# Electronics & Telecommunication Engineering Department

Curriculum: SE (E&TC)

| Program Educational Objective(s) | |
|---|---|
| After graduation and few years of graduation, the Electronics & Telecommunication Engineering graduates would | |
| PEO 1 | Core Competency: Graduates will provide engineering solutions with strong base of science and mathematics, subject domain knowledge for challenging problems in Electronics and allied disciplines. |
| PEO 2 | Career Building: Graduates will fulfill professional responsibilities effectively by synergizing theoretical and practical skills. |
| PEO 3 | Technical Proficiency: Graduates will practice analytical, creative, innovative skills for higher education, research, industrial development. |
| PEO 4 | Managerial Skills: Graduates will perform cohesively in group using moral, ethical practice, managerial, entrepreneurial skills for welfare of society with global outlook. |

# Electronics & Telecommunication Engineering Department

## Electronics & Telecommunication Engineering Department

## Programme Outcomes (PO's)

Programme Outcomes describe what students are expected to know or be able to do by the time of graduation from the programme. The POs for Under Graduate Course in Electronics and Telecommunication Engineering are able to

1. Apply knowledge of mathematics, science and technical fundamentals for solutions of domain problems
2. Identify, formulate, review the literature, analyze the complex engineering problems
3. Design and implement the systems' components and processes serving the needs of safety, environment and society
4. Perform experiment, analyze and interpret results
5. Use modern tools and technical skills necessary for electronic system development
6. Understand the impact of electronics in modern era
7. Explore the needs of society for sustainable development and human values
8. Understand professional, ethical and legal responsibilities
9. Work effectively in diverse and multidisciplinary tasks, to accomplish common goal
10. Communicate effectively
11. Engage in continuing educational / professional, entrepreneurship development
12. Apply electronics engineering and management principles / skills, as a member and leader in a team to solve social and industrial problems

## Electronics & Telecommunication Engineering Department

| **Program Educational Objective(s)** | | Mapped Programme Outcomes |
|---|---|---|
| PEO 1 | Core Competency: Graduates will provide engineering solutions with strong base of science and mathematics, subject domain knowledge for challenging problems in Electronics and allied disciplines. | 1,2,3,4,5,6 |
| PEO 2 | Career Building: Graduates will fulfill professional responsibilities effectively by synergizing theoretical and practical skills. | 6,7,8,9,10,11,12 |
| PEO 3 | Technical Proficiency: Graduates will practice analytical, creative, innovative skills for higher education, research, industrial development. | 1,2,3,4,5,6,9,11 |
| PEO 4 | Managerial Skills: Graduates will perform cohesively in group using moral, ethical practice, managerial, entrepreneurial skills for welfare of society with global outlook. | 7,8,9,10,11,12 |

**Mapping of PEOs and POs**

# GOVERNMENT COLLEGE OF ENGINEERING, AURANGABAD

(An Autonomous Institute of Government of Maharashtra)

## Department of Electronics & Telecommunication Engineering

Teaching and Evaluation Scheme

## SE (Full-Time) in Electronics & Telecommunication Engineering

## SEMESTER-I

| | **THEORY COURSES** | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Sr. No** | **Course Code** | **Subject** | **Programme Outcomes** | **Scheme of Teaching (Hrs /Week)** | | | **Total Credits** | **Scheme of Evaluation (Marks)** | | | | | | |
| | | | | | | | | **Theory** | | | | **Term Work** | **Practical / Viva-voce** | **Total** |
| | | | | **L** | **T** | **P** | | **TestI** | **TestII** | **TA** | **ESE** | | | |
| 1 | MA2001 | Engineering Mathematics-III | 1,2,3,9,11 | 4 | - | - | 4 | 15 | 15 | 10 | 60 | - | - | 100 |
| 2 | HS2001 | Environmental Studies | | 4 | - | - | 4 | 15 | 15 | 10 | 60 | - | - | 100 |
| 3 | **Any one** from ET2001/ ET2002 | | | | | | | | | | | | | |
| | ET2001 | Electrical Fundamentals | 1,2 | 2 | - | - | 2 | 10 | - | 10 | 30 | - | - | 50 |
| | ET2002 | Programming Language | 1,2,3,11 | 2 | - | - | 2 | 10 | - | 10 | 30 | - | - | 50 |
| 4 | ET2003 | Electronics Devices & Circuits | 2,3,4,5 | 3 | - | - | 3 | 15 | 15 | 10 | 60 | - | - | 100 |
| 5 | ET2005 | Digital Electronics | 1,2,3 | 3 | - | - | 3 | 15 | 15 | 10 | 60 | - | - | 100 |
| 6 | ET2007 | Signals & Systems | 1,2,11 | 3 | - | - | 3 | 15 | 15 | 10 | 60 | - | - | 100 |
| | **LABORATORY COURSES** | | | | | | | | | | | | | |
| 7 | ET2004 | Lab-Electronics Devices & Circuits | 4,5 | - | - | 2 | 1 | - | - | - | - | 25 | 25 | 50 |
| 8 | ET2006 | Lab- Digital Electronics | 1,4,5 | - | - | 2 | 1 | - | - | - | - | 25 | 25 | 50 |
| 9 | ET2008 | Lab- Signals & Systems | 1,2,4 | - | - | 2 | 1 | - | - | - | - | 25 | 25 | 50 |
| 10 | **MANDATORY COURSES (Only ONE Course during four year Program)** | | | | | | | | | | | | | |
| | | | **Total** | **19** | **0** | **6** | **22** | **85** | **75** | **60** | **330** | **75** | **75** | **700** |

## SEMESTER-II

| **THEORY COURSES** | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Sr. No.** | **Course Code** | **Subject** | **Programme Outcomes** | **Scheme of Teaching (Hrs /Week)** | | | **Total Credits** | **Scheme of Evaluation (Marks)** | | | | | | |
| | | | | | | | | **Theory** | | | | **Term Work** | **Practical / Viva-voce** | **Total** |
| | | | | **L** | **T** | **P** | | **TestI** | **TestII** | **TA** | **ESE** | | | |
| 1 | HS1004 | Any one from Humanity Group | | 3 | - | - | 3 | 15 | 15 | 10 | 60 | - | - | 100 |
| 2 | ET2009 | Instrumentation & Measurement | 1,2,5 | 2 | - | - | 2 | 10 | - | 10 | 30 | - | - | 50 |
| 3 | ET2011 | Network Theory | 1,2,11 | 3 | 2 | - | 4 | 15 | 15 | 10 | 60 | - | - | 100 |
| 4 | ET2013 | Linear Integrated Circuits | 1,2,3 | 3 | - | - | 3 | 15 | 15 | 10 | 60 | - | - | 100 |
| 5 | ET 2015 | Analog Communication | 1,2,3,11 | 3 | - | - | 3 | 15 | 15 | 10 | 60 | - | - | 100 |
| 6 | ET 2017 | Mathematics- IV | 1,2,3,11 | 4 | - | - | 4 | 15 | 15 | 10 | 60 | - | - | 100 |
| | **LABORATORY COURSES** | | | | | | | | | | | | | |
| 7 | ET2010 | Lab- Instrumentation & Measurement | 1,4 | - | - | 2 | 1 | - | - | - | - | 25 | 25 | 50 |
| 8 | ET2012 | Lab- Network Theory | 1,.4,5,11 | - | - | 2 | 1 | - | - | - | - | 25 | 25 | 50 |
| 9 | ET2014 | Lab- Linear Integrated Circuits | 1,4,5 | - | - | 2 | 1 | - | - | - | - | 25 | 25 | 50 |
| 10 | ET2016 | Lab-Analog Communication | 4,5,11 | - | - | 2 | 1 | - | - | - | - | 25 | 25 | 50 |
| 11 | **MANDATORY COURSES (Only ONE Course during four year Program)** | | | | | | | | | | | | | |
| | | | **Total** | **17** | **4** | **8** | **23** | **85** | **75** | **60** | **330** | **100** | **100** | **750** |
| | | | **Grand Total** | **36** | **4** | **14** | **45** | **170** | **150** | **120** | **660** | **175** | **175** | **1450** |

***L-Lectures, T-Tutorials, P-Practical, TA-Teacher Assessment, ESE-End-Semester Examination***

Mandatory Courses: Group Discussion/ Seminar/ Implant Training/ NSS/ NCC/ Yoga/ Talent Hour

| MA2001: Engineering Mathematics-III<br>(Basic Science) | |
|---|---|
| **Teaching Scheme**<br>**Lectures: 4 Hrs/Week**<br>**Total Credits : 3+1+0** | **Examination Scheme**<br>**Class Test-I : 15 Marks**<br>**Class Test-II : 15 Marks**<br>**Teachers Assessment : 10Marks**<br>**End Semester Exam : 60 Marks** |

**Course description**:

Engineering Mathematics-III (MA 2001) is a compulsory course to all second year engineering students of the institute in the Semester –III and is a continuation of previous year courses viz. Engineering Mathematics-I (MA1001) and Engineering Mathematics-II (MA1002). This course intends to provide engineering students a coherent and balanced account of major mathematical techniques and tools.

**Course Objective:**

This course intends to provide an overview of analytical and numerical techniques to solve ordinary and partial differential equations, which we apply to solve many engineering problems of mechanical, civil electrical Engineering.

**Course Outcomes:**

After completing the course, students will be able to:

| | |
|---|---|
| CO1 | Determine the solution of second and higher order linear differential equation and apply knowledge of LDE to solve the problems in Engineering |
| CO2 | Classify, formulate and solve the first order and second order linear, non-linear partial differential equations and apply the knowledge of partial differential equations to solve the problems in Engineering |
| CO3 | Find approximate solution of ordinary differential equations of first order and find the convergence and stability of the approximate solutions |

**Detailed syllabus:**

| | | |
|---|---|---|
| Unit-I | **Linear Differential Equations (LDE):**<br>Linear Differential Equations **(LDE)** with constant coefficients, Differential equations reducible to LDE with constant coefficients, Simultaneous LDE with constant coefficients | 08 Hrs |
| Unit-II | **Applications of Linear Differential Equations (LDE):**<br>L-C-R Circuit, Coupled Electrical Circuits, Bending of beams, Spring-Mass system | 08 Hrs |
| Unit-III | **Partial Differential Equations (PDE):**<br>First order linear/ nonlinear Partial Differential Equation Formation **(PDE)**, Lagrange's equation, Linear Partial Differential Equations **(PDE)** of second and higher order with constant coefficients, Linear non-homogeneous PDE. | 08 Hrs |
| Unit-IV | **Applications of Partial Differential Equations:**<br>Solutions of one-dimensional wave equation, one-dimensional heat equation, Steady state solution of two-dimensional heat equation, Fourier series solutions in Cartesian coordinates. | 08 Hrs |

| | | |
|---|---|---|
| Unit-V | **The approximation for the solution of first order Ordinary Differential Equations:**<br>Taylor series method, Euler's method, Euler's modified Method,<br>Runge-Kutta Fourth order Method, Milne's Predictor-Corrector Method, Solution of system of ordinary differential equations by Runge-Kutta methods. | 08 Hrs |

**Text and Reference Books**


1. A Text Book of engineering Mathematics (Vol.1 &2) by P.N.Wartikar & J.N.Wartikar, Pune Vidhyarthi Griha Prakashan, Pune.
2. Advanced Engineering Mathematics by Erwin Kreyszig, Willey Eastern Ltd. Mumbai.
3. Engineering Mathematics-A Tutorial Approach by Ravish R Singh, Mukul Bhatt.
4. Higher Engineering Mathematics by B. S. Grewal, Khanna publication, New Delhi.
5. Advanced Engineering Mathematics by H. K. Dass, S. Chand and Sons.
6. Calculus by G. B. Thomas and R. L. Finney, Addison- Wesley, 1996
7. Elements of Partial Differential Equations by I.N. Sneddon


**Mapping of Course outcome with Program Outcomes (Civil Engineering)**

| Course Outcome | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 1 | 1 | 2 | | | | | | 1 | | | |
| CO2 | 1 | 1 | 2 | | | | | | 1 | | | |
| CO3 | 1 | 1 | 2 | | | | | | 2 | | | |

**Mapping of Course outcome with Program Outcomes (Mechanical Engineering)**

| Course Outcome | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 |
|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 1 | | 1 | | 2 | 3 | | | | |
| CO2 | 1 | | 2 | | 2 | 3 | | | | |
| CO3 | 1 | | 3 | | 3 | 3 | | | | |

**Mapping of Course outcome with Program Outcomes (Electrical Engineering)**

| Course Outcome | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PO13 | PO14 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 1 | | | | | | | | | | | | | |
| CO2 | 1 | | | | | | | | | | | | | |
| CO3 | 1 | | | | | | | | | | | | | |

**Mapping of Course outcome with Program Outcomes (Electronics and Telecommunication Engineering)**

| Course Outcome | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 2 | 3 | 3 | | | | | | 3 | | 3 | |
| CO2 | 2 | 3 | 3 | | | | | | 3 | | 3 | |
| CO3 | 2 | 3 | 3 | | | | | | 3 | | 3 | |

**Mapping of Course outcome with Program Outcomes (Computer Science Engineering)**

| Course Outcome | PO 1 | PO2 | PO 3 | PO4 | PO5 | PO 6 | PO7 | PO8 | PO9 | PO1 0 | PO1 1 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 1 | 1 | | | | | | | | | | 3 |
| CO2 | 1 | 1 | | | | | | | | | | 3 |
| CO3 | 1 | 1 | | | | | | | | | | 3 |

**Mapping of Course outcome with Program Outcomes (Information Technology)**

| Course Outcome | PO 1 | PO2 | PO 3 | PO4 | PO5 | PO 6 | PO7 | PO8 | PO9 | PO1 0 | PO1 1 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 1 | 1 | | | | | | | | 3 | | |
| CO2 | 1 | 1 | | | | | | | | 3 | | |
| CO3 | 1 | 1 | | | | | | | | 3 | | |

**1 – High, 2 – Medium, 3 - Low**

**Assessment table:**

| Course outcomes | **CO1** | | | | **CO2** | | | | **CO3** | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Assessment Tool | **K1** | **K2** | **K3** | **K5** | **K1** | **K2** | **K3** | **K5** | **K1** | **K2** | **K3** | **K5** |
| Class Test-I 15 Marks | 2 | 1 | 6 | 6 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Class Test-II 15 Marks | 0 | 0 | 0 | 0 | 2 | 1 | 6 | 6 | 0 | 0 | 0 | 0 |
| Teachers Assessment 10 Marks | 1 | 1 | 0 | 2 | 1 | 1 | 0 | 2 | 0 | 0 | 0 | 2 |
| ESE Assessment 60 Marks | 4 | 0 | 10 | 10 | 4 | 0 | 10 | 10 | 2 | 0 | 0 | 10 |

**Teaching Strategies:**

The teaching strategy planned through the lectures, and team based home works. Exercises assigned weekly to stimulate the students to actively use and revise the learned concepts, which also help the students to express their way of solving the problems fluently in written form. Most critical concepts and mistakes emphasized

**Teacher's Assessment:** Teacher's assessment of 10 marks based on the following.

1) Home assignments
2) Surprise tests with multiple choice questions

**Assessment Pattern:**

| Assessment Pattern Level No. | Knowledge Level | Test1 | Test2 | Teachers Assessment/ Assignment | End Semester Examination |
|---|---|---|---|---|---|
| K1 | Remember | 2 | 2 | 2 | 10 |
| K2 | Understand | 1 | 1 | 2 | 0 |
| K3 | Apply | 06 | 06 | 00 | 20 |
| K4 | Analyze | 00 | 00 | 00 | 00 |
| K5 | Evaluate | 06 | 06 | 06 | 30 |
| K6 | Create | 00 | 00 | 00 | 00 |
| Total | | 15 | 15 | 10 | 60 |

| ET2001 : Electrical Fundamentals | |
|---|---|
| **Teaching Scheme**<br>**Lectures: 2 Hrs/Week**<br>**Credits: 02** | **Examination Scheme**<br>**Test 1 : 10 Marks**<br>**Teachers Assessment : 10 Marks**<br>**End Semester Exam : 30 Marks** |

**Course description**: On completion of this course, students will have a knowledge of fundamentals of electronics Engineering. It includes the Kirchhoff's voltage law, current law, source transformation, network analysis methods and AC circuits.

**Course Objectives:**

- To offer basic understanding for solving circuits using KCL, KVL and network theorems.
- To explain DC circuits, magnetic circuits and AC circuits.

**Course Outcomes**

After completing the course, students will be able to:

| | | |
|---|---|---|
| CO1 | K1 | Define network theorems, analysis methods fundamentals of magnetic and AC circuits |
| CO2 | K2 | Understand DC circuits, magnetic circuits and AC circuits for simplifying the complex networks. |

**Detailed Syllabus:**

| | |
|---|---|
| Unit 1 | **DC Circuits:**<br>Kirchoff's laws, Source conversion, series and parallel circuit, current and voltage division rule, Delta-star and star-delta conversion, Node voltage and Mesh current methods, Superposition theorem, Thevenin's and Norton's theorems, Maximum power transfer theorem. Charging and discharging of capacitor, Time constant for RC circuit |
| Unit 2 | **Electromagnetic Induction**: Faraday's laws, statically and dynamically induced emf, self and mutual inductance, coefficients of coupling, dot convention, inductance in series and parallel, principle of operation, constructional details, types and applications of single phase Transformer, Induction motors, DC motors. |
| Unit 3 | **Single phase AC Circuits**: Concept of single phase supply, Terms related with A.C. quantities, pure resistive, inductive and capacitive circuits, Complex and phasor representation of AC quantities, series and parallel circuits, introduction to resonance |

**TEXT AND REFERENCE BOOKS**


1. Leonard Bobrow ''Fundamentals of Electrical Engineering" ,Oxford University press
2. Vincent Del Toro, "Principles of Electrical Engineering ", Prentice Hall.
3. D.P. Kothari, I.J Nagrath ,"Basic Electrical Engineering "Tata McGraw Hill
4. M.S.Naidu, S.Kamakshaiah ,"Introduction to Electrical Engineering" Tata McGraw Hill
5. J.P.Tiwari,"Basic Electrical Engineering "New Age Publication
6. Joseph Administer,"Schaum's outline of Electric circuits", Tata McGraw Hill

**Mapping of Course outcome with Program Outcomes**

| Course Outcome | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | | | | | | | | | | | |
| CO2 | 2 | 2 | | | | | | | | | | |

**1 – High2 – Medium3 - Low**

**Teacher's Assessment:** Teachers Assessment of 10 marks is based on one of the / or combination of few of following

1) Simulation
2) Prototype development
3) Power point presentation of case studies
4) Question & answer / Numerical solution

**Assessment Pattern**

| **Assessment Pattern Level No.** | **Knowledge Level** | **Test 1** | **Teachers Assessment/ Assignment** | **End Semester Examination** |
|---|---|---|---|---|
| K1 | Remember | 04 | 00 | 06 |
| K2 | Understand | 06 | 10 | 24 |
| K3 | Apply | 00 | 00 | 00 |
| K4 | Analyze | 00 | 00 | 00 |
| K5 | Evaluate | 00 | 00 | 00 |
| K6 | Create | 00 | 00 | 00 |
| **Total Marks 100** | | 10 | 10 | 30 |

**Assessment table**

| Assessment Tool | K1 | K2 |
|---|---|---|
| | C01 | C02 |
| Class Test (20 Marks) | 04 | 06 |
| Teachers Assessment (20 Marks) | 00 | 10 |
| ESE Assessment (60 Marks) | 06 | 24 |

**Special Instructions if any: Nil**

| ET2002 : Programming Language<br>(Engineering Science Elective) | |
|---|---|
| **Teaching Scheme**<br>**Lectures: 2 Hrs/Week**<br>**Total Credits : 02** | **Examination Scheme**<br>**Class Test : 10 Marks**<br>**Teachers Assessment : 10 Marks**<br>**End Semester Exam : 30 Marks** |

**Prerequisites: Nil**

**Course description**: This course covers fundamentals of Programming. It mainly emphasizes on programming language C. It deals with introduction of C language along with applications development using it.

**Course Objectives:**

- To learn and acquire art of computer programming
- To know about concepts of popular programming language C
- To develop simple applications using C programming concepts

**Course Outcomes**

After completing the course, students will able to:

| | | |
|---|---|---|
| CO1 | To learn basics of C Programming Language | K1 |
| CO2 | To Write & Debug C Programs using basic C constructs | K2 |
| CO3 | Solve real time problems using C programming Language | K3 |

**Detailed Syllabus:**

| | |
|---|---|
| Unit 1 | **Introduction to C Language fundamentals**, The C character set, variables and constants, data types, keywords, expressions, statements, operators- arithmetic operators , unary operators, relational & logical operators, conditional operators, type conversions , type casting. |
| Unit 2 | **C Programming: Control Structures-** Conditional and Unconditional Branching Using if, nested if, if else, switch, break, continue, go to statement, and return statements.<br>**Loop structures** - For loop, While loop, Do while loop.<br>**Functions** – Creating subprograms using Functions, Parameter passing by value, parameter passing by reference, returning values from functions, recursion, Local and Global variables concepts, main function with argv, argc[]. |
| Unit 3 | **Arrays-** definition, passing array to the function, Multidimensional array, String operation- String copy, String length, String concatenation, String compare. Introduction to structure and union. Array of structure, Passing structure as an object to function. Structure as an return type of function**.**<br>**Pointer**s- pointer as a variable, pointer to array, pointer as argument to function. String operations using pointers. |

**Text and Reference Books**


1. E. Balgurusamy, "Programming in ANSIC C", Third Edition, Tata McGraw Hill.
2. Kernighan Ritchie, "The C Programming Language", Prentice Hall of India.
3. Yashvant Kanetkar, "Let Us C", Seventh Edition, BPB Publications.
4. Behrouz A. Forouzan, Richard F. Gilberg, "Computer Science- A Structured Programming approach using C", Indian Edition,Thomson, 3rd Edition.

**Mapping of Course outcome with Program Outcomes**

| Course Outcome | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 2 | | | | | | | | | | | |
| CO2 | 2 | 2 | | | | | | | | | 3 | |
| CO3 | | 2 | 3 | | | | | | | | 3 | |

**1 – High 2 – Medium 3 - Low**

**Teacher's Assessment:** Teachers Assessment of 20 marks is based on one of the / or combination of few of following

1) Application development using C
2) Power point presentation of case studies
3) Question & answer
4) Mini projects

**Assessment Pattern**

| Assessment Pattern Level No. | Knowledge Level | Class Test | Teachers Assessment/ Assignment | End Semester Examination |
|---|---|---|---|---|
| K1 | Remember | 04 | 00 | 05 |
| K2 | Understand | 06 | 10 | 20 |
| K3 | Apply | 00 | 00 | 05 |
| K4 | Analyze | 00 | 00 | 00 |
| K5 | Evaluate | 00 | 00 | 00 |
| K6 | Create | 00 | 00 | 00 |
| **Total Marks 50** | | **10** | **10** | **30** |

**Assessment table**

| Assessment Tool | **K1** | **K2** | **K2** |
|---|---|---|---|
| | **CO1** | **CO2** | **CO3** |
| Class Test (10 Marks) | 04 | 06 | 00 |
| Teachers Assessment (10 Marks) | 00 | 05 | 05 |
| ESE Assessment (30 Marks) | 05 | 20 | 05 |

**Special Instructions if any: Nil**

| ET 2003 : Electronics Devices and Circuits | |
|---|---|
| **Teaching Scheme**<br>**Lectures: 3 Hrs/Week**<br>**Credits: 03** | **Examination Scheme**<br>**Test 1 : 15Marks**<br>**Test 2 : 15 Marks**<br>**Teachers Assessment : 10 Marks**<br>**End Semester Exam : 60 Marks** |

**Prerequisites:** Knowledge of Physics and Mathematics

**Course description**: After completing this course, students will be able to understand working principles of semiconductor devices and their applications also analyze frequency response. This will help students in learning dependent core courses.

**Course Objectives:**

- To acquaint the students with construction, theory and characteristics of various Semiconductor devices
- To lay a strong fundamental base of electronics.
- To develop capacity to interpret and analyze different electronics circuits

**Course Outcomes**

After completing the course, students will able to:

| | | |
|---|---|---|
| CO1 | Know basics of semiconductor devices. | K1 |
| CO2 | Understand working and characteristics of semiconductor devices | K2 |
| CO3 | Describe various applications of diode and transistor | K2 |
| CO4 | Analyze amplifiers for various frequency models | K3 |

**Detailed Syllabus:**

| | |
|---|---|
| Unit 1 | **Diodes and Circuits**<br>Review of device construction, operation, characteristics and voltage and current equations for – PN junction diode, Schottky diode, Light Emitting Diode, Laser Diode, Zener Diode, GUNN diode etc.<br>Design of diode circuits- Full Wave, Half Wave and Bridge Rectifiers, Detectors, Single and Balanced Mixers, Clippers and Clampers, Over-voltage protection circuits.<br>Diodes for device isolation in semiconductor process. Diode as voltage dependent capacitor in Voltage Controlled Oscillator, Diode as a voltage reference |
| Unit 2 | **BJTs and FETs**<br>Review of device construction, operation, characteristics and voltage and current equations for- Bipolar Junction Transistor, MOSFET and MESFET<br>Heterojunction BJT (HBT) features to improve forward current gain, terminal frequency and power capability. HBTs in SiGe, GaAs and GaN.<br>Scaling of Gate Length in MOSFET. Short Channel Effects and mitigation in FinFETs. pHEMT |
| Unit 3 | **Transistor Applications**<br>Operation, design and simulation of Gain stages, Current Mirror Loads, CS, CG and CD amplifiers and their frequency response, Differential Amplifiers and Op-Amps, Comparator, Schmitt Trigger, OTAs, Low Dropout Voltage Linear Regulator, CTAT, PTAT and Bandgap temperature compensate references, Gilbert Cell Multiplier, Digital Circuits- Gates, Flip Flop, MUX, DeMUX, Decoder, Arithmetic circuits. |

| | |
|---|---|
| Unit 4 | **Feedback Amplifiers and Oscillators**<br>Lead Compensation, Split Pole Compensation, Source Degeneration, Barkhausen criteria of stability, Feedback Oscillators- Hartley, Colpitts, Ring Oscillator, LC-Oscillators, Jitter and Phase Noise, Effect of phase noise on RADAR and communication systems, Crystal Oscillators |
| Unit 5 | **Power Amplifiers**<br>Non-switching Amplifiers- Class A, Class B, Class C, Class AB, Class B Push-pull, Cross-over distortion in Class B Push-pull, Class AB Push-pull<br>Switching Amplifiers- Class E, Class F and Class D amplifiers<br>Mixed Mode Amplifiers- Class J<br>Device Utilization Factor, Power Added Efficiency, Power Gain, Return Loss, Power Amplifier Non-linearity- Third Order Intercept (TOI), IM3. Spectral Regrowth, EVM and BER.<br>Application of Power Amplifiers in RADAR and Communication Systems. Power Amplifiers in TDD and FDD Systems |

**Text and Reference Books**


1. Boylestad & Nashelsky, Electronics Devices & Circuits, Pearson Education
2. Millman & Halkias, Electronic Devices & Circuits, TMH
3. D. A. Neamen, Electronic circuit analysis and design, TMH, (Second edition)
4. S.Salivahanan, N Sureshkumar, "Electronic Devices and Circuits", McGraw Hill Publication(Third Edition)
5. J.B. Gupta, "Electronic Devices and Circuits", Katson Education Series($6^{th}$ Edition)


**Mapping of Course outcome with Program Outcomes**

| Course Outcome | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 2 | 3 | | | | | | | | | | |
| CO2 | 2 | 2 | | | | | | | | | | |
| CO3 | 2 | 2 | | | | | | | | | | |
| CO4 | 1 | 2 | 2 | | | | | | | | | |

**1 – High2 – Medium3 - Low**

**Teacher's Assessment:** Teachers Assessment of 20 marks is based on one of the / or combination of few of following

1) Simulation
2) Application development
3) Power point presentation of case studies
4) Question & answer / Numerical solution
5) Mini projects

**Assessment Pattern**

| Assessment Pattern Level No. | Knowledge Level | Class Test I | Class Test II | Teachers Assessment/ Assignment | End Semester Examination |
|---|---|---|---|---|---|
| K1 | Remember | 04 | 04 | 00 | 10 |
| K2 | Understand | 05 | 05 | 03 | 20 |
| K3 | Apply | 06 | 06 | 05 | 20 |
| K4 | Analyze | 00 | 00 | 02 | 10 |
| K5 | Evaluate | 00 | 00 | 00 | 00 |
| K6 | Create | 00 | 00 | 00 | 00 |
| **Total Marks 100** | | 15 | 15 | 10 | 60 |

**Assessment table**

| Assessment Tool | **K1** | **K2** | **K2** | **K3** |
|---|---|---|---|---|
| | **CO1** | **CO2** | **CO3** | **CO4** |
| Class Test 1 (15 Marks) | 04 | 05 | 06 | 00 |
| Class Test 2 (15 Marks) | 04 | 05 | 06 | 00 |
| Teachers Assessment (10 Marks) | 05 | 05 | 05 | 05 |
| ESE Assessment (60 Marks) | 10 | 20 | 20 | 10 |

| ET2004: Lab-Electronics Devices and Circuits | |
|---|---|
| **Teaching Scheme**<br>**Practical: 2Hrs/Week**<br>**Credits: 01** | **Examination Scheme**<br>**Term Work : 25 Marks**<br>**Practical Examination & Viva Voce: : 25 Marks** |

**Laboratory Course Outcomes**

As an outcome of completing the Laboratory course, students will able to:

| | |
|---|---|
| CO1 | Know the testing of components |
| CO2 | understanding of electrical circuits in practical applications |
| CO3 | to analyze and design amplifier circuits, oscillators and filter circuits employing BJT, FET devices |
| CO4 | Implement hardwired circuit to test performance and application for what it is being designed. |

**List of Experiments**

| Sr. No. | Details |
|---|---|
| 1. | To calculate Efficiency and Ripple Factor in case of Half Wave, Full Wave & Bridge Rectifier and to observe the effect of load and filters. |
| **2** | Study of Series Positive Clipper and Series Negative Clipper Circuits and Shunt Positive Clipper and Shunt Negative Clipper Circuits |
| **3** | To analyze the Drain and Transfer Characteristics of N- channel MOSFET |
| **4** | To evaluate Input resistance, Output resistance and Current gain of NPN and PNP Transistor in CB, CC and CE Configuration and plot their characteristics |
| **5** | Evaluation of following parameters of JFET: DC Drain resistance, Transconductance, Amplification factor and plot the V-I characteristics of JFET |
| **6** | To plot the Frequency response of RC–Coupled amplifier |
| **7** | To plot the Frequency response of a FET amplifier. |
| **8** | Study of design and functioning of Hartley Oscillator ,Colpitt Oscillator and Wein Bridge Oscillator |
| **9** | Study of the working principle of Class A, Class B and Class AB Push-pull Amplifier |
| **10** | Study of the working principle of class C Amplifier , Differential amplifier and its operation at tuned frequency |

**Mapping of Course outcome with Program Outcomes**

| Course Outcome | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | | | | 1 | 3 | | | | | | | |
| CO2 | | 1 | | | | | | | | | | |
| CO3 | | 1 | 2 | | | | | | | | | |
| CO4 | | | | 1 | 2 | | | | | | | |

**1 – High 2 – Medium 3 - Low**

**Assessment Table**

| Assessment Tool | S1 | S2 | S3 | S2 |
|---|---|---|---|---|
| | CO1 | CO2 | CO3 | CO4 |
| Term Work (25 Marks) | 05 | 05 | 10 | 05 |
| Practical Examination & Viva Voce (25 Marks) | 10 | 05 | 05 | 05 |

**Assessment Pattern**

| **Assessment Pattern Level No.** | **Skill Level** | **Term Work** | **Practical Examination & viva voce** |
|---|---|---|---|
| S1 | Imitation | 05 | 10 |
| S2 | Manipulation | 10 | 10 |
| S3 | Precision | 10 | 05 |
| S4 | Articulation | 00 | 00 |
| 55 | Naturalization | 00 | 00 |
| **Total** | | 25 | 25 |

| | | |
|---|---|---|
| Preparation (S1) | 05 | 10 |
| Conduct of Experiment (S2) | 10 | 10 |
| Observation and Analysis of Results (S3) | 05 | 05 |
| Mini-Project / Presentation/ Viva-Voce (S3) | 05 | 00 |
| Total | **25** | **25** |

| ET2005 : Digital Electronics<br>(Professional Core) | |
|---|---|
| **Teaching Scheme**<br>**Lectures: 03 Hrs/Week**<br>**Total Credits :03** | **Examination Scheme**<br>**Class Test I :15 Marks**<br>**Class Test II :15 Marks**<br>**Teachers Assessment :10 Marks**<br>**End Semester Exam :60 Marks** |

**Prerequisites:** Nil

**Course description**: After completing this course, students will have a clear and fundamental understanding of Digital systems. Topics range from an overview of Basics of Digital Electronics, Types of digital logics, different logic families and Finite State Machine

**Course Objectives:**

- To lay a strong base in basic principles of Numbering Systems, logic gates
- To use basic components for digital electronics design
- To Design combinational and Sequential Circuits
- To develop conceptual understanding of Logic Families & HDL

**Course Outcomes**

After completing the course, students will able to:

| | |
|---|---|
| CO1 | Identify functions of digital circuits and their Boolean representation. |
| CO2 | Understand fundamentals of minimization techniques and basic building circuits for Digital electronics. |
| CO3 | Design combinational and sequential circuits. |

**Detailed Syllabus:**

| | |
|---|---|
| Unit 1 | **Boolean Algebra and Logic Simplification**<br>BCD, Octal, Hexadecimal Number systems, Conversions from one to other type, De Morgan‟s<br>Theorem, Code converters, Logic Gates. Reduction of logic function using Boolean algebra, SOP & POS forms, canonical forms of SOP and POS equation. Karnaugh map up to 4 variables. |
| Unit 2 | **Combinational Logic Design**<br>Code conversion, Half, Full Adders and subtractor circuits, Digital Comparator, Multiplexer, Demultiplexer, Encoder, Decoder, Study of ALU |
| Unit 3 | **Sequential Logic Design**<br>S-R, clocked S-R, J-K and Master-Slave J-K flip-flops, excitation table of flip-flop, flip flop Conversions, shift registers their types and applications, Counters, Design of ripple and synchronous counters |
| Unit 4 | **Logic Families, Interfacing:**<br>TTL NAND gate, specifications, tri-state TTL, ECL, MOS, CMOS families and their interfacing. Introduction to ADC and DAC |
| Unit 5 | **Finite State Machine**<br>Clocked synchronous state machine analysis, Clocked synchronous state machine design, Mealy and Moore machine, designing state machines using state diagrams and state table. |

**Text/References**


- A.P. Malvino, Digital Electronics, Mc-Graw Hill
- W.H. Gothman, Digital Electronics-An introduction to theory and practice, PHI
- Douglas V. Hall, Digital Circuits and Systems, McGraw Hill
- R.P.Jain, Digital Electronics, Tata McGraw Hill
- William I Fleatcher, An Engineering approach to digital design, PHI
- J.F.Wakerly: Digital Design, Principles and Practices,4$^{th}$Edition,Pearson Education, 2005
- Charles H Roth: Digital Systems Design using VHDL, Thomson Learning, 1998
- H.Taub and D. Schilling, Digital Integrated Electronics, McGraw Hill, 1977
- D.A. Hodges and H.G. Jackson, Analysis and Design of Digital Integrated Circuits, International Student Edition, McGraw Hill, 1983.


**Mapping of Course outcome with Program Outcomes**

| Course Outcome | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | | | | | | | | | | | |
| CO2 | 2 | 2 | | | | | | | | | | |
| CO3 | 1 | 1 | 2 | | | | | | | | | |

**1 – High 2 – Medium 3 – Low**

**Teacher's Assessment:** Teachers Assessment of 20 marks is based on one of the / or combination of few of following

1) Simulation
2) Application development
3) Power point presentation of case studies
4) Question & answer / Logic problem solving
5) Mini projects

**Assessment Pattern**

| **Assessment Pattern Level No.** | **Knowledge Level** | **Test** I | **Test** II | **Teachers Assessment/ Assignment** | **End Semester Examination** |
|---|---|---|---|---|---|
| K1 | Remember | 10 | 00 | 00 | 12 |
| K2 | Understand | 05 | 10 | 05 | 30 |
| K3 | Apply | 00 | 05 | 05 | 18 |
| K4 | Analyze | 00 | 00 | 00 | 00 |
| K5 | Evaluate | 00 | 00 | 00 | 00 |
| K6 | Create | 00 | 00 | 00 | 00 |
| **Total Marks 100** | | 15 | 15 | 10 | 60 |

**Assessment table**

| Assessment Tool | **K1** | **K3** | **K2** |
|---|---|---|---|
| | **C01** | **C02** | **C03** |
| Class Test I (15 Marks) | 10 | 05 | 00 |
| Class Test II (15 Marks) | 00 | 10 | 05 |
| Teachers Assessment (10 Marks) | 00 | 05 | 05 |
| ESE Assessment (60 Marks) | 12 | 30 | 18 |

| ET2006: Lab-Digital Electronics | |
|---|---|
| **Teaching Scheme**<br>**Practical: 2Hrs/Week**<br>**Total Credits :01** | **Examination Scheme**<br>**Term Work :25 Marks**<br>**Practical Examination & Viva Voce: :25 Marks** |

**Laboratory Course Outcomes**

As an outcome of completing the Laboratory course, students will able to:

| | |
|---|---|
| CO1 | Implement logical operations using basic and universal logic gates |
| CO2 | Perform and realize arithmetic, logic circuits using ICs |
| CO3 | Execute and realize the combinational logic circuits using gates and ICs |
| CO4 | Perform and realize sequential logic, circuits using ICs. |

**List of Experiments**

**Note: At least 10 Practicals should be performed.**

| Sr. No. | Details |
|---|---|
| 1 | To verify of logic gates such as AND, OR, NOT, NAND, NOR, EX-OR, EX-NOR |
| 2 | To realize logic operations using NAND /NOR |
| 3 | To reduce Karnaugh Map (SOP/POS)<br>• Realize a code converter binary to gray<br>• Realize a circuit to detect prime numbers in a 4-bit binary numbers<br>• Realize a circuit to detect the numbers divisible by 03 in 4-bit binary numbers |
| 4 | To develop Adder/ Subtractor<br>Study of 4-bit adder using IC7483 |
| 5 | Multiplexer- Demultiplexer<br>Study of 4-bit Adder using 4:1 MUX |
| 6 | To study Decoder 3:8, 4:16 |
| 7 | To study Encoder 8:3, 16:4 |
| 8 | To study Flip-flops D, R-S, J-K<br>Realize conversion of JK to T, JK to D flip flop |
| 9 | To design Asynchronous counter using J-K Flip-flops |
| 10 | To study Shift Register |
| 11 | To study Decade counter/Ring counter |
| 12 | To design Synchronous Counter using J-K Flip –flops |
| 13 | To study A.L.U. such as 74181 |
| 14 | Introduction to Hardware Description Language, |

**Mapping of Course outcome with Program Outcomes**

| Course Outcome | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 2 | | | | 2 | | | | | | | |
| CO2 | | | | 2 | | | | | | | | |
| CO3 | | | | 1 | 2 | | | | | | | |
| CO4 | | | | 1 | 2 | | | | | | | |

**1 – High 2 – Medium 3 – Low**

**Assessment Table**

| Assessment Tool | S1 | S2 | S3 | S2 |
|---|---|---|---|---|
| | CO1 | CO2 | CO3 | CO4 |
| Term Work (25 Marks) | 05 | 05 | 10 | 05 |
| Practical Examination & Viva Voce (25 Marks) | 05 | 05 | 10 | 05 |

**Assessment Pattern**

| **Assessment Pattern Level No.** | **Skill Level** | **Term Work** | **Practical Examination & viva voce** |
|---|---|---|---|
| S1 | Imitation | 05 | 05 |
| S2 | Manipulation | 15 | 15 |
| S3 | Precision | 05 | 05 |
| S4 | Articulation | 00 | 00 |
| S5 | Naturalization | 00 | 00 |
| **Total** | | 25 | 25 |

| ET2007: Signals and Systems | |
|---|---|
| **Teaching Scheme**<br>**Lectures: 3 Hrs/Week**<br>**Credits: 3** | **Examination Scheme**<br>**Class Test I : 15 Marks**<br>**Class Test II : 15 Marks**<br>**Teachers Assessment : 10 Marks**<br>**End Semester Exam : 60 Marks** |

**Prerequisites:** Inclination to learn mathematics, basic knowledge of differential equations and difference equations, electrical circuits and networks.

**Course Description:**
The course will provide strong foundation on signals and systems which will be useful for creating foundation of communication and signal processing. The students will learn basic continuous time and discrete time signals and systems. Student will understand application of various transforms for analysis of signals and systems both continuous time and discrete time. Students will also explore to power and energy signals and spectrum.

**Course Outcomes**
After completing the course, students will be able to:

| | | |
|---|---|---|
| CO1 | Identify different signals, systems and transforms. | K1 |
| CO2 | Understand about various types of signals and systems | K2 |
| CO3 | Understand behavior of signal in time and frequency domain. | K2 |
| CO4 | Apply various transforms on signals | K3 |

**Detailed Syllabus:**

| | |
|---|---|
| Unit 1 | Basic definitions, Classification of signals and systems. Signal operations and properties. Basic continuous time signals, signal sampling and reconstruction, Basic system properties. |
| Unit 2 | Continuous and discrete time:<br>Impulse response characterization and convolution integral for LTI system, signal responses to LTI system, properties of convolution, LTI system response properties |
| Unit 3 | Laplace Transform and its properties, Inverse Laplace Transform Application of Laplace transform. |
| Unit 4 | Fourier Analysis of Continuous Time Signals and Systems, Fourier Series, Fourier Transform and properties, Fourier Analysis of Discrete Time Signals and Systems, Discrete Time Fourier series, Discrete Fourier Transform and properties. Frequency response of LTI systems |
| Unit 5 | The z-Transform, Convergence of z-Transform, Basic z-Transform, Properties of z-Transform, Inverse z-Transform and Solving difference equation using z-Transform |

**TEXT AND REFERENCE BOOKS**


1. Signals and Systems by Alan V. Oppenheim, Alan S. Wilsky and Nawab, Prentice Hall
2. Signals and Systems by K. Gopalan, Cengage Learning (India Edition)
3. Signals and Systems by Michal J. Roberts and Govind Sharma, Tata Mc-Graw Hill Publications
4. Signals and Systems by Simon Haykin and Bary Van Veen, Wiley- India Publications
5. Linear Systems and Signals by B.P.Lathi, Oxford University Press
6. Signal, Systems and Transforms by Charles L. Philips, J. M. Parr and E. A. Riskin, Pearson Education
7. Digital Signal Processing Fundamentals and Applications by Li Tan, Elsevier, Academic Press 8. Signal and Systems By Anand Kumar, 3rd Edition, PHI


**Mapping of Course outcome with Program Outcomes**

| Course Outcome | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 3 | | | | | | | | | | |
| CO2 | 2 | 2 | | | | | | | | | 3 | |
| CO3 | 2 | 2 | | | | | | | | | 3 | |
| CO4 | 1 | 2 | | | | | | | | | 2 | |

**1 – High 2 – Medium 3 - Low**

**Teacher's Assessment:** Teachers Assessment of 20 marks is based on one of the / or combination of few of following

1) Simulation
2) Prototype development
3) Power point presentation of case studies
4) Question & answer / Numerical solution

**Assessment Pattern**

| Assessment Pattern Level No. | Knowledge Level | Test 1 | Test 1 | Teachers Assessment/ Assignment | End Semester Examination |
|---|---|---|---|---|---|
| K1 | Remember | 05 | 00 | 00 | 12 |
| K2 | Understand | 10 | 10 | 05 | 36 |
| K3 | Apply | 00 | 05 | 05 | 12 |
| K4 | Analyze | 00 | 00 | 00 | 00 |
| K5 | Evaluate | 00 | 00 | 00 | 00 |
| K6 | Create | 00 | 00 | 00 | 00 |
| **Total Marks 100** | | 15 | 15 | 10 | 60 |

**Assessment table**

| Assessment Tool | K1 | K2 | K2 | K3 |
|---|---|---|---|---|
| | CO1 | CO2 | CO3 | CO4 |
| Class Test (20 Marks) | 05 | 10 | 00 | 00 |
| Teachers Assessment (20 Marks) | 00 | 10 | 05 | 00 |
| ESE Assessment (60 Marks) | 12 | 18 | 18 | 12 |

| ET2008: Lab-Signals and Systems | |
|---|---|
| **Teaching Scheme**<br>**Practical: 2 Hrs/Week**<br>**Total Credits :01** | **Examination Scheme**<br>**Term Work : 25 Marks**<br>**Practical Examination & Viva Voce: : 25 Marks** |

**Laboratory Course Outcomes**

As an outcome of completing the Laboratory course using MATLAB/CCS/IDE, students will able to:

| | |
|---|---|
| CO1 | Build mathematical modeling of signals and systems |
| CO2 | Simulate continuous and discrete time system |
| CO3 | Execute frequency response of FT/DFT/filters, transfer order |

**List of Experiments**

| Sr. No. | Details |
|---|---|
| 1 | List of Experiments: 1. Generations and capturing various continuous time signals from sensors. 2. Generation and capturing of discrete time signals and plot them.<br>3. Discretization using different sampling rate and observing aliasing effect.<br>4. Observing the effects of lower sampling rate and higher sampling rate on CT signal.<br>5. Performing various operations on the signal using circuits and computational software.<br>6. Using digital circuit building block to perform operations on signals.<br>7. Simulation of continuous time LTI system.<br>8. Simulation of discrete time LTI systems.<br>9. Obtaining impulse response of the systems.<br>10. Computing FT and DTFT of the CT signals and DT sequences. |
| 2 | Design based Problems (DP)/Open Ended Problem: 1. Design of active noise removal / cancellation circuit. 2. Design of digital building blocks to perform various operations on discrete time sequences and singals. 3. Design of efficient and accurate signal converter. 4. Design of sample and hold circuits 5. Design of anti aliasing filter, |

**Mapping of Course outcome with Program Outcomes**

| Course Outcome | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 2 | 3 | | 3 | | | | | | | | |
| CO2 | | 3 | | 2 | | | | | | | | |
| CO3 | 2 | 2 | | 1 | | | | | | | | |

**1 – High 2 – Medium 3 - Low**

**Assessment Table**

| Assessment Tool | S2 | S1 | S3 |
|---|---|---|---|
| | CO1 | CO2 | CO3 |
| Term Work (25 Marks) | 05 | 10 | 10 |
| Practical Examination & Viva Voce (25 Marks) | 05 | 10 | 10 |

**Assessment Pattern**

| **Assessment Pattern Level No.** | **Skill Level** | **Term Work** | **Practical Examination & viva voce** |
|---|---|---|---|
| S1 | Imitation | 05 | 05 |
| S2 | Manipulation | 10 | 10 |
| S3 | Precision | 10 | 10 |
| S4 | Articulation | 00 | 00 |
| S5 | Naturalization | 00 | 00 |
| **Total** | | 25 | 25 |

| ET2009: Instrumentation and Measurement (Engineering Sciences) | |
|---|---|
| **Teaching Scheme**<br>**Lectures: 2 Hrs /Week** | **Examination Scheme**<br>**Test I : 10 Marks**<br>**Teachers Assessment : 10 Marks**<br>**End Semester Exam : 30 Marks** |

**Prerequisites: Knowledge of basic Electronics**

**Course description**:

This course is electronics based course dealing with measurements and instrumentation designed for students in Electronics Engineering. It is a theory course based on the use of electrical and electronics instruments for measurements. The course deals with topics such as Principle of measurements, Errors, Accuracy, Units of measurements and electrical standards, Q- meters, Watt-meters, Digital voltmeters, recorders, the principles of operation of transducers used for measurement.

**Course Objectives:**

- To understand the operation of different instruments
- To familiarize with various measurement methods and electronic measurement equipment's
- To analyze the signals using different analyzers
- To introduce transduction methods

**Course Outcomes**

After completing the course, students will be able to:

| | | |
|---|---|---|
| CO1 | Identify elements of setup for measurement of physical quantities and parameter. | K1 |
| CO2 | Explain the various techniques for parameter measurement & signal analyzing.. | K2 |

**Detailed Syllabus:**

| | |
|---|---|
| Unit 1 | **Instrumentation Basics and bridge measurement**<br>Introduction to measurements, Units and standards of measurement and their classification, Sensing and Transduction, Block diagram of Instrumentation system, Errors in measurements, Probability of errors, Static and Dynamic performance characteristics of measuring Transducer.<br>Bridge measurement: Measurement of Voltage, Current, AC /DC Bridges such as Wheatstone, Kelvin, Maxwell, Hay, Schering, Wein bridge and their application. |
| Unit 2 | **Transducer**<br>Definition, classification, selection criterion, Resistive, Capacitive and Inductive Transducers, , Hall Effect Transducer, Thermocouple ,strain gauge, Transducers for measurement of Flow, Viscosity, Humidity, Pressure and necessary signal conditioning. |
| Unit 3 | **Basic Parameter Measurement and analysis by Electronic Instrumentation**<br>AC voltmeters using rectifiers, True RMS voltmeter, Vector voltmeter, Digital voltmeter, Q-meter, Electronic multimeter, Sound level meter, RF Voltage/ power measurement, Recorders. Wave analyzers, Harmonic distortion analyzer, DSO, Spectrum analyzer, logic analyzer, Network Analyzer. |

**Text and Reference Books**


1. Cooper and Helfrick, Modern Electronic Instrumentation and Measurements, Prentice-Hall of India
2. Kalsi, Electronic Instrumentation and Measurements, TMH
3. Oliver & Cage, Electronic Measurements and Instrumentation, McGraw Hill
4. J.J. Carr, Elements of Electronics Instrumentation and Measurement Handbook, Pearson Education, 3rd Edition
5. B.C. Nakra and K.K. Chaudhary, Instrumentation Measurement and Analysis, Tata McGraw Hill, 2nd Edition


**Mapping of Course outcome with Program Outcomes**

| Course Outcome | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO 9 | PO1 0 | PO1 1 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 2 | 2 | | | | | | | | | | |
| CO2 | 2 | 2 | | | 2 | | | | | | | |

**1 – High 2 – Medium 3 - Low**

**Teacher's Assessment:** Teachers Assessment of 20 marks is based on one of the / or combination of few of following

1) Simulation
2) Power point presentation of case studies
3) Question & answer / Numerical solution
4) Study of Industry processes and its presentation

**Assessment Pattern**

| Assessment Pattern Level No. | Knowledge Level | Test I | Teachers Assessment/ Assignment | End Semester Examination |
|---|---|---|---|---|
| K1 | Remember | 05 | 00 | 06 |
| K2 | Understand | 05 | 10 | 24 |
| K3 | Apply | 00 | 00 | 00 |
| K4 | Analyze | 00 | 00 | 00 |
| K5 | Evaluate | 00 | 00 | 00 |
| K6 | Create | 00 | 00 | 00 |
| **Total Marks 100** | | 10 | 10 | 30 |

**Assessment table**

| Assessment Tool | **K1** | **K2** |
|---|---|---|
| | **CO1** | **CO2** |
| Class Test (10 Marks) | 05 | 05 |
| Teachers Assessment (10 Marks) | 00 | 10 |
| ESE Assessment (30 Marks) | 06 | 24 |

| ET2010: Lab Instrumentation & Measurement | |
|---|---|
| **Teaching Scheme**<br>**Practical: 2 Hrs/Week**<br>**Total Credits :01** | **Examination Scheme**<br>**Term Work :25 Marks**<br>**Practical Examination & Viva Voce: :25 Marks** |

**Laboratory Course Outcomes**

As an outcome of completing the Laboratory course, students will be able to:

| | |
|---|---|
| CO1 | Implement the setup for obtaining characteristics of various transducer. |
| CO2 | Perform experiments for parameter measurements by different instruments. |

**List of Experiments**

| | |
|---|---|
| 1 | Error measurement. |
| 2 | Identify unknown resistance with Wheatstone bridge |
| 3 | Measure the values of various inductors, capacitors and resistors by using LCR-Q meter. |
| 4 | Plot Pressure Transducer characteristics |
| 5 | Study Flow measurement |
| 6 | Study Strain measurement |
| 7 | Study DC voltmeter. |
| 8 | Study of multimeter. |
| 9 | Measurements using digital storage Oscilloscope |
| 10 | Study of spectrum analyzer and measurements |

**Mapping of Course outcome with Program Outcomes**

| Course Outcome | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | | | 2 | | | | | | | | |
| CO2 | 3 | | | 2 | | | | | | | | |

**1 – High 2 – Medium 3 - Low**

**Assessment Table**

| Assessment Tool | S1 | S2 |
|---|---|---|
| | CO1 | CO2 |
| Term Work (25 Marks) | 10 | 15 |
| Practical Examination & Viva Voce (25 Marks) | 10 | 15 |

**Assessment Pattern**

| Assessment Pattern Level No. | Skill Level | Term Work | Practical Examination & viva voce |
|---|---|---|---|
| S1 | Imitation | 10 | 10 |
| S2 | Manipulation | 15 | 15 |
| S3 | Precision | 00 | 00 |
| S4 | Articulation | 00 | 00 |
| S5 | Naturalization | 00 | 00 |
| **Total** | | **25** | **25** |

| ET2011 : Network Theory<br>(Professional Core) | |
|---|---|
| **Teaching Scheme**<br>**Lectures: 3 Hrs/Week**<br>**Tutorial: 2 Hr/Week**<br>**Credits: 04** | **Examination Scheme**<br>**Class Test I : 15 Marks**<br>**Class Test II : 15 Marks**<br>**Teachers Assessment : 10 Marks**<br>**End Semester Exam : 60 Marks** |

**Prerequisites:** Basic knowledge of Fundamentals Electrical Engineering

**Course description**: On completion of this course, students will have a basic and comprehensive understanding of network analysis and synthesis methods. It includes the network analysis methods, resonance, transient analysis, properties of symmetric and asymmetric network, passive filter design, attenuator, network functions and two port parameters.

**Course Objectives:**

To offer basic understanding for solving circuits using network theorems.

To explain resonance circuits, properties of symmetric and asymmetric passive network, passive filters and attenuators.

To give knowledge about two port parameters, network functions, stability and transient analysis of basic circuits.

**Course Outcomes**

After completing the course, students will able to:

| | | |
|---|---|---|
| CO1 | Define basic terms in concern with different networks. | K1 |
| CO2 | Understand network analysis concepts. | K2 |
| CO3 | Perform transient analysis and AC analysis of few networks. | K2 |
| CO4 | Apply the knowledge of network analysis concepts to solve given problem. | K3 |

**Detailed Syllabus:**

| | |
|---|---|
| Unit 1 | **Network Analysis:** Mesh, Super mesh, Node and Super Node analysis, Superposition, Thevenin's, Norton's and Maximum Power Transfer Theorems, Millers Theorem and its dual.(AC circuit analysis for all above topics of this unit)<br>**Graph Theory:**<br>Network graph, tree, co-tree, and loops. Incidence matrix, tie-set, cut-set matrix. Formulation of equilibrium equations in matrix form |
| Unit 2 | **Transient Analysis of Basic RC, RL and RLC Circuits**<br>Initial conditions, source free RL and RC circuits, properties of exponential response, Driven RL and RC circuits, Natural and Forced response of RL and RC circuits. Introduction to Source free and driven series RLC circuit. Over damped and Under damped series RLC circuit. |
| Unit 3 | **Resonance**<br>**Series Resonance:** Impedance, Phase angle variations with frequency, Voltage and current variation with frequency, Bandwidth, Selectivity.<br>**Parallel resonance:** Resonant frequency and admittance variation with frequency, |

| | |
|---|---|
| | Bandwidth and selectivity. General case: Resistance present in both branches. Comparison and applications of series and parallel resonant circuits. |
| Unit 4 | **Filters and Attenuators**<br>**Classifications:** Symmetrical networks, asymmetrical networks, properties of symmetrical and asymmetrical networks.<br>**Filters:** Filter fundamentals, Constant K-LPF, HPF, BPF and BSF, introduction to concept of m derived LPF and HPF, Terminating half sections, and composite filters.<br>**Attenuators:** Introduction to Neper and Decibel. Symmetrical T and type attenuators. |
| Unit 5 | **Two Port Network Parameters and Functions**<br>Terminal characteristics of network: Z, Y, h, ABCD Parameters; Reciprocity and Symmetry conditions, Applications of the parameters. Application of Laplace Transforms to circuit analysis. Network functions for one port and two port networks, Pole-zeros of network functions and network stability. |

**TEXT AND REFERENCE BOOKS**


1. Franklin F. Kuo, Network Analysis and Synthesis, Wiley Publications
2. M.E. Van Valkanburg, Network Analysis, PHI Publications
3. M.E. Van Valkanburg, Introduction to Modern Network Synthesis, Wiley Publications
4. C.L. Wadhawa, Network Analysis and Synthesis, New Age International Publications
5. D. Roy Chaudhary, Networks and Systems, New Age International Publications
6. Network Lines and Fields by John D Ryder; PHI, New Delhi.
7. Network Filters and Transmission Lines by AK Chakarvorty; Dhanpat Rai and Co. Publication


**Mapping of Course outcome with Program Outcomes**

| Course Outcome | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | | | | | | | | | | 3 | |
| CO2 | 2 | 3 | | | | | | | | | 3 | |
| CO3 | 2 | 3 | | | | | | | | | 3 | |
| CO4 | 1 | 2 | | | | | | | | | 2 | |

**1 – High 2 – Medium 3 - Low**

**Teacher's Assessment:** Teachers Assessment of 10 marks is based on one of the / or combination of few of following

1) Simulation
2) Prototype development
3) Power point presentation of case studies
4) Question & answer / Numerical solution

**Assessment Pattern**

| Assessment Pattern Level No. | Knowledge Level | Class Test I | Class Test II | Teachers Assessment/ Assignment | End Semester Examination |
|---|---|---|---|---|---|
| K1 | Remember | 05 | 05 | 00 | 10 |
| K2 | Understand | 10 | 10 | 00 | 42 |
| K3 | Apply | 00 | 00 | 10 | 08 |
| K4 | Analyze | 00 | 00 | 00 | 00 |

| | | | | | |
|---|---|---|---|---|---|
| K5 | Evaluate | 00 | 00 | 00 | 00 |
| K6 | Create | 00 | 00 | 00 | 00 |
| **Total Marks 100** | | 15 | 15 | 10 | 60 |

**Assessment table**

| Assessment Tool | **K1** | **K2** | **K2** | **K3** |
|---|---|---|---|---|
| | **CO1** | **CO2** | **CO3** | **CO4** |
| Class Test I (15 Marks) | 05 | 05 | 05 | 00 |
| Class Test II (15 Marks) | 05 | 05 | 05 | 00 |
| Teachers Assessment (10 Marks) | 00 | 00 | 00 | 10 |
| ESE Assessment (60 Marks) | 10 | 24 | 18 | 08 |

**Special Instructions if any: Nil**

| ET2012 : Lab-Network Theory | |
|---|---|
| **Teaching Scheme**<br>**Practical: 2 Hrs/Week**<br>**Credits: 01** | **Examination Scheme**<br>**Term Work : 25 Marks**<br>**Practical Examination & Viva Voce: : 25 Marks** |

**Laboratory Course Outcomes**

As an outcome of completing the Laboratory course, students will able to:

| | |
|---|---|
| CO1 | Experiment for verification of network theorems, transient response of RL, RC circuits and measurements of two port parameters for a given circuit. |
| CO2 | Plot frequency response of passive networks. |

**List of Experiments**

| Sr. No. | List of Experiments |
|---|---|
| 1 | To verify<br>i. Thevenin's theorem.<br>ii. Maximum power transfer theorem<br>iii. Superposition theorem. |
| 2 | To find transient response of RL and RC circuits |
| 3 | To measure the 'Z' and 'Y' parameters of two port network. |
| 4 | To measure the 'h' and ABCD parameters of two port network. |
| 5 | i. To find resonance frequency and bandwidth of series and parallel RLC circuit.<br>ii. Simulate parallel resonance circuit in which resistance present in both branches |
| 6 | To plot frequency response of low pass and high pass filter. Also find out cutoff frequency. |
| 7 | To plot frequency response of band pass and band stops filter. |
| 8 | To plot frequency response of m derived low pass and high pass filter. |
| 9 | Design of symmetrical T and pi attenuator |

**Mapping of Course outcome with Program Outcomes**

| Course Outcome | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 2 | | | 2 | | | | | | | 3 | |
| CO2 | 2 | | | 2 | 3 | | | | | | 3 | |

**1 – High 2 – Medium 3 - Low**

**Assessment Table**

| Assessment Tool | S2 | S2 |
|---|---|---|
| | CO1 | CO2 |
| Term Work (25 Marks) | 15 | 10 |
| Practical Examination & Viva Voce (25 Marks) | 15 | 10 |

**Assessment Pattern**

| Assessment Pattern Level No. | Skill Level | Term Work | Practical Examination & viva voce |
|---|---|---|---|
| S1 | Imitation | 05 | 05 |

| | | | |
|---|---|---|---|
| S2 | Manipulation | 20 | 20 |
| S3 | Precision | 00 | 00 |
| S4 | Articulation | 00 | 00 |
| S5 | Naturalization | 00 | 00 |
| **Total** | | 25 | 25 |

| ET2013 : Linear Integrated Circuits<br>(Professional Core) | |
|---|---|
| **Teaching Scheme**<br>**Lectures: 3 Hrs/Week**<br>**Total Credits : 03** | **Examination Scheme**<br>**Class Test I : 15 Marks**<br>**Class Test II : 15Marks**<br>**Teachers Assessment : 10 Marks**<br>**End Semester Exam : 60 Marks** |

**Prerequisites:** Knowledge of Electronic Devices and Circuits

**Course description**: This course covers fundamentals of Linear Integrated Circuits. It deals with characteristics of Operational amplifiers. It covers applications such as summing, precision rectifying, filtering as well as timer, PLL *etc.*

**Course Objectives:**

To impart knowledge of working principles of Op-Amp & its applications
To emphasize the features and advantages of integrated circuits
To introduce the theoretical concepts and applications of analog multipliers & PLL
To design simple filter circuits for particular application

**Course Outcomes**

After completing the course, students will able to:

| | | |
|---|---|---|
| CO1 | Define the basic concepts related to Op-Amp. | K1 |
| CO2 | Explain the working of op-amp based circuits. | K2 |
| CO3 | Illustrate linear ICs and their use. | K2 |
| CO4 | Apply linear circuits for real life situations | K3 |

**Detailed Syllabus:**

| | |
|---|---|
| Unit 1 | **Op-Amp Fundamentals**<br>Block diagram of Op-Amp. An overview of different types of OPAMP, their peculiarities and application areas. Op-Amp parameters, Frequency response, inverting, and non-inverting configurations. |
| Unit 2 | **Op-Amp Applications**<br>Summing amplifier, Difference amplifier, Instrumentation amplifier and applications, Integrator, Differentiator and applications. V to I and I to V converter, Comparators, Limitations of Op-amp as Comparator, Schmitt trigger, Comparator IC LM339, Precision rectifiers, Peak detector. |
| Unit 3 | **Signal Generators**<br>Sine wave generators, Triangular wave generators, Saw tooth generators, V to F and F to V converters, function generator IC 8038 , Multi vibrators using IC 555, D-A and A-D converters. |
| Unit 4 | **Active Filter Design** |

| | |
|---|---|
| | All types of filter responses, First and second order active filters LP and HP, BPF, band reject and bi quad filters, sensitivity analysis. |
| Unit 5 | **Non-linear Applications and Phase Locked Loops**<br>Log and Antilog amplifiers, Analog multipliers, Block diagram of PLL, free running frequency, lock range, capture range, Transfer characteristics of PLL, Block diagram of PLL IC 565, Applications of PLL - Frequency synthesizer, FM demodulator, AM demodulator, FSK demodulator |

**Text and Reference Books**


1. D. Roy Choudhary, Shail Jain, Linear Integrated Circuits, New Age International
2. MilimanHykin, Integrated Circuits, TMH.
3. GovindDaryanani, Principles of Active Network Synthesis and Design, John Wiley and Sons
4. Ramakant A. Gaikwad, "Op-Amps and Linear Integrated Circuits",PHI.
5. Sergio Franco, "Design with Operational Amplifiers and Analog Integrated Circuits", TMH, Third Edition


**Mapping of Course outcome with Program Outcomes**

| Course Outcome | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 2 | | | | | | | | | | | |
| CO2 | 2 | | 3 | | | | | | | | | |
| CO3 | 2 | 3 | | | | | | | | | | |
| CO4 | 2 | 3 | 2 | | | | | | | | | |

**1 – High2 – Medium3 - Low**

**Teacher's Assessment:** Teachers Assessment of 10 marks is based on one of the / or combination of few of following

1) Simulation
2) Application development
3) Power point presentation of case studies
4) Question & answer / Numerical solution
5) Mini projects

**Assessment Pattern**

| Assessment Pattern Level No. | Knowledge Level | Class Test I | Class Test II | Teachers Assessment/ Assignment | End Semester Examination |
|---|---|---|---|---|---|
| K1 | Remember | 10 | 00 | 00 | 12 |
| K2 | Understand | 05 | 15 | 10 | 42 |
| K3 | Apply | 00 | 00 | 00 | 06 |
| K4 | Analyze | 00 | 00 | 00 | 00 |
| K5 | Evaluate | 00 | 00 | 00 | 00 |
| K6 | Create | 00 | 00 | 00 | 00 |
| **Total Marks 100** | | 15 | 15 | 10 | 60 |

**Assessment table**

| Assessment Tool | **K1** | **K2** | **K2** | **K3** |
|---|---|---|---|---|
| | **CO1** | **CO2** | **CO3** | **CO4** |
| Class Test I (15 Marks) | 10 | 05 | 00 | 00 |
| Class Test II (15 Marks) | 00 | 10 | 05 | 00 |
| Teachers Assessment (10 Marks) | 00 | 05 | 05 | 00 |
| ESE Assessment (60 Marks) | 12 | 24 | 18 | 06 |

**Special Instructions if any: Nil**

| ET2014 : Lab Linear Integrated Circuits | |
|---|---|
| **Teaching Scheme**<br>**Practical: 2 Hrs/Week**<br>**Total Credits : 01** | **Examination Scheme**<br>**Term Work : 25 Marks**<br>**Practical Examination & Viva Voce: : 25 Marks** |

**Laboratory Course Outcomes**

As an outcome of completing the Laboratory course, students will able to:

| | |
|---|---|
| CO1 | Imitate measurement process for Op-Amp parameters & Op-Amp applications. |
| CO2 | Implement wave generator circuit. |
| CO3 | Demonstrate the applications using linear ICs. |

**List of Experiments**

| Sr. No. | List of Experiments |
|---|---|
| 1 | To measure operational amplifiers parameters. |
| 2 | To build noninverting amplifier and to study Op-Amp as unity gain buffer. |
| | To build inverting amplifier and to study Op-Amp as inverter (sign changer). |
| 3 | To build Summing amplifier and subtractor. |
| 4 | To assemble Integrator and Differentiator. |
| 5 | To plot Frequency response of active filter (LP/HP) |
| 6 | To build Voltage to current converter |
| 7 | To build Waveform generator 8038 |
| 8 | To assemble and plot the output waveform for astable multivibrators using IC555 |
| 9 | To assemble Zero crossing detector and observe the input output waveforms. |
| 10 | To study PLL 565 |

**Mapping of Course outcome with Program Outcomes**

| Course Outcome | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | | | 2 | | | | | | | | |
| CO2 | 3 | | | 2 | 2 | | | | | | | |
| CO3 | 3 | | | 2 | 2 | | | | | | | |

**1 – High 2 – Medium 3 - Low**

**Assessment Table**

| Assessment Tool | S1 | S2 | S2 |
|---|---|---|---|
| | CO1 | CO2 | CO3 |
| Term Work (25 Marks) | 05 | 10 | 10 |

| | | | |
|---|---|---|---|
| Practical Examination & Viva Voce (25 Marks) | 05 | 10 | 10 |

**Assessment Pattern**

| **Assessment Pattern Level No.** | **Skill Level** | **Term Work** | **Practical Examination & viva voce** |
|---|---|---|---|
| S1 | Imitation | 05 | 05 |
| S2 | Manipulation | 20 | 20 |
| S3 | Precision | 00 | 00 |
| S4 | Articulation | 00 | 00 |
| 55 | Naturalization | 00 | 00 |
| **Total** | | 25 | 25 |

| ET2015 : Analog Communication<br>(Professional Core) | |
|---|---|
| **Teaching Scheme**<br>**Lectures : 03Hrs/Week**<br>**Total Credits : 03** | **Examination Scheme**<br>**Class Test I : 15 Marks**<br>**Class Test II : 15 Marks**<br>**Teachers Assessment : 10 Marks**<br>**End Semester Exam : 60 Marks** |

**Prerequisites: Nil**

**Course description**: After completing this course, students will have a clear and fundamental understanding of Communication theory. Topics range from an overview of types of modulation. Effect of noise in communication is also covered. Subject develops the understanding of students to treat the modulation in time and frequency domain.

**Course Objectives:**

- To provide students with basics of Analog Communication principles
- To emphasize Analog modulation and demodulation techniques.
- To emphasize Performance of communication circuits in presence of noise
- To emphasize Modern trends in communication systems and transmitter/receiver circuits.

**Course Outcomes**

After completing the course, students will able to:

| | | |
|---|---|---|
| CO1 | State basic concepts in modern electronic communication | K1 |
| CO2 | Understand various modulation and demodulation techniques and noise | K2 |
| CO3 | Comprehend different types of modulations in time and frequency domain | K2 |
| CO4 | Explain effect of noise and different applications of various modulations | K2 |

**Detailed Syllabus:**

| | |
|---|---|
| Unit 1 | **Amplitude Modulation**<br>Introduction to communication system, Need for modulation, Frequency Division Multiplexing, Amplitude Modulation, Definition, Time domain and frequency domain description, single tone modulation, power relations in AM waves, Generation of AM waves, Switching modulator, Detection of AM Waves; Square law detector, Envelope detector, Double side band suppressed carrier modulators, time domain and frequency domain description, Generation of DSBSC Waves, Balanced Modulators, Ring Modulator |
| Unit 2 | **SSB Modulation**<br>Frequency domain description, Frequency discrimination method for generation of AM SSB Modulated Wave, Time domain description, Phase discrimination method for generating AM SSB Modulated waves. Demodulation of SSB Waves, Vestigial side band modulation: Frequency description, Generation of VSB Modulated wave, Time domain description, Envelope detection of a VSB Wave pulse Carrier, Comparison of AM Techniques. |
| Unit 3 | **Angle Modulations**<br>Basic concepts, Frequency Modulation: Single tone frequency modulation, Spectrum Analysis of Sinusoidal FM Wave, Narrow band FM, Wide band FM, Constant Average Power, Transmission bandwidth of FM Wave - Generation of FM Waves, Direct FM, Detection of |

| | |
|---|---|
| | FM Waves: Balanced Frequency discriminator, Zero crossing detector, Comparison of FM and AM. |
| Unit 4 | **Noise in Analog Modulation**<br>Definition, classification, Noise in Analog communication System, Noise in DSB and SSB System, Noise in AM System, Noise in Angle Modulation System, Threshold effect in Angle Modulation System, Pre-emphasis and de-emphasis. |
| Unit 5 | **Pulse Modulation and Radio Transmitters & Receivers**<br>Types of Pulse modulation, PAM (Single polarity, double polarity) PWM: Generation and demodulation of PWM, PPM, Generation and demodulation of PPM, Time Division Multiplexing. Receiver Types - Tuned radio frequency receiver, Super-heterodyne receiver, RF section and Characteristics - Frequency changing and tracking, Intermediate frequency, AGC, FM Receiver, Comparison with AM Receiver, Amplitude limiting. |

**Text and Reference Books**


1. Simon Haykin, Analog and Digital Communications, John Wiley, 2005
2. George F. Kennedy, Electronic Communication System, Tata McGraw Hill.
3. F.E.Terman, Electronics and Radio Engg, Mc- Graw Hill.
4. R. Coolen, Electronic Communications, PHI
5. K. Sam Shanmugam ,Analog and Digital Communication, Willey ,2005
6. Wayne Tomasi, Electronics Communication Systems-Fundamentals through Advanced, PHI, 5th Edition, 2009


**Mapping of Course outcome with Program Outcomes**

| Course Outcome | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 2 | 3 | | | | | | | | | | |
| CO2 | 2 | 2 | 3 | | | | | | | | 2 | |
| CO3 | 2 | 2 | 2 | | | | | | | | 3 | |

**1 – High, 2 – Medium, 3 - Low**

**Teacher's Assessment:** Teachers Assessment of 10 marks is based on one of the / or combination of few of following

1) Simulation
2) Application development
3) Power point presentation of case studies
4) Question & answer / Numerical solution
5) Study of Industry processes and its presentation
6) Mini projects

**Assessment Pattern**

| Assessment Pattern Level No. | Knowledge Level | Test 1 | Test 2 | Teachers Assessment/ Assignment | End Semester Examination |
|---|---|---|---|---|---|
| K1 | Remember | 05 | 05 | 00 | 10 |
| K2 | Understand | 10 | 10 | 10 | 50 |
| K3 | Apply | 00 | 00 | 00 | 00 |
| K4 | Analyze | 00 | 00 | 00 | 00 |
| K5 | Evaluate | 00 | 00 | 00 | 00 |
| K6 | Create | 00 | 00 | 00 | 00 |
| **Total Marks 100** | | 15 | 15 | 10 | 60 |

**Assessment table**

| Assessment Tool | K1 | K2 | K2 | K2 |
|---|---|---|---|---|
| | CO1 | CO2 | CO3 | CO4 |
| Class Test 1 (15 Marks) | 05 | 05 | 05 | 00 |
| Class Test 2 (15 Marks) | 00 | 05 | 05 | 05 |
| Teachers Assessment (10 Marks) | 00 | 05 | 00 | 05 |
| ESE Assessment (60 Marks) | 10 | 20 | 15 | 15 |

| ET2016: Lab-Analog Communication<br>(Professional Core) | |
|---|---|
| **Teaching Scheme**<br>**Practical: 2Hrs/Week**<br>**Total Credits : 01** | **Examination Scheme**<br>**Term Work : 25 Marks**<br>**Practical Examination & Viva Voce: 25 Marks** |

**Laboratory Course Outcomes**

As an outcome of completing the Laboratory course, students will able to:

| | |
|---|---|
| CO1 | Implement and realize circuits for different modulation techniques |
| CO2 | Implement and realize circuits for different modulation techniques |
| CO3 | Build and test the basic digital communication circuits |
| CO4 | Write programs for generation and detection of different modulations and demodulation |

**List of Experiments**

| Sr. No. | Details |
|---|---|
| **1** | Implement the circuit for Amplitude Modulation and Demodulation |
| **2** | Determine modulation index with trapezoidal method |
| **3** | DSB SC Modulation and Demodulation |
| **4** | SSB SC Modulation and Demodulation |
| **5** | Diode Detector Characteristics |
| **6** | Frequency Modulation and Demodulation |
| **7** | PAM generation and Reconstruction |
| **8** | PWM and PPM: Generation and Reconstruction |
| **9** | Pre Emphasis - De Emphasis Circuits |
| **10** | AGC Characteristics |

**Mapping of Course outcome with Program Outcomes**

| Course Outcome | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | | | | 2 | 3 | | | | | | | |
| CO2 | | | | 1 | 2 | | | | | | 3 | |
| CO3 | | | | 2 | 3 | | | | | | | |
| CO4 | | | | 2 | 3 | | | | | | 3 | |

**1 – High 2 – Medium 3 - Low**

**Assessment Table**

| Assessment Tool | S1 | S2 | S3 | S2 |
|---|---|---|---|---|
| | CO1 | CO2 | CO3 | CO4 |
| Term Work (25 Marks) | 08 | 07 | 05 | 05 |
| Practical Examination & Viva Voce (25 Marks) | 08 | 07 | 05 | 05 |

**Assessment Pattern**

| **Assessment Pattern Level No.** | **Skill Level** | **Term Work** | **Practical Examination & viva voce** |
|---|---|---|---|
| S1 | Imitation | 05 | 10 |
| S2 | Manipulation | 15 | 10 |
| S3 | Precision | 05 | 05 |
| S4 | Articulation | 00 | 00 |
| S5 | Naturalization | 00 | 00 |
| **Total** | | 25 | 25 |

| | | |
|---|---|---|
| Preparation (S1) | 05 | 10 |
| Conduct of Experiment (S2) | 15 | 10 |
| Observation and Analysis of Results (S3) | 05 | 05 |
| Mini-Project / Presentation/ Viva-Voce (S3) | 00 | 00 |
| Total | **25** | **25** |

| ET2017 : Engineering Mathematics IV | |
|---|---|
| **Teaching Scheme**<br>**Lectures: 4 Hrs /Week**<br>**Credits: 04** | **Examination Scheme**<br>**Test 1 : 15 Marks**<br>**Test 2 : 15 Marks**<br>**Teachers Assessment : 10 Marks**<br>**End Semester Exam : 60 Marks** |

**Prerequisites: Knowledge of basic mathematics**

**Course description**: This course will give exposure on vector spaces, linear mapping, correlation, regression and queuing theory. The contents are creating basis for mathematics involved in higher level and research oriented courses.

**Course Objectives:**

- Understand vector spaces
- Understand concepts of linear mapping
- Impart knowledge of orthogonality concepts
- Expose basics of Queuing theory

**Course Outcomes**

After completing the course, students will able to:

| | | |
|---|---|---|
| CO1 | Examine a system of vectors for linear dependence and for being a basis | K2 |
| CO2 | Understand linear transformations and orthogonality | K2 |
| CO3 | Find best fit curve by using least square method and regression analysis | K2 |
| CO4 | Solve Wave equations using numerical approach | K3 |

**Detailed Syllabus:**

| | |
|---|---|
| Unit 1 | **Vector Spaces**<br>Introduction , Vector Spaces, Examples of vector spaces, linear combinations, Spanning Sets, Subspaces, Linear spans, Row space of a matrix, Linear dependence and independence, Basis and dimensions, Application to matrices, rank of matrix, Sums and direct sums, coordinates Introduction to linear transformation and vector spaces |
| Unit 2 | **Linear Mapping and Matrices**<br>Introduction, Mapping, functions, Linear mapping (Linear transformations), Kernel and image of linear mapping, singular and Non-singular linear mapping, Isomorphism, Operations with linear mappings, Algebra A(V) of linear operators.<br>Introduction, Matrix Representation of a Linear Operator, Change of basis, Similarity, Matrix and general linear mappings. |
| Unit 3 | **Inner Product Spaces, Orthogonality**<br>Introduction, Inner product spaces, example of inner product spaces, Cauchy-Schwarz Inequality, Applications, Orthogonality, Orthogonal Sets and Bases, Gram-Schmidt Orthogonalization Process, Orthogonal and positive definite matrices, Complex inner product spaces, Normed vector spaces. |

| | |
|---|---|
| Unit 4 | **Correlation and Regression & Probability theory**<br>Correlation and regression analysis, Linear regression, multivariable regression<br>Analysis of variance, Least square curve fitting<br>The notion of probability and basic properties, Random variables: Basic definition and properties, Transformations for random variables, Methods for generation of random variables |
| Unit 5 | **Numerical Solution of Partial Differential Equations**<br>Introduction, Laplace's equation, solution of Laplace equation by Jacobi's method and Gauss-Seidel method, Numerical solution of Wave equation |
| **Text and Reference Books**<br>1. Introductory Methods of Numerical Analysis, S. S. Sastry, PHI Publication<br>2. Linear Algebra, Schaum Outline Series, Seymour Lipschutz, Marc Lipson, McGraw Hill Publication<br>3. Elementary Statistical Methods, S. P. Gupta, S. Chand Publication<br>4. Linear Algebra and Vector Calculus, Rajesh R. Singh, Mukul Bhatt, McGraw Hill Publication | |

**Mapping of Course outcome with Program Outcomes**

| Course Outcome | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 2 | | | | | | | | | | | |
| CO2 | 2 | 3 | | | | | | | | | | |
| CO3 | 2 | 2 | 2 | | | | | | | | 3 | |
| CO4 | 1 | 2 | 3 | | | | | | | | 3 | |

**1 – High2 – Medium3 - Low**

**Teacher's Assessment:** Teachers Assessment of 10 marks is based on the syllabus

**Assessment Pattern**

| **Assessment Pattern Level No.** | **Knowledge Level** | **Test 1** | **Test 2** | **Teachers Assessment/ Assignment** | **End Semester Examination** |
|---|---|---|---|---|---|
| K1 | Remember | 5 | 5 | 0 | 10 |
| K2 | Understand | 10 | 10 | 5 | 40 |
| K3 | Apply | 0 | 0 | 5 | 10 |
| K4 | Analyze | 0 | 0 | 0 | 0 |
| K5 | Evaluate | 0 | 0 | 0 | 0 |
| K6 | Create | 0 | 0 | 0 | 0 |
| **Total Marks 100** | | 15 | 15 | 10 | 60 |

**Assessment table**

| Assessment Tool | **K2** | **K2** | **K2** | **K3** |
|---|---|---|---|---|
| | **C01** | **C02** | **C03** | **CO4** |
| Class Test 1 (15 Marks) | 5 | 10 | 0 | 0 |
| Class Test 1 (15 Marks) | 00 | 5 | 10 | 0 |
| Teachers Assessment (10 Marks) | 0 | 3 | 2 | 5 |
| ESE Assessment (60 Marks) | 15 | 20 | 20 | 05 |