5, chapter-1. machine tools (milling m/c) | TUESDAY-TT I:E: Pentagonal prism (Theory), Lab: Solids Started. |
| | Others | VTU Exam Invigilation | * completed finalization of I.A. marks of m/c shop lab. | * Exam Invigilation Duty. |

| WEEK 10 | | MONDAY 01/03 DATE | TUESDAY 02/03 DATE | WEDNESDAY 03/03 DATE |
|---|---|---|---|---|
| ACTIVITY | Class Hours | I-B: CNC milling & Application. (3rd hr)<br>II-B: Robotics & its application (4th hr) | IE: Pentagonal problems (Theory)<br>SQ & pentagonal problems. | II-B: Introduction & Basic parts of engineering materials. Labelling introduction.<br>IE: Revision (odd class) |
| | Others | Meeting with Dean Academics from 3.00 - 5.15 p.m. | * NAAC work.<br>* Office work regarding class arrangement (EGDL). | * meeting with Dean regarding EGDL |

| WEEK 11 | | MONDAY 08/03 DATE | TUESDAY 09/03 DATE | WEDNESDAY 10/03 DATE |
|---|---|---|---|---|
| ACTIVITY | Class Hours | CASUAL LEAVE | IB: Additional class open belt drive derivation.<br>IE: Pyramid problems (Both theory & Lab). | IB: Derivation of ratio of tension in belt |
| | Others | | Valuation of EGDL books. | * Sketch book Valuation<br>* EGDL Additional class circulars |

| WEEK 12 | | MONDAY 15/03 DATE | TUESDAY 16/03 DATE | WEDNESDAY 17/03 DATE |
|---|---|---|---|---|
| ACTIVITY | Class Hours | I-B: Problems on belt drives. | I-E: ISO metric problems & Completion of solids in lab. | ON LEAVE (Due to not feeling well)<br>CL |
| | Others | * preparation of SRG/ Quizz slides of module-I & module-II.<br>* meeting with Dean Academics regarding stationary proposal. | | |

| WEEK 10 | | THURSDAY 04/03 DATE | FRIDAY 05/03 DATE | SATURDAY 06/03 DATE |
|---|---|---|---|---|
| ACTIVITY | Class Hours | I-B: Development & ray Acceptance Modeling | I-B: Prism & Pyramid (Introduction). I-F: Prism - Lab problems (Introduction). I-E: Pyramids (Theory) Hexagonal prism (Lab) | I-B: Solid Geometry, Intersection, Classification between Prism. I-E (Add): Lab record. I-F: Solids problems (Lab work). |
| | Others | | | |

| WEEK 11 | | THURSDAY 11/03 DATE | FRIDAY 12/03 DATE | SATURDAY 13/03 DATE |
|---|---|---|---|---|
| ACTIVITY | Class Hours | MAHASHIVRATRI FESTIVAL | I-B: Detection of length Belt to cross belt drive system. I-F: Problems on Pyramids (Lab) I-E: Problems on Cube. | Special Class conducted for I Section Students inorder to complete the portion morning: 8:30-1:00 - Solids Afternoon - 2:00-4:00 - Isometric |
| | Others | | (9-4:45) full in class | WEEK OFF Hexahedron, Cube, Tetrahedron & Cone problems (10-1:00) |

| WEEK 12 | | THURSDAY 18/03 DATE | FRIDAY 19/03 DATE | SATURDAY 20/3 DATE |
|---|---|---|---|---|
| ACTIVITY | Class Hours | I-B: SES- Quiz2 Conducted through MyQuizz in M.S Team | I-B: Power transmission Gear drives. | MONDAY I-B: Gear trains (TP1). I-E: Isometric projection problems (Theory) |
| | Others | * preparation of Assignment, Analysis of SES. | | |

# WORK DONE DIARY

| WEEK 13 | | MONDAY 22/03 DATE | TUESDAY 23/03 DATE | WEDNESDAY 24/03 DATE |
|---|---|---|---|---|
| ACTIVITY | Class Hours | I-B: Gear trains Numericals | I-E: Isometric projection problems | I-B: SCS- Quiz-II module-III & IV. |
| | Others | ITC- Seminar/Mini Investigation | Quiz-II, other Academic work. | Graphics connection |

| WEEK 14 | | MONDAY 29/03 DATE | TUESDAY 30/03 DATE | WEDNESDAY 31/03 DATE |
|---|---|---|---|---|
| ACTIVITY | Class Hours | I-B: Revision Discussion on Mod 1 & 2 | I-E: Developments Cylinder, Pyramid & Conical Sections | I-B: Revision Discussion on mod 3 & 4 |
| | Others | | | |

| WEEK 15 | | MONDAY DATE | TUESDAY DATE | WEDNESDAY DATE |
|---|---|---|---|---|
| ACTIVITY | Class Hours | | | |
| | Others | | | |

# WORK DONE DIARY

ATME College of Engineering

| WEEK 13 | | THURSDAY 25/03 DATE | FRIDAY 26/03 DATE | SATURDAY 27/03 DATE |
|---|---|---|---|---|
| ACTIVITY | Class Hours | end Central lecture. J.B: mod-IV - evaluation & mobilization & C. | J.B: Completion of evaluation, J.B: Discussion of Industry employee by a guest. Finishing | blow: J.B. |
| | Others | | | |

| WEEK 14 | | THURSDAY 01/04 DATE | FRIDAY DATE | SATURDAY DATE |
|---|---|---|---|---|
| ACTIVITY | Class Hours | J.B: Revision on module 5 & Test Briefing. | | |
| | Others | | | |

| WEEK 15 | | THURSDAY DATE | FRIDAY DATE | SATURDAY DATE |
|---|---|---|---|---|
| ACTIVITY | Class Hours | | | |
| | Others | | | |

# ATME College of Engineering

## C1.1.1 - The Institution ensures effective curriculum delivery through a well-planned and documented process

## Supporting Documents

### Index

| Sl. No. | Academic Year | Particulars |
|---|---|---|
| 1 | 2020-21 | Academic Calendar- College |
| 2 | | Teaching Plan |
| 3 | | Department Meeting – Sample MoM |
| 4 | | Learning Outcome- Course Module |
| 5 | | Time Table |
| 6 | | Teaching – Learning resources |
| 7 | | Attendance Record |
| 8 | | Question Bank-VTU Previous Year QP |
| 9 | | Result Analysis |
| 10 | | Teachers Diary |

## ATME COLLEGE OF ENGINEERING, MYSURU

**Revised Academic Calendar (ODD SEMESTER, 2020-21)**

| WEEK | MONTH | SUN | MON | TUE | WED | THU | FRI | SAT | HOLIDAY (H) | COLLEGE EVENTS |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | SEPTEMBER | | | 1 | 2 | 3 | 4 | 5 | | 3rd, 5th & 7th Semester : commencement of Online Classes |
| 2 | | 6 | 7 | 8 | 9 | 10 | 11 | 12 | | |
| 3 | | 13 | 14 | 15 | 16 | 17 | 18 | 19 | Mahalaya Amavasya | |
| 4 | | 20 | 21 | 22 | 23 | 24 | 25 | 26 | | |
| 5 | | 27 | 28 | 29 | 30 | | | | | |
| 6 | OCTOBER | | | | | 1 | 2 | 3 | Gandhi Jayanthi | |
| 6 | | 4 | 5 | 6 | 7 | 8 | 9 | 10 | | First I A for 3rd , 5th and 7th Semester |
| 7 | | 11 | 12 | 13 | 14 | 15 | 16 | 17 | | |
| 8 | | 18 | 19 | 20 | 21 | 22 | 23 | 24 | | |
| 9 | | 25 | 26 | 27 | 28 | 29 | 30 | 31 | Ayudha Pooja, Vijaya Dashami, Eid Milad , Valmiki Jayanthi | |
| 10 | NOVEMBER | 1 | 2 | 3 | 4 | 5 | 6 | 7 | Kannada Rajyotsava | |
| 11 | | 8 | 9 | 10 | 11 | 12 | 13 | 14 | Naraka Chaturdashi | Second IA for 3rd , 5th and 7th Semester |
| 12 | | 15 | 16 | 17 | 18 | 19 | 20 | 21 | Balipadyami | Commencement of On Campus Classes for Semester 7. |
| 13 | | 22 | 23 | 24 | 25 | 26 | 27 | 28 | | |
| 14 | | 29 | 30 | | | | | | | |

Non Working Saturdays

## ATME COLLEGE OF ENGINEERING, MYSURU

**Revised Academic Calendar (ODD SEMESTER, 2020-21)**

| WEEK | MONTH | SUN | MON | TUE | WED | THU | FRI | SAT | HOLIDAY (H) | COLLEGE EVENTS |
|---|---|---|---|---|---|---|---|---|---|---|
| 14 | DECEMBER | | | 1 | 2 | 3 | 4 | 5 | Kanakadasa Jayanthi | |
| 15 | | 6 | 7 | 8 | 9 | 10 | 11 | 12 | | |
| 16 | | 13 | 14 | 15 | 16 | 17 | 18 | 19 | | |
| 17 | | 20 | 21 | 22 | 23 | 24 | 25 | 26 | Christmas | |
| 18 | | 27 | 28 | 29 | 30 | 31 | | | | Third IA for Semesters 3, 5 and 7 |
| 18 | JANUARY | | | | | | 1 | 2 | | |
| 19 | | 3 | 4 | 5 | 6 | 7 | 8 | 9 | | LAB Interenals for Semesters 3,5 and 7 |
| 20 | | 10 | 11 | 12 | 13 | 14 | 15 | 16 | Makra Sankranthi | Improvement IA for Semesters 3,5 and 7, LAST working day for ODD Sem 2020-21 |
| 21 | | 17 | 18 | 19 | 20 | 21 | 22 | 23 | | Comencement of Odd Semester Practical Exams |
| 22 | | 24 | 25 | 26 | 27 | 28 | 29 | 30 | Republic Day | |
| 23 | | 31 | | | | | | | | |
| 23 | FEBRUARY | | 1 | 2 | 3 | 4 | 5 | 6 | | End of Odd Semester Practical Exams |
| 24 | | 7 | 8 | 9 | 10 | 11 | 12 | 13 | | Commencement of Odd Semester Theory Exams |
| 25 | | 14 | 15 | 16 | 17 | 18 | 19 | 20 | | |
| 26 | | 21 | 22 | 23 | 24 | 25 | 26 | 27 | | |
| 27 | | 28 | | | | | | | | |

Non Working Saturdays

| No. Of Working Days | 17 | 20 | 20 | 17 | 17 | 9 | Total No. Of Working Days | 100 |
|---|---|---|---|---|---|---|---|---|

## ATME COLLEGE OF ENGINEERING, MYSURU

**Revised Academic Calendar (ODD SEMESTER, 2020-21)**

| WEEK | MONTH | SUN | MON | TUE | WED | THU | FRI | SAT | HOLIDAY (H) | COLLEGE EVENTS |
|---|---|---|---|---|---|---|---|---|---|---|
| 14 | MARCH | | 1 | 2 | 3 | 4 | 5 | 6 | | |
| 15 | | 7 | 8 | 9 | 10 | 11 | 12 | 13 | Mahashivaratri | |
| 16 | | 14 | 15 | 16 | 17 | 18 | 19 | 20 | | |
| 17 | | 21 | 22 | 23 | 24 | 25 | 26 | 27 | | 26th End of odd semester Theory exams, 26th Mar 2021 Commencement of Even Semester |
| 18 | | 28 | 29 | 30 | 31 | | | | | |
| 18 | APRIL | | | | | 1 | 2 | 3 | Good Friday | |
| 19 | | 4 | 5 | 6 | 7 | 8 | 9 | 10 | | |
| 20 | | 11 | 12 | 13 | 14 | 15 | 16 | 17 | Chadramana Yugadi, Ambedkar Jayanthi | |
| 21 | | 18 | 19 | 20 | 21 | 22 | 23 | 24 | | |
| 22 | | 25 | 26 | 27 | 28 | 29 | 30 | | Mahavir Jayanthi | |
| 23 | MAY | | | | | | | 1 | May Day (Labour Day) | |
| 23 | | 2 | 3 | 4 | 5 | 6 | 7 | 8 | | |
| 24 | | 9 | 10 | 11 | 12 | 13 | 14 | 15 | Idul-Fitr, Basava Jayathi | |
| 25 | | 16 | 17 | 18 | 19 | 20 | 21 | 22 | | |
| 26 | | 23 | 24 | 25 | 26 | 27 | 28 | 29 | | |
| 27 | | 30 | 31 | | | | | | | |

Non Working Saturdays

Sd-
Dr. L Basavaraj
Principal

## ATME COLLEGE OF ENGINEERING, MYSURU

**Academic Calendar (SECOND SEMESTER, 2020-21)**

| WEEK | MONTH | SUN | MON | TUE | WED | THU | FRI | SAT | No. of Days | HOLIDAY (H) | COLLEGE EVENTS |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | MAY | | | | | | | 1 | | May Day | |
| | | 2 | 3 | 4 | 5 | 6 | 7 | 8 | | | |
| | | 9 | 10 | 11 | 12 | 13 | 14 | 15 | | Basava Jayanthi | |
| 1 | | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 4 | | Commencement of Second Sem |
| 2 | | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 6 | | |
| 3 | | 30 | 31 | | | | | | | | |
| 3 | JUNE | | | 1 | 2 | 3 | 4 | 5 | 6 | | |
| 4 | | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 6 | | |
| 5 | | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 6 | | End of First Session of Mentoring |
| 6 | | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 6 | | |
| 7 | | 27 | 28 | 29 | 30 | | | | | | |
| 7 | JULY | | | | | 1 | 2 | 3 | 6 | | First IA |
| 8 | | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 6 | | First IA |
| 9 | | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 6 | | Attendance and IA to Parents |
| 10 | | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 5 | Bakrid | End of Second Session of Mentoring |
| 11 | | 25 | 26 | 27 | 28 | 29 | 30 | 31 | 6 | | |

## ATME COLLEGE OF ENGINEERING, MYSURU
Academic Calendar (SECOND SEMESTER, 2020-21)

| WEEK | MONTH | SUN | MON | TUE | WED | THU | FRI | SAT | No. of Days | HOLIDAY (H) | COLLEGE EVENTS |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 12 | AUGUST | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 6 | | |
| 13 | | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 6 | | |
| 14 | | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 5 | Last Day of Moharram | |
| 15 | | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 6 | | |
| 16 | | 29 | 30 | 31 | | | | | | | Attendance & IA to Parents |
| 16 | SEPTEMBER | | | | 1 | 2 | 3 | 4 | 6 | | Second IA |
| 17 | | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 5 | Ganesh Chathurthi | Second IA |
| 18 | | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 6 | | |
| 19 | | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 5 | | End of Third Session of Mentoring |
| 20 | | 26 | 27 | 28 | 29 | 30 | | | 4 | | Third IA, End of Second Semeste. |
| | OCTOBER | | | | | | 1 | 2 | | Gandhi Jayanthi | Attendace & IA to Parents |
| | | 3 | 4 | 5 | 6 | 7 | 8 | 9 | | Mahalaya Amavasya | Commencement of Lab Exams for Second Sem |
| | | 10 | 11 | 12 | 13 | 14 | 15 | 16 | | Ayudhapooja, Vijaya Dashami | |
| | | 17 | 18 | 19 | 20 | 21 | 22 | 23 | | Valmiki Jayanthi, Eid-Milad | End of Lab Exams for Second Semester. Commencement of Theory Exams for 2nd Sem |
| | | 24 | 25 | 26 | 27 | 28 | 29 | 30 | | | |
| | | 31 | | | | | | | | | |
| TOTAL NUMBER OF WORKING DAYS IN THE SEMESTER | | | | | | | | | | | 112 |

ATME COLLEGE OF ENGINEERING, MYSURU
Academic Calendar (SECOND SEMESTER, 2020-21)

| WEEK | MONTH | SUN | MON | TUE | WED | THU | FRI | SAT | No. of Days | HOLIDAY (H) | COLLEGE EVENTS |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | NOVEMBER | | 1 | 2 | 3 | 4 | 5 | 6 | | Kannada Rajyotsava Naraka Chaturdashi, Balipadyami | |
| | | 7 | 8 | 9 | 10 | 11 | 12 | 13 | | | End of Theory Exams for 2nd Sem |
| | | 14 | 15 | 16 | 17 | 18 | 19 | 20 | | | Commencement of 2021-22 First Semester |
| | | 21 | 22 | 23 | 24 | 25 | 26 | 27 | | Kanakadasa Jayanthi | |
| | | 28 | 29 | 30 | | | | | | | |
| | | | | | | | | | | | |
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Sd/-
Dr. Govinde Gowda M S
Dean Academics

Sd/-
Dr. L Basavaraj
Principal

A T M E — Lesson Plan

Engineering Physics - 18PHY12 — Semester & Section : 1st Sec — Final

| Class No | Date Planned | Topics proposed to be covered | Topic Covered Date | Remarks |
|---|---|---|---|---|
| | | Module-1 | 26-8-19 | |
| 1 | 26-8-19 | Brief introduction to course | 26-8-19 | |
| 2 | 27-8-19 | Module-1: Free oscillations: Definition of SHM, | 27-8-19 | |
| 3 | 28-8-19 | Mechanical simple harmonic oscillator characteristics of SHM, natural frequency | 28-8-19 | |
| 4 | 29-8-19 | Combination of springs: theory of damped oscillations | 29-8-19 | |
| 5 | 30-8-19 | over damping, critical damping & under damping | 30-8-19 | |
| 6 | 31-8-19 | theory of forced oscillations (simple problems) differential equation of forced oscillations, Quality factor | 31-8-19 | |
| 7 | 03-9-19 | Numerical problems | 03-9-19 | |
| 8 | 04-9-19 | Numerical problems | 04-9-19 | |
| 9 | 05-9-19 | Shock waves: classification, mach number, mach regimes, properties of shock waves | 05-9-19 | |
| 10 | 06-9-19 | Central volume, Laws of conservation of mass, | 06-9-19 | |
| 11 | 07-9-19 | Energy and momentum, Rankine Hugoniot equations and velocity of Bubble shock tube | 07-9-19 | |
| 12 | 11-9-19 | Applications of shock waves, Numerical problems | 09/9/19 | |
| 13 | 12-9-19 | Numerical problems | 10/9/19 | |
| 14 | 13-9-19 | Module-2: Elasticity: concept of elasticity, Hooke's law, stress-strain curve, strain energy & | 11/9/19 | Lab |
| 15 | 16-9-19 | Poisson's ratio, relation between elastic constants, Torsion of cylinder, | 12/9/19 | |
| 16 | 17-9-19 | Torsional pendulum: theory and experiment, | 13/9/19 | |
| 17 | 18-9-19 | Bending of beam: Bending moment, Cantilever, | 14/9/19 | |
| 18 | 19-9-19 | Beam supported at both ends, uniform bending, | 16/9/19 | |
| 19 | 20-9-19 | Numerical Problems | 17/9/19 | |
| 20 | 23-9-19 | Bending of beam: neutral surface and moment of inertia, Expression for bending moment, | 18/9/19 | |
| 21 | 24-9-19 | Uniform bending: Expression for Young's modulus, single cantilever: theory | 20/9/19 | |
| 22 | 25-9-19 | Numerical Problems | 21/9/19 | Home assignment 26/9/19 |
| 23 | 26-9-19 | Torsion of cylinder: Expression for couple per unit twist of a solid cylinder | 27/9/19 | |
| 24 | 27-9-19 | Torsional Pendulum: Numerical Problems | 27/9/19 | |
| 25 | 30-9-19 | Module-3: Modules of rigidity: Fundamentals of wave motion, Differential equation for wave motion, | 30/9/19 | |

| | | | | |
|---|---|---|---|---|
| 26 | 01-10-19 | Concept of wave intensity, Superposition of waves | 01/10/19 | |
| 27 | 03-10-19 | Group velocity, Phase velocity, Stoke's theorem, Relation between group velocity and phase velocity | 03/10/19 | |
| 28 | 04-10-19 | Particle velocity, Wave velocity in a medium, Brief Recall of Gauss law of electrostatics | 04/10/19 | |
| 29 | 07-10-19 | Application of Gauss law to find electric field due to infinite plane sheet of charge, | 07/10/19 | |
| 30 | 08-10-19 | Electric field due to charged conducting sphere, Electric field due to charged spherical shell, | 08/10/19 | |
| 31 | 10-10-19 | Electric field due to charged wire, Electric field due to charged plane sheet using Gauss law, | 10/10/19 | |
| 32 | 11-10-19 | Capacitance of parallel plate capacitor, Capacitance of spherical capacitor, | 11/10/19 | |
| 33 | 14-10-19 | Energy density in electrostatic field, Energy stored in capacitor, | 14/10/19 | |
| 34 | 15-10-19 | Dielectric medium, Polarization, Polarization vector, Relation between D, E and P, | 15/10/19 | |
| 35 | 17-10-19 | Gauss law in dielectric medium, Electric susceptibility, Dielectric constant, Relation between dielectric constant and susceptibility, | 17/10/19 | |
| 36 | 18-10-19 | Numerical Problems | 18/10/19 | |
| 37 | 21-10-19 | Module-4: Quantum mechanics: Introduction, Black body radiation, Planck's explanation for energy density, | 21/10/19 | |
| 38 | 22-10-19 | Wien's and Rayleigh-Jeans formula from Planck's law, Photoelectric effect, Experimental study of photoelectric effect, | 22/10/19 | |
| 39 | 24-10-19 | Laws of photoelectric emission, Einstein's photoelectric equation, Compton effect, | 24/10/19 | |
| 40 | 25-10-19 | Theory of Compton effect, Wave nature of particles, de-Broglie hypothesis, | 25/10/19 | |
| 41 | 28-10-19 | Phase velocity and group velocity, Relation between phase velocity and group velocity, | 28/10/19 | Lab Completed |
| 42 | 29-10-19 | Davisson-Germer experimental verification of de-Broglie hypothesis, Heisenberg's uncertainty Principle, Position probability density, | 29/10/19 | |
| 43 | 31-10-19 | Physical significance of wave function, Properties of wave function, Normalization, | 31/10/19 | |
| 44 | 01-11-19 | Eigen values & Eigen functions, Postulates of quantum mechanics, | 01/11/19 | |
| 45 | 04-11-19 | Time dependent Schrodinger wave equation, Particle in a 1-D Potential well of infinite height, | 04/11/19 | |
| 46 | 05-11-19 | Numerical Problems | 05/11/19 | |
| 47 | 07-11-19 | Laser: Introduction and Principle, Spontaneous and stimulated emission, Einstein's coefficients, Population inversion, Pumping mechanisms, | 07/11/19 | |
| 48 | 08-11-19 | Metastable state, Requirements of Laser system, Construction and working of CO2 Laser and Nd-YAG laser, | 08/11/19 | |
| 49 | 11-11-19 | Applications of lasers in engineering and medicine, | 11/11/19 | |
| 50 | 12-11-19 | Concept of Holography, Recording and reconstruction of a hologram, Applications of Holography, | 12/11/19 | |
| 51 | 14-11-19 | Fiber optics: Principle of optical fiber, Numerical Aperture and acceptance angle, | 14/11/19 | |
| 52 | 15-11-19 | Types of optical fiber, Numerical Problems | 15/11/19 | |
| 53 | 18-11-19 | Fiber optic communication system (Block diagram), Advantages of optical fiber communication, | 18/11/19 | |
| 54 | 19-11-19 | Applications of optical fibers in various fields, Fiber optic sensors: Pressure and displacement sensors, | 19/11/19 | |
| 55 | 21-11-19 | Temperature and liquid level sensors, Numerical Problems | 21/11/19 | |
| 56 | 22-11-19 | Module-5: Acoustics and Ultrasonics: Classification of sound, Loudness, Intensity level, Absorption coefficient and Reverberation time, | 22/11/19 | |
| 57 | 25-11-19 | Sabine's formula, Derivation using growth and decay method, Factors affecting architectural acoustics and their remedies, | 25/11/19 | |
| 58 | 26-11-19 | Production of ultrasonics by magnetostriction and piezoelectric methods, Detection of ultrasonics, | 26/11/19 | |
| 59 | 28-11-19 | Properties of ultrasonics, Applications of ultrasonics in various fields, Ultrasonic Diffractometer, | 28/11/19 | |
| 60 | 29-11-19 | Determination of velocity of sound in liquids, Numerical Problems | 29/11/19 | |

Faculty Member Signature — HOD Signature

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A T M E College of Engineering

## DEPARTMENT OF BASIC SCIENCES AND HUMANITIES
## C-CYCLE

### Minutes Of Meeting – First Year Faculty (C-Cycle-even sem)

Department Of Chemistry,06/10 /2020, 5:00 PM

**Agenda:** Attendance Status, Final IA marks, Mentoring, Syllabus completion, Assignment.

**Minutes:**

1. Student's attendance is discussed. Student's with low attendance should be identified and the list and sent to VTU.
2. Final IA marks should be finalized as soon as possible. Students who have below average marks should be given a chance to improve their IA marks. Finalized marks should be uploaded in VTU Portal.
3. IA marks to be entered in CERP after finalization.
4. Discussed about the mentoring and the same to be uploaded in CERP
5. Assignments given are to be documented.
6. Discussed about Syllabus completion and found all the subjects portion is completed as per the lesson plan.

**Members Present online:**

1. Dr. Mohamed Eliyas , HOD Chemistry
2. Dr. Avinash K
3. Mr. Kiran Kumar P
4. Mr. Sudakar N, HOD Maths Sudhakar.N
5. Mr. Madhusudhan K V
6. Mrs. Divya K
7. Ms. Bharathi R
8. Mrs. Shalini VS
9. Mr. Tejkumar J
10. Mr. Pradeep Kumar Y
11. Mr. Arjun MS
12. Mr. Mohan Kumar KC
13. Mr. Shrinivasa G
14. Ms. Kavyashree ED

ATME College of Engineering
DEPARTMENT OF BASIC SCIENCES AND HUMANITIES

**PERSONAL TIME TABLE FOR ODD SEMESTER 2020-2021**

**STAFF NAME: Mr Ramachandra M N**

| DAY TIME | 9.00 10.00 | 10.00 11.00 | 11.00 11.15 | 11.15 12.15 | 12.15 1.15 | 1.15 2.00 | 2.00 2.55 | 2.55 3.50 | 3.50 4.45 |
|---|---|---|---|---|---|---|---|---|---|
| Mon | | E-1 Batch | | F | E-1 Batch | Lunch Break | G | | |
| Tue | G | F | G-1 Batch | | | | F-1 Batch | | |
| Wed | | | | F | G | | | | |
| Thu | | F-2 Batch | | | G | | E-1 Batch | F | E-1 Batch |
| Fri | F | G | | | | | G-2 Batch | | |
| Sat | | | | | | | | | |

| Curricular | | Units | Co-curricular | Units |
|---|---|---|---|---|
| Lecture | 8h*2units | 16 | Lab Incharge | 1 |
| Lab | 12h*1unit | 12 | Mentor | 1 |
| Tutorial | 2h*2unit | 4 | Anti Ragging Member secretary | 1 |
| Lab Co | 6*1units | 6 | SSP E-Attestation Officer | 6 |
| Total | | 38 | | 9 |

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HOD

ATME College of Engineering
DEPARTMENT OF BASIC SCIENCES AND HUMANITIES

**PERSONAL TIME TABLE FOR ODD SEMESTER 2020-2021**

**STAFF NAME: Dr Mahesh Lohith K S**

| DAY TIME | 9.00 10.00 | 10.00 11.00 | 11.00 11.15 | 11.15 12.15 | 12.15 1.15 | 1.15 2.00 | 2.00 2.55 | 2.55 3.50 | 3.50 4.45 |
|---|---|---|---|---|---|---|---|---|---|
| Mon | E | E-1 Batch | | | | Lunch Break | | | |
| Tue | E | G-1 Batch | | | | | F-1 Batch | | |
| Wed | | E | | | | | | | |
| Thu | E | F-2 Batch | | | | | E-2 Batch | | |
| Fri | | | Break | E | | | G-2 Batch | | |
| Sat | | | | | | | | | |

| Curricular | | Units | Co-curricular | Units |
|---|---|---|---|---|
| Lecture | 4h*2units | 8 | HOD | 6 |
| Lab | 6h*1unit | 6 | NBA coordinator | 2 |
| Tutorial | 1h*2unit | 2 | | |
| Lab Co | 12h*1units | 12 | | |
| Total | | 28 | | 8 |

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HOD

A T M E College of Engineering
DEPARTMENT OF BASIC SCIENCES AND HUMANITIES
Approved by AICTE (New Delhi) and Affiliated to VTU (Belagavi).13th km Stone, Bannur Road, Mysuru - 570028

**COURSE MODULES OF THE SUBJECT TAUGHT FOR THE SESSION 2020-21**

**Course Syllabi with CO's**

| Faculty Name : | | | Academic Year: **2020-21** | | | | |
|---|---|---|---|---|---|---|---|
| Department: Chemistry | | | | | | | |
| Course Code | Course Title | Core/Elective | Prerequisite | Contact Hours | | | Total Hrs/ Sessions |
| | | | | L | T | P | |
| **18CHE12/22** | **Engineering Chemistry** | **Core** | Electrochemistry, Thermodynamics, Corrosion, Polymers, Hydrology, Nanoscience | **3** | **2** | - | **50** |
| **Objectives** | • To acquire knowledge and comprehend fundamentals of electrochemistry, batteries and Fuel cells.<br>• Acquire the knowledge of various types of Corrosion, their significance and preventive measures. Importance of metal coating.<br>• Know the importance and present research investigation in the field of fuels and solar energy.<br>• Gain knowledge about types of boiler problems, various physical and chemical techniques for water treatment and its analysis, desalination process used to produce potable water from brackish water.<br>• Gain chemical knowledge on concepts of polymers, their structural properties and gain basic knowledge about nanomaterials, fullerenes and Dendrimers and able to apply them in multi-disciplinary fields | | | | | | |

**Topics Covered as per Syllabus**

**Module 1:**

**Electrochemistry and Energy storage systems**

**Use of free energy in chemical equilibria**: Thermodynamic functions: Definitions of free energy and entropy. Cell potential, derivation of Nernst equation for single electrode potential, numerical problems on E, EO, and E cell

**Electrochemical energy systems:** Reference electrodes: Introduction, construction, working and applications of Calomel electrode. Ion-selective electrode - Definition, construction and principle of Glass electrode and determination of pH using glass electrode. Electrolyte concentration cells, numerical problems

**Energy storage systems:** Introduction, classification - primary, secondary and reserve batteries. Construction, working and applications of Ni-MH and Li-ion batteries. **(RBT Levels: L3)**

**Module 2:**

**Corrosion and Metal finishing**

**Corrosion:** Introduction, Electrochemical theory of corrosion, Factors affecting the rate of corrosion: ratio of anodic to cathodic areas, nature of corrosion product, and nature of medium -pH, conductivity and temperature. Types of corrosion - Differential metal and differential aeration - pitting and water line). Corrosion control: Anodizing - Anodizing of aluminum, Cathodic protection - sacrificial anode and impressed current methods, Metal coatings – Galvanization. **Metal finishing**: Introduction, Technological importance. Electroplating: Introduction, principles governing electroplating-Polarization, decomposition potential and overvoltage. Electroplating of chromium (hard and decorative). Electroless plating: Introduction, Electroless plating of nickel & copper, distinction between electroplating and Electroless plating processes. **(RBT Levels: L1 & L2)**

**Module 3:**

**Energy Systems:**

**Chemical Fuels:** Introduction, classification, definitions of CV, LCV, and HCV, determination of calorific value of solid/liquid fuel using bomb calorimeter, numerical problems. Knocking of petrol engine - Definition, mechanism, ill effects and prevention. Power alcohol, unleaded petrol and biodiesel. **Fuel Cells:** Introduction, differences between conventional cell and fuel cell, limitations & advantages. Construction, working & applications of methanol- oxygen fuel cell with H2S04 electrolyte, and solid oxide fuel cell (SOFCs). **Solar Energy:** Photovoltaic cells-introduction, construction and working of a typical PV cell, Preparation of solar grade silicon by Union Carbide Process/Method. Advantages & disadvantages of PV cells. **(RBT Levels: L3)**

**Module 4:**

**Environmental Pollution and Water Chemistry**

**Environmental Pollution**: Air pollutants: Sources, effects and control of primary air pollutants: Carbon monoxide, Oxides of nitrogen and Sulphur, hydrocarbons, Particulate matter, Carbon monoxide, Mercury and Lead. Secondary air pollutant: Ozone, Ozone depletion

Waste Management: Solid waste, e-waste & biomedical waste: Sources, characteristics & disposal methods (Scientific land filling, composting, recycling and reuse). **Water Chemistry:** Introduction, sources and impurities of water; boiler feed water, boiler troubles with disadvantages -scale and sludge formation, boiler corrosion (due to dissolved $0_2$, $C0_2$ and $MgC1_2$). Sources of water pollution, Sewage, Definitions of Biological oxygen demand (BOD) and Chemical Oxygen Demand (COD), determination of COD, numerical problems on COD. Chemical analysis of water: Sulphates (gravimetric) and Fluorides (colorimetry). Sewage treatment: Primary, secondary (activated sludge) and tertiary methods. Softening of water by ion exchange process. Desalination of seawater by reverse osmosis. **(RBT Levels: L3)**

**Module 5:**

**Instrumental methods of analysis and Nanomaterials**

**Instrumental methods of analysis**: Theory, Instrumentation and applications of Colorimetry, Flame Photometry, Atomic Absorption Spectroscopy, Potentiometry, Conductometry (Strong acid with a strong base, weak acid with a strong base, mixture of strong acid and a weak acid with a strong base)

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**Nanomaterials:** Introduction, size dependent properties (Surface area, Electrical, Optical, Catalytic and Thermal properties). Synthesis of nanomaterials: Top down and bottom up approaches, Synthesis by Sol-gel, precipitation and chemical vapour deposition, Nanoscale materials: Fullerenes,Carbon nanotubes and graphenes -properties and applications. **(RBT Levels: L1 & L2)**

**List of Text Books**

1. P.C. Jain & Monica Jain. **"Engineering Chemistry"**, Dhanpat Rai Publications, New Delhi (2015- Edition).
2. S.S.Dara,**Atextbook of Engineering Chemistry**, 10th Edition, SChand & Co. Ltd.,New Delhi, 2014.
3. **Physical Chemistry**,by P.W.Atkins, Oxford Publications (Eighth edition- 2006).

**List of Reference Books**

1. O.G. Palanna, **"Engineering Chemistry"**, Tata McGraw Hill Education Pvt Ltd,New Delhi, Fourth Reprint (2015- Edition).
2. R.V. Gadag & A. Nityananda Shetty., **"Engineering Chemistry"**, I KInternational Publishing House Private Ltd. New Delhi (2015- Edition).
3. **"Wiley Engineering Chemistry"**, Wiley India Pvt Ltd. New Delhi. Second Edition-2013.
4. B. Jaiprakash, R. Venugopal, Sivakumaraiah and Pushpa Iyengar, **Chemistry for Engineering Students**, Subhash Publications, Bengaluru, (2015- Edition).

**List of URLs, Text Books, Notes, Multimedia Content, etc**

1 https://www.youtube.com/watch?v=YXo9B2AbH0s
2 https://plastics.americanchemistry.com/plastics/The-Basics/
3 *nptel.ac.in/courses/103103033 /module9 /lecture1.pdf*
4 www.npl.co.uk/upload/pdf /beginners_guide_to_corrosion.pdf
5 *nptel.ac.in/courses/112105127 /pdf / LM-30.pdf*

| Course Outcomes: Students will be able to | RBT |
|---|---|
| **CO1: Apply** the knowledge of thermodynamic function in electrochemical systems. | L1, L2, L3 |
| **CO2: Interpretation** on metallic corrosion, control & the surface modification. | L1, L2 |
| **CO3: Utilization** of chemical fuels & renewable source for the production and consumption of energy | L1, L2, L3 |
| **CO4: Apply** the knowledge on facts & techniques related to environmental pollution waste management & water chemistry. | L1, L2 |
| **CO5: Explain** the basic principles involved in different Analytical/Instrumentation techniques & Nanoscience. | L1, L2,L3 |

**Assignment Marks:** 10 (3 Assignments / Quiz and Seminars are provided during the semester)
**Internal Assessment Marks:** 30 (3 Session Tests are conducted during the semester and marks allotted based on its average).
**Continuous Internal Evaluation (CIE): 40 Marks** (Assignment + Internal Assessment)

| Subject Code: | 18CHE12/22 | | TITLE: Engg. Chemistry | | | | | Faculty Name: | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| List of CO | Program Outcomes | | | | | | | | | | | | Total |
| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | |
| CO-1 | 3 | 2 | - | - | - | - | - | - | - | - | - | 3 | 8 |
| CO-2 | 2 | 1 | - | - | - | - | - | - | - | - | - | 2 | 5 |
| CO-3 | 3 | - | - | - | - | - | - | - | - | - | - | 3 | 6 |
| CO-4 | 3 | - | - | - | - | 2 | 2 | - | - | - | - | 3 | 10 |
| CO-5 | 3 | 2 | - | - | - | - | - | - | - | - | - | 3 | 8 |
| Total | 14 | 5 | - | - | - | 2 | 2 | - | - | - | - | 14 | 37 |

**Note:** 3 = Strong Contribution 2 = Average Contribution 1 = Weak Contribution

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# Part I

# Module - 1 - Oscillations ad Waves - Dr. Mahesh Lohith K S

# Chapter 1

# Oscillations

## 1.1 Free Oscillations

### 1.1.1 Simple Harmonic Motion (SHM)

Oscillations and vibrations are the most frequently occuring phenomena. It is very essential to understand the nature of oscillations and vibrations. Oscillation is a repeating motion that occurs when a time varying force acts on the system. Oscillations are periodic motions. If the oscillations occur without the action of an external periodic force then such oscillations are called ***free oscillations***. SHM is a special kind of periodic motion. The motion of an object is said to be simple harmonic motion if the restoring force (or acceleration) is directly proportional to the displacement and acts in the direction opposite to that of motion. It is also defined as the projection of uniform circular motion on the diameter with respect to time. Motion of the bob of of an oscillating pendulum and motion of the weight attached to the oscillating spring are the best examples of SHM.

### 1.1.2 SHM as a Projection of Uniform Circular Motion

With regard to the definition of SHM , let us consider a vector in rotation with its initial point at the center of the circle and at a constant angular velocity $\omega_0$. The terminal point traces a circle. As the vector completes one rotation the projection of the vector exhibits one oscillation. Thus SHM is the projection of uniform circular motion on the diameter.

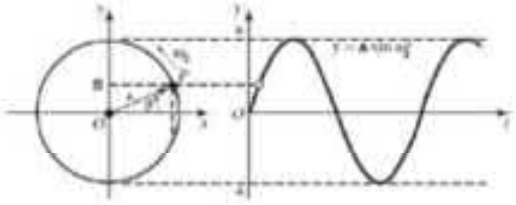


Figure 1.1: Simple Harmonic Motion

Let 't' be the time taken by the vector (or point) to rotate through an angle '$\theta$'. From the above diagram from Right angled $\triangle OBP$ we get

$$y = A\sin(\omega_0 t) \tag{1.1}$$

Equation 1.1 represents the displacement of the particle in oscillation from the equilibrium position with respect to time. In general the equation for the displacement is given by

$$y = A\sin(\omega_0 t + \phi) \tag{1.2}$$

Here $\phi$ is the initial phase and $A$ is the amplitude of SHM.

### 1.1.3 Mechanical simple harmonic oscillator and Expression for SHM

Consider a mass attached to spring of negligible mass which is suspended from a rigid support as shown in the figure. The mass is made to oscillate up and down. The oscillations are due to the restoring force developed in the spring and is directly proportional to the displacement of the mass from the equilibrium position.

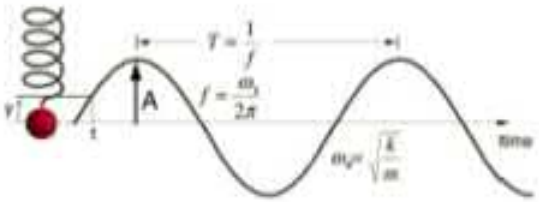



Figure 1.2: Oscillating Spring-Mass system

According to Hooke's Law the restoring force is directly proportional to displacement.

$$f = -ky \tag{1.3}$$

Here $k$ is called spring constant or stiffness factor or force constant. Note : y is used since the displacement is along vertical direction.

$$ma = -ky$$

Applying equation of kinematics of motion the above equation could be written as

$$m\frac{d^2y}{dt^2} = -ky$$

$$\frac{d^2y}{dt^2} = \frac{-k}{m}y$$

$$\frac{d^2y}{dt^2} + \frac{k}{m}y = 0$$

$$\frac{d^2y}{dt^2} + \omega_0^2 y = 0 \qquad (1.4)$$

Equation 1.4 is the second order homogeneous differential equation for SHM. Here $\omega_0 = \sqrt{\frac{k}{m}}$ is the angular frequency of the oscillations. This auxiliary equation could be written as

$$(D^2 + \omega_0^2)y = 0 \qquad (1.5)$$

The roots of the equation 1.5 are $D = i\omega_0$ and $D = -i\omega_0$. Thus the general solution for equation 1.4 could be written as

$$y = Me^{i\omega_0 t} + Ne^{-i\omega_0 t} \qquad (1.6)$$

Here M and N are unknown constants to be determined using initial conditions. By substituting for $e^{i\theta} = cos\theta + isin\theta$ in the above equation it could be reduced to the form

$$y = Asin(\omega_0 t + \phi) \qquad (1.7)$$

Equation 1.7 also represents the equation of motion for free oscillations. $A$ is the amplitude of the SHM and $\phi$ is the initial phase.

### 1.1.4 Characteristics of SHM

**Amplitude:** The value of the displacement $y$ varies from $+A$ to $-A$. Thus the maximum displacement of the particle during the simple harmonic motion is called amplitude ($A$).

**Phase Angle and Initial Phase :** The value $(\omega t + \phi)$ represents the state of the system and is called phase angle. The angle $\phi$ is called initial phase.

**Angular velocity or Frequency** ($\omega_0$): It is the rate of change of angular displacement and is given by $\omega_0 = \sqrt{\frac{k}{m}}$

**Frequency** ($f$): Frequency of oscillations is defined as the no. of oscillations per second and is given by $f = \frac{\omega_0}{2\pi} = \frac{1}{2\pi}\sqrt{\frac{k}{m}}$.

**Time Period** ($T$) : It is the time taken to complete one oscillation and is given by $T = \frac{1}{f}$. For larger values of $k$ smaller will be the time period and for smaller values of $k$ larger will be the time period.

**Velocity** ($v$): The velocity of the particle in simple harmonic motion is given by differentiating the equation 1.7 with respect to time. The velocity of the particle varies with time. Hence we get

$$v = \frac{dy}{dt} = A\omega_0 Cos(\omega_0 t + \phi) \qquad (1.8)$$

The velocity varies from $+A\omega_0$ to $-A\omega_0$. When magnitude of displacement is maximum velocity is zero and when then magnitude of displacement is zero (at equilibrium position during oscillation) velocity is maximum.

**Acceleration (a):** The acceleration in SHM varies with time and is given by differentiating the equation velocity with respect to time.

$$a = \frac{dv}{dt} = -A\omega_0^2 Sin(\omega_0 t + \phi) = -\omega_0^2 y \qquad (1.9)$$

Thus the acceleration is proportional to displacement and acts in the direction opposite to displacement. When the magnitude of the displacement is maximum acceleration is maximum and the acceleration will be minimum at equilibrium position. Acceleration varies from $+A\omega_0^2$ to $-A\omega_0^2$.

The variation of displacement, velocity and acceleration with respect to time during SHM are as shown in the below figure 1.3.

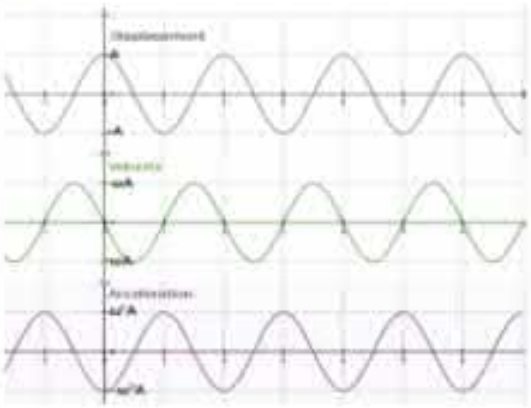


Figure 1.3: SHM - Variation of y, v and a

### 1.1.5 Force constant and its physical significance

"It is the amount of force exerted when a spring is elongated/compressed by unit length." It determines the stiffness of the string. The SI unit of spring constant unit is

$Nm^{-1}$). The physical significance of $k$ is, if $k$ large then higher force is required for unit extension and if $k$ is small relatively lower force is required for unit extension in the spring.

### 1.1.6 Natural frequency

When a body exhibits free oscillations the frequency with which the oscillations occur is called *Natural Frequency*. The natural frequency of oscillations depends on the dimensions of the system like Length of the string in simple pendulum and spring constant of the spiral spring. The spring constant depends on the physical dimensions of the spring.

### 1.1.7 Springs in Series and Parallel

Consider two springs of negligible masses and with force constants $k_1$ and $k_2$. Let us calculate the effective spring constant when the two springs are connected in series to a mass and when connected in parallel, as shown in the figure 1.4.

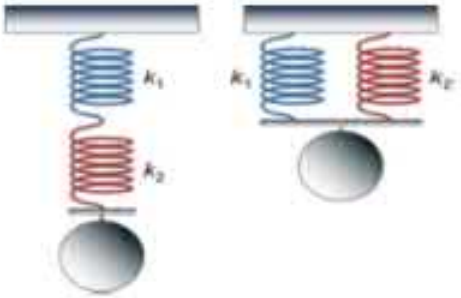



Figure 1.4: Springs in series and parallel

**Springs in series**

When springs are in connected in series to a mass the net extension $y$ is given by

$$y = y_1 + y_2 \tag{1.10}$$

Here $y$ is the total extension, $y_1$ is the extension in the spring with force constant $k_1$ and $y_2$ is the extension in the spring with force constant $k_2$. If $k_s$ is the effective force constant of the combination and if $F$ is the force applied on the combination then we get

$$\frac{F}{k_s} = \frac{F}{k_1} + \frac{F}{k_2}$$

Thus

$$\frac{1}{k_s} = \frac{1}{k_1} + \frac{1}{k_2} \tag{1.11}$$

Thus from equation 1.11 effective force constant of the series combination is given by

$$k_s = \frac{k_1 k_2}{k_1 + k_2} \tag{1.12}$$

**Springs in parallel**

When springs are in connected in parallel to a mass the net force $F$ on the system of springs is given by

$$F = F_1 + F_2 \tag{1.13}$$

Here $F_1$ is the force on the spring with force constant $k_1$ and $F_2$ is the force on the spring with force constant $k_2$. If $k_p$ is the effective force constant of the combination and if $y$ is the total extension in the combination then we get

$$k_p y = k_1 y + k_2 y$$

Thus the effective force constant of the parallel combination is given by

$$k_p = k_1 + k_2 \tag{1.14}$$

### 1.1.8 Complex notation of SHM and Phasor representation of SHM

In general a complex number could be written as $z = Ae^{i\theta}$. Here $\theta = \omega t$ and the complex number $z$ represents a vector in the complex plane with magnitude $A$ and phase angle $\theta$. If $A$ is a constant then for all angles of $\theta$ a circle is described by $z$. Complex notation of SHM could be expressed even in other forms. In the cartesian form $z = x + iy$ and in the polar form $z = r\angle\theta$.

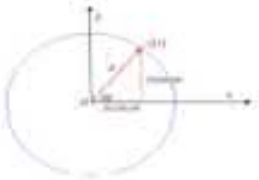


Figure 1.5: Complex notation of SHM

In physics and engineering, a phasor is a complex number representing a sinusoidal function whose amplitude ($A$), angular frequency ($\omega$), and initial phase ($\theta$) are time-invariant. Thus a Phasor is a rotating vector and SHM could represented using Phasors. Phasors are extensively used while representing the Electrical quantities like current and voltage which are sinusoidal. The phase difference between the the quantities could be easily estimated using phasor diagrams. Example: $\bar{I} = I\angle\theta = I\cos\theta + jI\sin\theta$ and $\bar{V} = V\angle\theta = V\cos\theta + jV\sin\theta$

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ATTENDANCE

Course Title with Code: Engineering Physics 18PHY12

Semester & Section: First sem A & sec

Date: 26/27/28/29/30/31/03/04/05/06

| Sl. No. | USN | Student Name | Month: Aug Aug Aug Aug Aug Aug Sept Sept Sept Sept |
|---|---|---|---|
| | | | 1 2 3 4 5 6 7 8 9 10 |
| 41 | 1MV21AI | Nikhita B | A 2 3 4 5 A 6 7 8 |
| 42 | 1MV21AJ | Pavankumar B S | 1 2 3 4 5 6 7 8 9 10 |
| 43 | 1MV21AK | Poornesh M | 1 2 3 4 5 6 7 8 9 10 |
| 44 | 1MV21AL | Prajwal N | 1 2 3 4 5 6 7 8 9 10 |
| 45 | 1MV21AM | Prashanth P | 1 2 3 4 5 6 7 8 9 10 |
| 46 | 1MV21AN | Pruthvin N | 1 2 3 4 5 6 7 8 9 10 |
| 47 | 1MV21AP | Sagar S | 1 2 3 A A A 5 A 6 7 |
| 48 | 1MV21AQ | Saniya H M | 1 2 3 4 5 6 7 8 9 10 |
| 49 | 1MV21AR | Sanjana S Shetty | 1 2 3 4 5 6 7 A 8 9 |
| 50 | 1MV21AS | Shashank N | 1 2 A 3 4 5 6 7 A 8 |
| 51 | 1MV21AT | Shashank K | 1 2 3 4 5 6 7 8 9 10 |
| 52 | 1MV21AU | Srivatsa H R | 1 2 A 3 4 5 6 7 8 9 |
| 53 | 1MV21AV | Suhas P | 1 2 3 4 5 6 7 8 9 10 |
| 54 | 1MV21AW | Syed Imad Mehdi I | 1 2 3 4 5 6 7 8 9 10 |
| 55 | 1MV21AX | Syed Mushkeen | 1 2 3 4 5 6 7 8 9 10 |
| 56 | 1MV21AY | Tasmiya Anjum | 1 2 3 4 5 6 7 8 9 10 |
| 57 | 1MV21AZ | Varshitha K | 1 2 3 4 5 6 7 8 9 10 |
| 58 | 1MV21B0 | Varun Mahadevaswamy Mathapati | 1 2 3 4 5 6 7 8 9 10 |
| 59 | 1MV21B1 | Varun Mahadeva Mathapati | 1 2 3 4 5 6 7 8 9 10 |
| 60 | Absentees | Chetan P | 1 2 3 A A 5 6 7 8 |

| No. of Abs. | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Present | | | | | | | | | | |

ASSESSMENT

| Sl. No. | USN | Student Name | Assignments / Internal Test Marks | | | | | SEE Marks | Total Marks |
|---|---|---|---|---|---|---|---|---|---|
| | | | A1 | A2 | A3 | A4 | Best | | |
| 41 | 1MV21AI | Nikhita B | 28 | 20 | 11 | 12 | 32 | | |
| 42 | 1MV21AJ | Pavankumar B S | 37 | 35 | 33 | 34 | 34 | | |
| 43 | 1MV21AK | Poornesh M | 29 | 30 | 20 | 26 | 26 | | |
| 44 | 1MV21AL | Prajwal N | 31 | 26 | 30 | 28 | 28 | | |
| 45 | 1MV21AM | Prashanth P | 44 | 39 | 04 | 26 | 26 | | |
| 46 | 1MV21AN | Pruthvin N | 41 | 31 | 24 | 30 | 30 | | |
| 47 | 1MV21AP | Sagar S | 08 | 29 | 15 | 19 | 29 | | |
| 48 | 1MV21AQ | Saniya H M | 34 | 34 | 18 | 28 | 28 | | |
| 49 | 1MV21AR | Sanjana S Shetty | 10 | 19 | 19 | 19 | 19 | | |
| 50 | 1MV21AS | Shashank N | 26 | 21 | 17 | 22 | 22 | | |
| 51 | 1MV21AT | Shashank K | 36 | 41 | 30 | 32 | 32 | | |
| 52 | 1MV21AU | Srivatsa H R | 19 | 15 | 11 | 19 | 19 | | |
| 53 | 1MV21AV | Suhas P | 26 | 17 | 19 | 23 | 23 | | |
| 54 | 1MV21AW | Syed Imad Mehdi I | 19 | 24 | 11 | 20 | 20 | | |
| 55 | 1MV21AX | Syed Mushkeen | 18 | 16 | 20 | 21 | 21 | | |
| 56 | 1MV21AY | Tasmiya Anjum | 25 | 30 | 03 | 21 | 21 | | |
| 57 | 1MV21AZ | Varshitha K | 23 | 23 | 15 | 22 | 23 | | |
| 58 | 1MV21B0 | Varun Mahadevaswamy Mathapati | 29 | 35 | 15 | 28 | 28 | | |
| 59 | 1MV21B1 | Varun Mahadeva Mathapati | 17 | 19 | 11 | 19 | 19 | | |
| 60 | Absentees | Chetan P | 45 | 40 | 27 | 33 | 33 | | |

CBCS SCHEME

USN | | | | | | | | | | |

18CHE12/22

# First/Second Semester B.E. Degree Examination, Aug./Sept.2020
## Engineering Chemistry

Time: 3 hrs. Max. Marks: 100

**Note:** ***Answer any FIVE full questions, choosing ONE full question from each module.***

Important Note : 1. On completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages.
2. Any revealing of identification, appeal to evaluator and /or equations written eg, 42+8 = 50, will be treated as malpractice.

### Module-1

1 a. Define Standard reduction potential and derive Nernst equation for single electrode potential. **(06 Marks)**

b. What is a Reference electrode? Explain the construction and working of a Calomel electrode. **(07 Marks)**

c. Define Cell Potential. Give the cell representation, cell reactions and calculate the potential of the cell consists of Li and Cu electrodes dipped in 0.1 M Li Cl and 0.5M $CuSO_4$ solutions at 25°C. Given $E^0Li = -3.05V$ and $E^0Cu = 0.34V$ **(07 Marks)**

**OR**

2 a. Define Ion selective electrode. Explain the determination of pH using glass electrode. **(06 Marks)**

b. Derive an equation for potential of a concentration cell and calculate the potential of following cell at 25°C. $Ag/AgNO_3$ (0.005m) // $AgNO_3$(0.5m)/Ag. **(07 Marks)**

c. Explain the construction and working of Li - ion cells. Mention its applications. **(07 Marks)**

### Module-2

3 a. Briefly explain the effect of following factors on rate of corrosion:
i) The ratio of Anodic and Cathodic areas ii) Nature of corrosion product.
iii) pH of the medium. **(06 Marks)**

b. Define Corrosion of metals. Describe the electrochemical theory of rusting of iron. **(07 Marks)**

c. Define Electroless plating and explain electroless plating of copper. **(07 Marks)**

**OR**

4 a. Explain Electroplating of hard chromium and mention its applications. **(06 Marks)**

b. Discuss the following : i) Differential metal corrosion ii) Anodization of aluminum. **(07 Marks)**

c. Explain in brief : i) Sacrificial anode method ii) Decomposition potential. **(07 Marks)**

### Module-3

5 a. Define Calorific value of a fuel and calculate the gross and net calorific value of a coal from the following data :
i) Mass of coal burnt = 0.85 gms.
ii) Water equivalent mass of copper calorimeter = 0.65kg.
iii) Mass of water taken in the copper calorimeter = 2.2kg.
iv) Rise in temperature of water = 3.0°C.
v) Percentage of $H_2$ in the coal = 3.2.
vi) Latent heat of steam = 2457.76 kJ/kg. **(06 Marks)**

b. Define Fuel cell and explain the construction and working $CH_3OH - O_2$ fuel cell. **(07 Marks)**

c. Describe the preparation of solar grade silicon by Union carbide process. **(07 Marks)**

**OR**

6 a. Explain the experimental determination of calorific value of a fuel using bomb calorimeter. **(07 Marks)**
b. What are Solar cells? Explain the construction and working of a Photo voltaic cell. **(06 Marks)**
c. Discuss : i) Knocking of petrol engine ii) Power alcohol. **(07 Marks)**

**Module-4**

7 a. Discuss the sources , effects and control measures of oxides of nitrogen. **(06 Marks)**
b. Explain the causes, effects and disposal methods of biomedical wastes. **(07 Marks)**
c. Explain Scale and Sludge formation in boilers. **(07 Marks)**

**OR**

8 a. Define BOD and COD. Calculate the COD of a wastewater if 25ml of which consumes 10.5ml of 0.02N $K_2Cr_2O_7$ for complete oxidation. **(06 Marks)**
b. Explain the softening of water by ion exchange method. **(07 Marks)**
c. Explain the following : i) Ozone depletions ii) Reverse osmosis. **(07 Marks)**

**Module-5**

9 a. Explain the theory and instrumentation of colorimetry. **(07 Marks)**
b. Discuss the theory of conductometric titration and explain the nature of graph for the following titrations :
i) Strong acid with strong base ii) Weak acid with strong base. **(07 Marks)**
c. Explain the synthesis of nanomaterials by Chemical Vapour Deposition method. **(06 Marks)**

**OR**

10 a. Explain Sol – gel method of synthesis of nanomaterials. **(06 Marks)**
b. Write a note on synthesis , properties and uses of Fullerenes. **(07 Marks)**
c. Explain 'Atomic Absorption Spectroscopy'. **(07 Marks)**

* * * * *

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## DEPARTMENT OF BASIC SCIENCES AND HUMANITIES

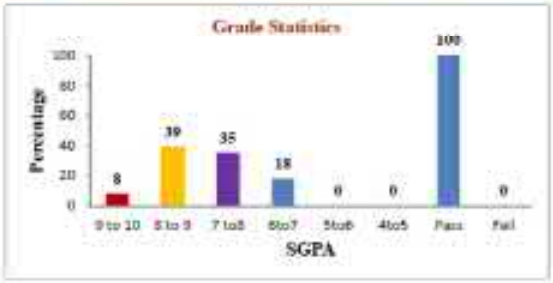
### RESULT ANALYSIS FOR SECOND SEMESTER - 2020-21

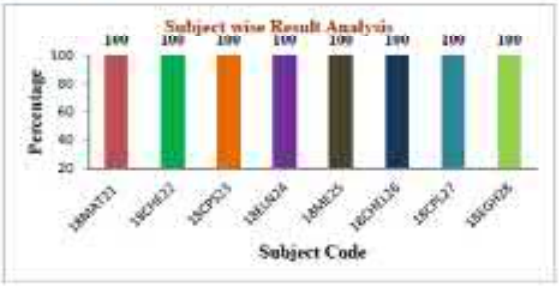
Branch: Computer Science Engineering

| Sl. No., | Subject Code | Subject | No., of Students | No., of Students Passed | Pass % | Class Average (Grade Point) |
|---|---|---|---|---|---|---|
| 1 | 18MAT21 | Advanced Calculus & Numerical Methods | 111 | 111 | 100 | 7 |
| 2 | 18CHE22 | Engineering Chemistry | 111 | 111 | 100 | 8 |
| 3 | 18CPS23 | C Programming for Problem Solving | 111 | 111 | 100 | 8 |
| 4 | 18ELN24 | Basic Electronics | 111 | 111 | 100 | 8 |
| 5 | 18ME25 | Elements of Mechanical Engineering | 111 | 111 | 100 | 8 |
| 6 | 18CHEL26 | Engineering Chemistry Lab | 111 | 111 | 100 | 8 |
| 7 | 18CPL27 | C Programming Laboratory | 111 | 111 | 100 | 8 |
| 8 | 18EGH28 | Technical English II | 111 | 111 | 100 | 8 |

| SGPA | 9 to 10 | 8 to 9 | 7 to8 | 6to7 | 5to6 | 4to5 | Pass | Fail |
|---|---|---|---|---|---|---|---|---|
| No., of Student | 9 | 43 | 39 | 20 | 0 | 0 | 111 | 0 |
| Percentage | 8 | 39 | 35 | 18 | 0 | 0 | 100 | 0 |




ATME College of Engineering

## DEPARTMENT OF BASIC SCIENCES AND HUMANITIES

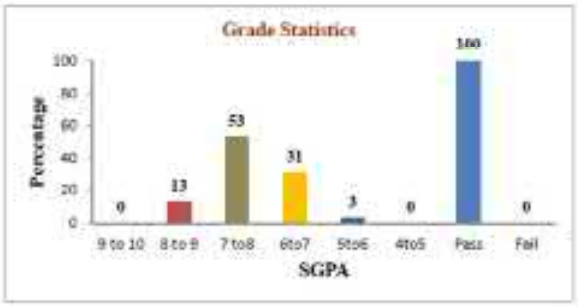
### RESULT ANALYSIS FOR SECOND SEMESTER - 2020-21

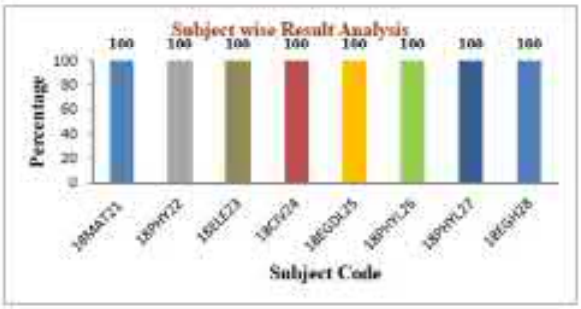
Branch: Civil Engineering

| Sl. No., | Subject Code | Subject | No., of Students | No., of Students Passed | Pass % | Class Average (Grade Point) |
|---|---|---|---|---|---|---|
| 1 | 18MAT21 | Advanced Calculus & Numerical Methods | 32 | 32 | 100 | 7 |
| 2 | 18PHY22 | Engineering Physics | 32 | 32 | 100 | 7 |
| 3 | 18ELE23 | Basic Electrical Engineering | 32 | 32 | 100 | 7 |
| 4 | 18CIV24 | Elements of Civil Engg., & Mechanics | 32 | 32 | 100 | 8 |
| 5 | 18EGDL25 | Engineering Graphics | 32 | 32 | 100 | 8 |
| 6 | 18PHYL26 | Engineering Physics Lab | 32 | 32 | 100 | 8 |
| 7 | 18PHYL27 | Basic Electrical Engineering Lab | 32 | 32 | 100 | 8 |
| 8 | 18EGH28 | Technical English II | 32 | 32 | 100 | 7 |

| SGPA | 9 to 10 | 8 to 9 | 7 to8 | 6to7 | 5to6 | 4to5 | Pass | Fail |
|---|---|---|---|---|---|---|---|---|
| No., of Student | 0 | 4 | 17 | 10 | 1 | 0 | 32 | 0 |
| Percentage | 0 | 13 | 53 | 31 | 3 | 0 | 100 | 0 |



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## DEPARTMENT OF BASIC SCIENCES AND HUMANITIES

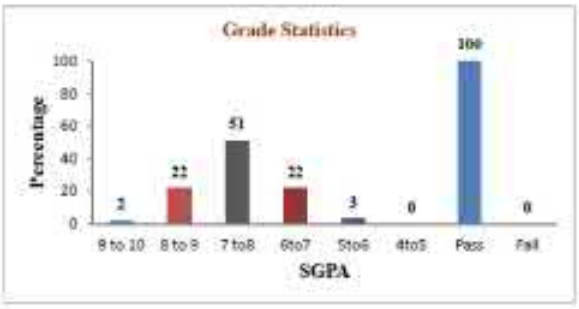
### RESULT ANALYSIS FOR SECOND SEMESTER - 2020-21

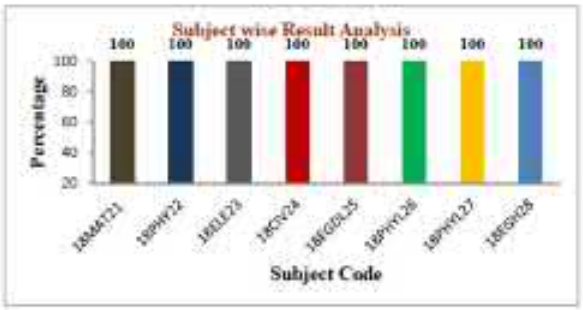
**Branch: Electronics & Communication Engineering**

| Sl. No., | Subject Code | Subject | No., of Students | No., of Students Passed | Pass % | Class Average (Grade Point) |
|---|---|---|---|---|---|---|
| 1 | 18MAT21 | Advanced Calculus & Numerical Methods | 79 | 79 | 100 | 7 |
| 2 | 18PHY22 | Engineering Physics | 79 | 79 | 100 | 7 |
| 3 | 18ELE23 | Basic Electrical Engineering | 79 | 79 | 100 | 8 |
| 4 | 18CIV24 | Elements of Civil Engg., & Mechanics | 79 | 79 | 100 | 8 |
| 5 | 18EGDL25 | Engineering Graphics | 79 | 79 | 100 | 8 |
| 6 | 18PHYL26 | Engineering Physics Lab | 79 | 79 | 100 | 8 |
| 7 | 18PHYL27 | Basic Electrical Engineering Lab | 79 | 79 | 100 | 8 |
| 8 | 18EGH28 | Technical English II | 79 | 79 | 100 | 7 |




| SGPA | 9 to 10 | 8 to 9 | 7 to8 | 6to7 | 5to6 | 4to5 | Pass | Fail |
|---|---|---|---|---|---|---|---|---|
| No., of Student | 2 | 17 | 40 | 17 | 3 | 0 | 79 | 0 |
| Percentage | 2 | 22 | 51 | 22 | 3 | 0 | 100 | 0 |




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## DEPARTMENT OF BASIC SCIENCES AND HUMANITIES

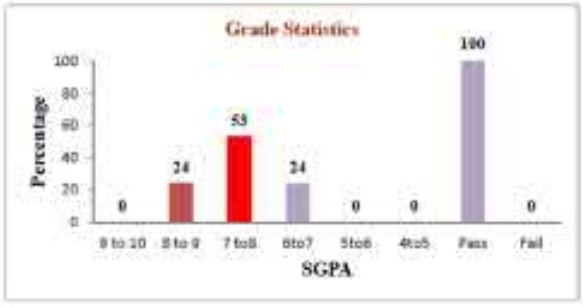
### RESULT ANALYSIS FOR SECOND SEMESTER - 2020-21

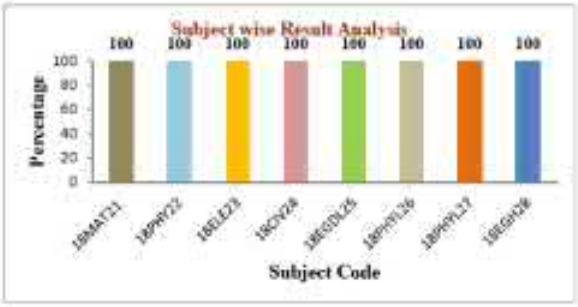
**Branch: Electrical & Electronics Engineering**

| Sl. No., | Subject Code | Subject | No., of Students | No., of Students Passed | Pass % | Class Average (Grade Point) |
|---|---|---|---|---|---|---|
| 1 | 18MAT21 | Advanced Calculus & Numerical Methods | 17 | 17 | 100 | 7 |
| 2 | 18PHY22 | Engineering Physics | 17 | 17 | 100 | 7 |
| 3 | 18ELE23 | Basic Electrical Engineering | 17 | 17 | 100 | 8 |
| 4 | 18CIV24 | Elements of Civil Engg., & Mechanics | 17 | 17 | 100 | 8 |
| 5 | 18EGDL25 | Engineering Graphics | 17 | 17 | 100 | 8 |
| 6 | 18PHYL26 | Engineering Physics Lab | 17 | 17 | 100 | 8 |
| 7 | 18PHYL27 | Basic Electrical Engineering Lab | 17 | 17 | 100 | 8 |
| 8 | 18EGH28 | Technical English II | 17 | 17 | 100 | 7 |




| SGPA | 9 to 10 | 8 to 9 | 7 to8 | 6to7 | 5to6 | 4to5 | Pass | Fail |
|---|---|---|---|---|---|---|---|---|
| No., of Student | 0 | 4 | 9 | 4 | 0 | 0 | 17 | 0 |
| Percentage | 0 | 24 | 53 | 24 | 0 | 0 | 100 | 0 |



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## DEPARTMENT OF BASIC SCIENCES AND HUMANITIES

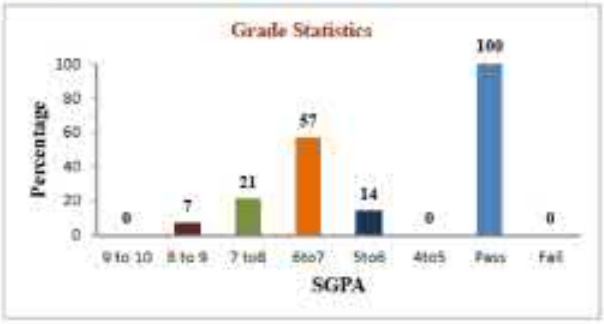
### RESULT ANALYSIS FOR SECOND SEMESTER - 2020-21

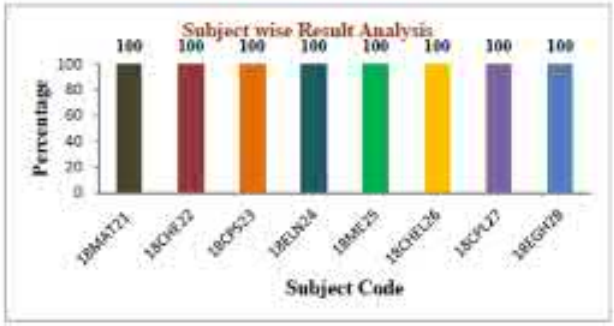
**Branch: Mechanical Engineering**

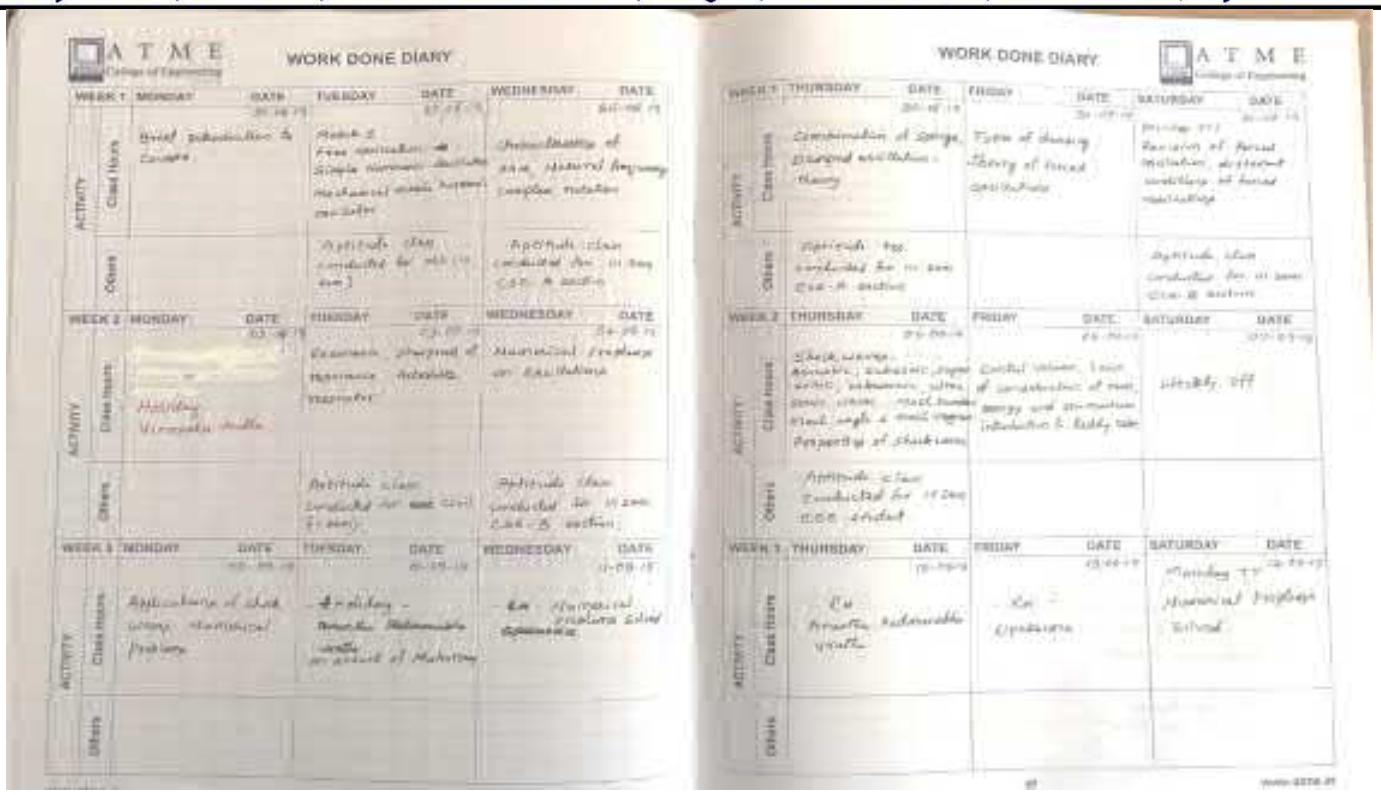
| Sl. No., | Subject Code | Subject | No., of Students | No., of Students Passed | Pass % | Class Average (Grade Point) |
|---|---|---|---|---|---|---|
| 1 | 18MAT21 | Advanced Calculus & Numerical Methods | 14 | 14 | 100 | 6 |
| 2 | 18CHE22 | Engineering Chemistry | 14 | 14 | 100 | 7 |
| 3 | 18CPS23 | C Programming for Problem Solving | 14 | 14 | 100 | 7 |
| 4 | 18ELN24 | Basic Electronics | 14 | 14 | 100 | 7 |
| 5 | 18ME25 | Elements of Mechanical Engineering | 14 | 14 | 100 | 7 |
| 6 | 18CHEL26 | Engineering Chemistry Lab | 14 | 14 | 100 | 7 |
| 7 | 18CPL27 | C Programming Laboratory | 14 | 14 | 100 | 8 |
| 8 | 18EGH28 | Technical English II | 14 | 14 | 100 | 7 |

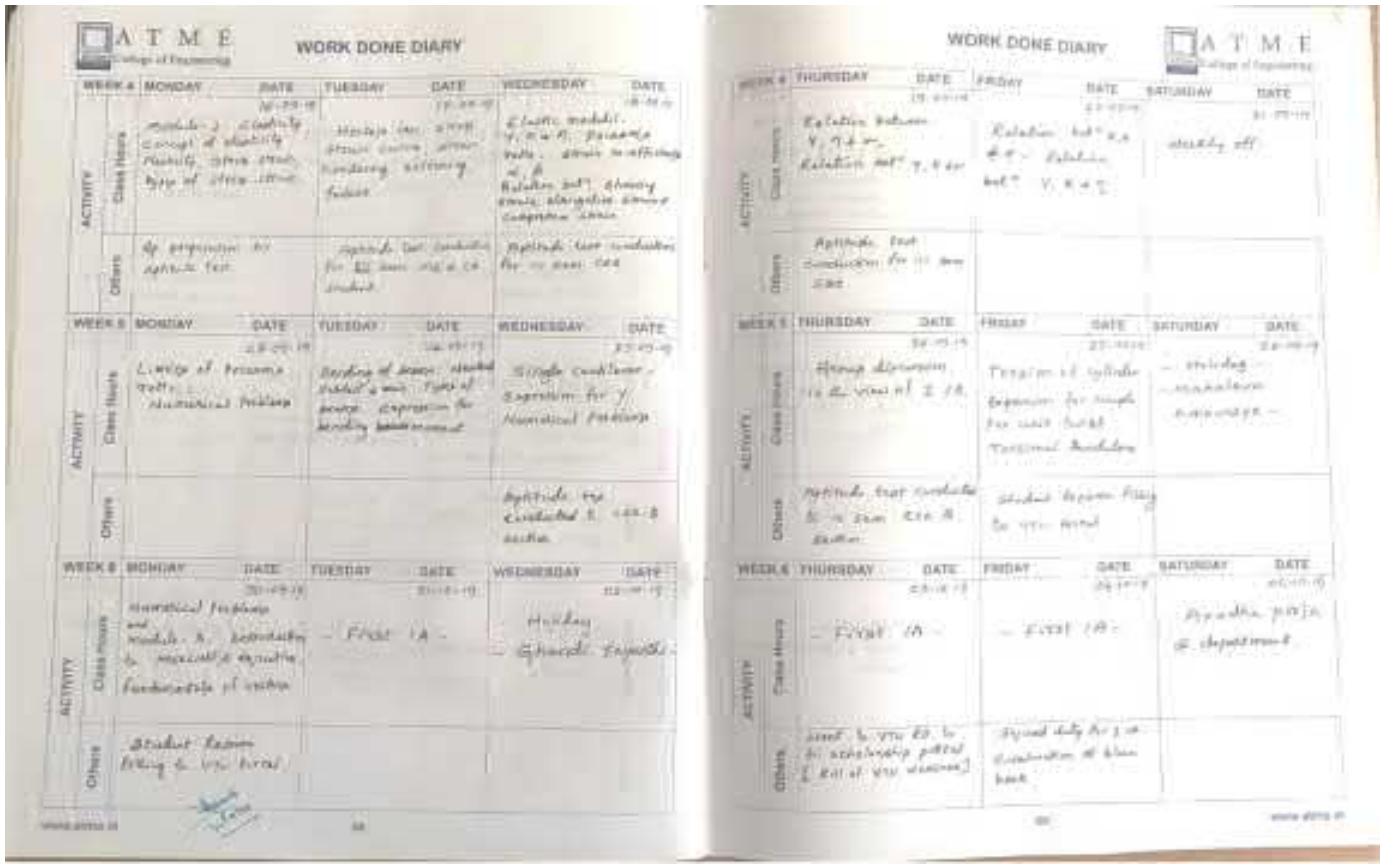



| SGPA | 9 to 10 | 8 to 9 | 7 to8 | 6to7 | 5to6 | 4to5 | Pass | Fail |
|---|---|---|---|---|---|---|---|---|
| No., of Student | 0 | 1 | 3 | 8 | 2 | 0 | 14 | 0 |
| Percentage | 0 | 7 | 21 | 57 | 14 | 0 | 100 | 0 |




WORK DONE DIARY
WEEK 1
MONDAY
TUESDAY
WEDNESDAY
THURSDAY
FRIDAY
SATURDAY
WEEK 2
WEEK 3
ACTIVITY
Class Hours
Others
Holiday
Weekly off


WORK DONE DIARY
WEEK 4
MONDAY
TUESDAY
WEDNESDAY
THURSDAY
FRIDAY
SATURDAY
WEEK 5
WEEK 6
ACTIVITY
Class Hours
Others
Holiday
Ghazal Tajwidi
Student Report Filling & VTU Portal
Weekly off