

## (COMMON TO ECE /ME)

**COURSE OBJECTIVES**

To enable the students to

- learn the basics of diode and rectifiers
- study the basics and characteristics of BJT and the basics of special semiconductor devices
- understand the basics and characteristics of FET and power devices
- introduce electric circuits and its analysis
- impart knowledge in solving circuits using network theorems

**UNIT I SEMICONDUCTOR DIODE 6**

PN junction diode, forward and reverse bias characteristics, Switching Characteristics. Clipping and Clamping Circuits – Voltage multipliers using diodes- Half wave and full wave rectifier.

**UNIT II BIPOLAR JUNCTION AND SPECIAL SEMICONDUCTOR DEVICES 6**

NPN -PNP -Junctions-Early effect-Current equations – Input and Output characteristics of CE, CB CC- h-parameter model, Ebers Moll Model - MESFET, Schottky barrier diode-Zener diode- PIN Diode- Varactor diode.

**UNIT III FIELD EFFECT TRANSISTORS AND POWER DEVICES 6**

JFETs – Drain and Transfer characteristics, Pinch off voltage- MOSFET- Characteristics, D-MOSFET, E-MOSFET, FINFET, UJT, SCR, Diac, and Triac.

**UNIT IV BASIC CIRCUITS ANALYSIS 6**

Ohm's Law – Kirchhoff's laws – DC and AC Circuits – Resistors in series and parallel circuits – Mesh current and node voltage method of analysis for D.C and A.C. circuits.

**UNIT V NETWORK THEOREMS FOR DC AND AC CIRCUITS 6**

Network reduction: voltage and current division, source transformation - Thevenin and Norton Theorem – Superposition Theorem – Maximum power transfer theorem – Reciprocity Theorem.

**TOTAL PERIODS: 30**

**COURSE OUTCOMES**

- analyze the basic concepts of semiconductor diodes.
- understand the basics and characteristics of BJT and be familiar with the concepts of special semiconductor devices
- know the basics and characteristics of FET and familiar with the concepts of special semiconductor devices
- analyze electrical circuits
- apply circuit theorems.

**TEXT BOOKS**

1. J Millman, C. Halkias & Satyabrata Jit "Electronic Devices and Circuits", Tata McGraw-Hill, 2007.
2. Donald A Neaman, "Semiconductor Physics and Devices", Third Edition, Tata Mc Graw Hill

**COURSE OBJECTIVES**

- To introduce electric circuits and its analysis
- To impart knowledge in solving circuits using network theorems.
- To introduce the phenomenon of resonance in coupled circuits.
- To analyze the transient response of circuits.
- To know the concepts of duality.

**UNIT I BASIC CIRCUITS ANALYSIS 9**

Ohm's Law – Kirchhoff's laws – DC and AC Circuits – Resistors in series and parallel circuits – Mesh current and node voltage method of analysis for D.C and A.C. circuits – Phasor Diagram – Power, Power Factor and Energy.

**UNIT II NETWORK REDUCTION AND NETWORK THEOREMS FOR DC AND AC CIRCUITS 9**

Network reduction: voltage and current division, source transformation – star delta conversion - Thevenin and Norton Theorem – Superposition Theorem – Maximum power transfer theorem – Reciprocity Theorem.

**UNIT III RESONANCE AND COUPLED CIRCUITS 9**

Series and parallel resonance – their frequency response – Quality factor and Bandwidth - Self and mutual inductance – Coefficient of coupling – Tuned circuits – Single tuned circuits – Double tuned circuits.

**UNIT IV TRANSIENT RESPONSE FOR DC CIRCUITS 9**

Transient response of RL, RC, RLC circuits using Laplace transform for DC input and A.C. with sinusoidal input – Characterization of two port networks in terms of Z, Y, h and ABCD parameters.

**UNIT V CONCEPTS OF DUALITY 9**

Concept of duality, Dual network, Graphs of a network, Trees, twig, link and branches, Incidence matrix, Tieset matrix and cutset matrix of a graph, Inverse networks and equalizers - Applications.

**TOTAL: 45 PERIODS**

**COURSE OUTCOMES**

At the end of this course, the students will be able to

- analyze electrical circuits
- apply circuit theorems
- analyze AC and DC Circuits
- design resonance circuits
- understand the concepts of Duality

## TEXT BOOKS

1. William H. Hayt Jr, Jack E. Kemmerly and Steven M. Durbin, "Engineering Circuits Analysis", Tata McGraw Hill publishers, 6<sup>th</sup> edition, New Delhi, 2003.
2. Joseph A. Edminister, Mahmood Nahri, "Electric circuits", Schaum's series, Tata McGraw-Hill, New Delhi, 2001.
3. Sudhakar A and Shyam Mohan SP, "Circuits and Network Analysis and Synthesis", Tata McGraw Hill, 2007.

## REFERENCES

1. M Russell, Mersereau and Joel R. Jackson, "Circuit Analysis- A System Approach", Pearson Education, 2007.
2. Chakrabati A, "Circuits Theory (Analysis and synthesis)", Dhanpath Rai & Sons, New Delhi, 1999.
3. Charles K. Alexander, Mathew N.O. Sadiku, "Fundamentals of Electric Circuits", Second Edition, McGraw Hill, 2003.
4. Robert L. Boylestad, "Experiments in Circuit Analysis to Accompany Introductory Circuit Analysis", Prentice Hall, 2000.

## WEB LINKS

1. <http://www.electronics-tutorials.ws/>
2. [www.electrical4u.com](http://www.electrical4u.com)
3. <http://nptel.ac.in/courses/Webcourse-contents/IIT-KANPUR/esc102/index.html>
4. [http://www.tina.com/1200\\_problems\\_and\\_examples](http://www.tina.com/1200_problems_and_examples)
5. [www.circuits-magic.com](http://www.circuits-magic.com)
6. [www.zen22142.zen.co.uk](http://www.zen22142.zen.co.uk)

| Mapping of Course Outcomes with Programme Outcomes:<br>(1/2/3 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak |     |     |     |     |     |     |     |     |     |      |      |      |      |      |
|-----------------------------------------------------------------------------------------------------------------------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|
| Programme Outcomes(POs)                                                                                                     |     |     |     |     |     |     |     |     |     |      |      |      |      |      |
| CO                                                                                                                          | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
| CO1                                                                                                                         | 3   | 3   | 3   | -   | -   | -   | -   | -   | -   | -    | 3    | -    | 3    | 3    |
| CO2                                                                                                                         | 3   | 3   | 3   | -   | -   | -   | -   | -   | -   | -    | 3    | -    | 3    | 3    |
| CO3                                                                                                                         | 3   | 3   | 3   | -   | -   | -   | -   | -   | -   | -    | 3    | -    | 3    | 3    |
| CO4                                                                                                                         | 3   | 3   | 3   | -   | -   | -   | -   | -   | -   | -    | 3    | -    | 3    | 3    |
| CO5                                                                                                                         | 3   | 3   | 3   | -   | -   | -   | -   | -   | -   | -    | 3    | -    | 3    | 3    |



**COURSE OBJECTIVES**

- To learn the basics of diode and rectifiers
- To study the basics and characteristics of BJT
- To understand the basics and characteristics of FET
- To know the basics of special semiconductor devices, power devices and display devices
- To be familiar with the theory, construction, and operation of Basic electronic devices.

**UNIT I SEMICONDUCTOR DIODE 9**

PN junction diode, Current equations, Diffusion and drift current densities, forward and reverse bias characteristics, Switching Characteristics. Clipping & Clamping Circuits – Voltage multipliers using diodes- Half wave and full wave rectifier.

**UNIT II BIPOLAR JUNCTION 9**

NPN -PNP -Junctions-Early effect-Current equations – Input and Output characteristics of CE, CB CC-Hybrid - $\pi$  model - h-parameter model, Ebers Moll Model- Multi Emitter Transistor.

**UNIT III FIELD EFFECT TRANSISTORS 9**

JFETs – Drain and Transfer characteristics, -Current equations-Pinch off voltage and its significance- MOSFET- Characteristics- Threshold voltage -Channel length modulation, D-MOSFET, E-MOSFET- Current equation - Equivalent circuit model and its parameters, FINFET, DUAL GATE MOSFET.

**UNIT IV SPECIAL SEMICONDUCTOR DEVICES 9**

Metal-Semiconductor Junction- MESFET, Schottky barrier diode-Zener diode- PIN Diode- Varactor diode –Tunnel diode- Gallium Arsenide device, LASER diode, LDR.

**UNIT V POWER DEVICES AND DISPLAY DEVICES 9**

UJT, SCR, Diac, Triac, Power BJT- Power MOSFET- DMOS-VMOS - LED, LCD, Photo transistor, Opto Coupler, Solar cell, CCD.

**TOTAL: 45 PERIODS**

**COURSE OUTCOMES**

At the end of this course, the students will be able to

- gain knowledge in the theory, construction, and operation of semiconductor diode
- understand the basics and characteristics of BJT
- know the basics and characteristics of FET
- be familiar with the concepts of special semiconductor devices, power devices and display devices.
- use the basic electronic devices

## TEXT BOOKS

1. J Millman, C. Halkias & Satyabrata JIT "Electronic Devices and Circuits", Tata McGraw-Hill, 2007.
2. Donald A Neaman, "Semiconductor Physics and Devices", Third Edition, Tata McGrawHill Inc. 2007.
3. Robert L. Boylestad, Louis Nashelsky, "Electronic Devices and Circuit Theory" Pearson Education 2006.

## REFERENCES

1. Christo Papadopoulos, "Solid State Electronic Devices", Springer-Verlag, New York, 2014
2. Thomas L. Floyd, "Electronic Devices", Merrill, 1992
3. Yang, "Fundamentals of Semiconductor devices", McGraw Hill International Edition, 1978.
4. David A. Bell, "Electronic Devices and Circuits", Prentice Hall, 1986

## WEB LINKS

1. [www.electronics-tutorials.ws/](http://www.electronics-tutorials.ws/)
2. <http://www.radio-electronics.com>
3. [www.allaboutcircuits.com](http://www.allaboutcircuits.com)
4. <http://textofvideo.nptel.iitm.ac.in/122106025/>
5. [www.electronicsforu.com](http://www.electronicsforu.com)
6. [www.chegg.com](http://www.chegg.com)

| Mapping of Course Outcomes with Programme Outcomes:<br>(1/2/3 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak |     |     |     |     |     |     |     |     |     |      |      |      |      |      |
|-----------------------------------------------------------------------------------------------------------------------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|
| Programme Outcomes(POs)                                                                                                     |     |     |     |     |     |     |     |     |     |      |      |      |      |      |
| CO                                                                                                                          | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
| CO1                                                                                                                         | 3   | 3   | 3   | -   | -   | -   | -   | -   | -   | -    | 3    | -    | 3    | 3    |
| CO2                                                                                                                         | 3   | 3   | 3   | -   | -   | -   | -   | -   | -   | -    | 3    | -    | 3    | 3    |
| CO3                                                                                                                         | 3   | 3   | 3   | -   | -   | -   | -   | -   | -   | -    | 3    | -    | 3    | 3    |
| CO4                                                                                                                         | 3   | 3   | 3   | -   | -   | -   | -   | -   | -   | -    | 3    | -    | 3    | 3    |
| CO5                                                                                                                         | 3   | 3   | 3   | -   | -   | -   | -   | -   | -   | -    | 3    | -    | 3    | 3    |



**COURSE OBJECTIVES**

To enable the students to

- gain the knowledge about circuit theorem
- learn about characteristics of electronic devices
- understand the characteristics of photo devices

**LIST OF EXPERIMENTS**

1. Verification of KVL and KCL
2. Verification of Thevenin and Norton Theorems
3. Verification of superposition Theorem
4. Verification of Maximum power transfer and reciprocity theorems
5. Frequency response of series and parallel resonance circuits
6. Characteristics of PN and Zener diode
7. Characteristics of CE configuration
8. Characteristics of CB configuration
9. Characteristics of UJT and SCR
10. Characteristics of JFET and MOSFET
11. Characteristics of Diac and Triac
12. Characteristics of Photodiode and Phototransistor

**TOTAL: 30 PERIODS**

**COURSE OUTCOMES**

At the end of this course, the students will be able to

- impart knowledge by analyzing and verifying the circuit theorems.
- analyze the characteristics of electronic devices
- acquire the knowledge of Photo devices

| Mapping of Course Outcomes with Programme Outcomes:<br>(1/2/3 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak |                         |     |     |     |     |     |     |     |     |      |      |      |      |      |
|-----------------------------------------------------------------------------------------------------------------------------|-------------------------|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|
| Cos                                                                                                                         | Programme Outcomes(POs) |     |     |     |     |     |     |     |     |      |      |      |      |      |
|                                                                                                                             | PO1                     | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
| CO1                                                                                                                         | 3                       | 3   | 3   | -   | 3   | -   | -   | -   | -   | -    | -    | -    | 3    | 3    |
| CO2                                                                                                                         | 3                       | 3   | 3   | -   | 3   | -   | -   | -   | -   | -    | -    | -    | 3    | 3    |
| CO3                                                                                                                         | 3                       | 3   | 3   | -   | 3   | -   | -   | -   | -   | -    | -    | -    | 3    | 3    |



**COURSE OBJECTIVES**

To enable the students to

- understand the basic concepts of biasing
- study the concept of small signal Amplifiers
- study the Multistage Amplifiers
- learn various types of Large Signal Amplifiers
- know about rectifiers, filters and power supplies

**UNIT I TRANSISTOR BIASING 9**

Transistor Biasing, Methods of Transistor Biasing - DC load line, AC load line, Quiescent point, variation due to uncertainty in  $\beta$ , Effect of temperature on the Q-point, Stability factor analysis, Bias compensation techniques, FET Biasing.

**UNIT II MID-BAND ANALYSIS OF SMALL SIGNAL AMPLIFIERS 9**

Two-Port Networks, Analysis of a Transistor Circuit using h-parameters, Simplified CE Hybrid Model, Analysis of CE, CC, and CB Configuration using Approximate Model, BJT Amplifiers, Small Signal Analysis of Single Stage BJT Amplifiers, Miller's Theorem and its Dual, Design of Single Stage RC Coupled Amplifier using BJT, Differential Amplifiers & Methods of improving CMRR.

**UNIT III MULTISTAGE AMPLIFIERS 9**

Different Coupling Schemes used in Amplifiers, General Analysis of Cascade Amplifiers, Choice of Transistor Configuration in Cascade Amplifier, Direct Coupled Amplifiers, Two Stage RC Coupled Amplifier, Transformer Coupled Amplifier, Methods of increasing input impedance, Cascode Amplifiers.

**UNIT IV HIGH FREQUENCY AND LARGE SIGNAL AMPLIFIERS 9**

General Shape of Frequency Response of Amplifiers, High Frequency  $\pi$  model for a Transistor- Large Signal Amplifiers - Introduction, Classification Based on Biasing Condition - Class A, ClassB, Class C Power Amplifiers, Thermal Stability and Heat Sink.

**UNIT V POWER SUPPLIES, RECTIFIERS AND FILTERS 9**

Linear Mode Power Supply - Rectifiers - Half wave rectifier - Full wave rectifier – Bridge rectifier & Comparison - Filters and its types - Voltage Regulators –Switched Mode Power Supply

**TOTAL PERIODS 45**

**COURSE OUTCOMES**

At the end this course, students will be able to

- explain the concept of biasing
- elaborate about the small signal amplifiers

- analyze various multistage amplifiers
- demonstrate the concept of large signal amplifiers
- explain about the power supplies, rectifiers and filter design

### TEXT BOOKS

1. L.Schilling Donald, Charles below, —Electronic CircuitsI, 3<sup>rd</sup> edition, McGraw Hill, 1989.
2. Salivahanan.S, Sureshkumar.N, —Electronic Devices and CircuitsI, 3<sup>rd</sup> edition, McGraw Hill, 2014

### REFERENCES

1. Jacob Millman, Christos C.Halkias, — Electronic Devices and CircuitsI, Tata McGraw Hill,1991
2. Donald.A.Neamen, —Electronic Circuit Analysis and DesignI, 2<sup>nd</sup> edition, Tata McGraw Hill, 2007
3. Adel.S.Sedra, Kenneth C.Smith, —Micro Electronic CircuitsI, 5<sup>th</sup> edition, Oxford University Press, 2004.

| Mapping of Course Outcomes with Programme Outcomes:<br>(1/2/3 indicates strength of correlation) 3-Strong, 2-Medium , 1-Weak |                         |     |     |     |     |     |     |     |     |      |      |      |      |      |
|------------------------------------------------------------------------------------------------------------------------------|-------------------------|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|
| COs                                                                                                                          | Programme Outcomes(POs) |     |     |     |     |     |     |     |     |      |      |      |      |      |
|                                                                                                                              | PO1                     | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
| CO1                                                                                                                          | 3                       | 3   | 3   | 3   | 3   | 3   | -   | -   | -   | -    | -    | 3    | 3    | 3    |
| CO2                                                                                                                          | 3                       | 3   | 3   | 3   | 3   | 3   | -   | -   | -   | -    | -    | 3    | 3    | 3    |
| CO3                                                                                                                          | 3                       | 3   | 3   | 3   | 3   | 3   | -   | -   | -   | -    | -    | 3    | 3    | 3    |
| CO4                                                                                                                          | 3                       | 3   | 3   | 3   | 3   | 3   | -   | -   | -   | -    | -    | 3    | 3    | 3    |
| CO5                                                                                                                          | 3                       | 3   | 3   | 3   | 3   | 3   | -   | -   | -   | -    | -    | 3    | 3    | 3    |



**COURSE OBJECTIVES**

To enable the students to

- understand the fundamentals and simplification of digital logic
- design the various combinational circuits
- study and design synchronous sequential circuits
- design and implement asynchronous sequential circuits
- acquire basic knowledge about memory devices and HDL programming

**UNIT I      BOOLEAN ALGEBRA AND LOGIC GATES      9**

Boolean postulates and laws – De-Morgan's Theorem - Principle of Duality - Boolean functions Minimization of Boolean functions– Karnaugh map Minimization – Tabulation Method - Don't care Conditions. Logic Gates- Implementations of Logic Functions using gates - NAND – NOR implementations - TTL - CMOS - NAND, NOR, NOT – Tristate gates

**UNIT II      COMBINATIONAL CIRCUITS      9**

Design procedure of Combinational circuits: Adders- Subtractors – Parallel and serial adder/ Subtractor - Carry look ahead adder- BCD adder - 2 bit Magnitude Comparator- Multiplexer, Demultiplexer - Encoder, Decoder – Parity generator and checker – Code converter.

**UNIT III      SEQUENTIAL CIRCUITS      9**

Flip flops – Triggering – Realization of flip flop using other flip flops – Asynchronous and Synchronous counters – Classification of sequential circuits – Moore and Mealy - Design of Synchronous counters – Modulo-n counter - Ring counters- Shift registers.

**UNIT IV      ASYNCHRONOUS SEQUENTIAL CIRCUITS      9**

Design of fundamental mode and pulse mode circuits – primitive state / flow table – Minimization of primitive state table – state assignment – Excitation table – cycles – Race Free State assignment – ASM Chart - Hazards: Static –Dynamic – Essential – Hazards elimination.

**UNIT V      MEMORY DEVICES AND INTRODUCTION TO HDL      9**

Classification of memories – ROM - ROM organization - PROM – EPROM – EEPROM EAPROM, RAM – RAM organization – Write operation – Read operation– Memory decoding – memory expansion – Static RAM Cell - Bipolar RAM cell – Dynamic RAM cell. Programmable Logic Devices – PLA – PAL - FPGA - Introduction to HDL – Simple programs Using Verilog HDL

**TOTAL PERIODS      45**

**COURSE OUTCOMES**

At the end of the course, the students will be able to

- explain the realization of boolean functions using various techniques

- design and implement combinational circuits
- design and implement synchronous sequential circuits
- design and study the effect of hazards in asynchronous sequential circuits
- elaborate the concepts of memories and HDL.

### TEXT BOOKS

1. M. Morris Mano, —Digital Design, 3.ed., Prentice Hall of India Pvt. Ltd., New Delhi, 2003/Pearson Education (Singapore) Pvt. Ltd., New Delhi, 2003 .
2. H. Charles Roth Jr, —Digital System Design using VHDL, Thomson/ Brookscole, 2005.(Unit V)

### REFERENCES

1. S. Salivahanan and S. Arivazhagan, —Digital Circuits and Design, 3rd Edition, Vikas Publishing House Pvt.Ltd, New Delhi, 2007.
2. John .M Yarbrough, —Digital Logic Applications and Design, Thomson Publications, New Delhi,2007.
3. Charles H.Roth, —Fundamentals of Logic Design, Thomson Publication Company, 2003.
4. Donald P.Leach and Albert Paul Malvino, —Digital Principles and Applications, 5th edition, Tata Mc-Graw Hill Publishing Company Limited, New Delhi, 2003.

| Mapping of Course Outcomes with Programme Outcomes:<br>(1/2/3 indicates strength of correlation) 3-Strong, 2-Medium , 1-Weak |                         |     |     |     |     |     |     |     |     |      |      |      |      |      |
|------------------------------------------------------------------------------------------------------------------------------|-------------------------|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|
| COs                                                                                                                          | Programme Outcomes(POs) |     |     |     |     |     |     |     |     |      |      |      |      |      |
|                                                                                                                              | PO1                     | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
| CO1                                                                                                                          | 3                       | 3   | 3   | 3   | 3   | 2   | -   | -   | -   | -    | -    | 3    | 3    | 3    |
| CO2                                                                                                                          | 3                       | 3   | 3   | 3   | 3   | 2   | -   | -   | -   | -    | -    | 3    | 3    | 3    |
| CO3                                                                                                                          | 3                       | 3   | 3   | 3   | 3   | 2   | -   | -   | -   | -    | -    | 3    | 3    | 3    |
| CO4                                                                                                                          | 3                       | 3   | 3   | 3   | 3   | 2   | -   | -   | -   | -    | -    | 3    | 3    | 3    |
| CO5                                                                                                                          | 3                       | 3   | 3   | 3   | 3   | 2   | -   | -   | -   | -    | -    | 3    | 3    | 3    |



**COURSE OBJECTIVES**

To enable the students to

- learn the basic concepts of continuous time and discrete time signals and systems
- analyze signals and systems using different transforms
- know about the analysis and realization of LTI Continuous Time systems
- acquire the basic knowledge in Sampling and Z transform
- understand about the analysis and realization of LTI Discrete Time systems

**UNIT I CLASSIFICATION OF SIGNALS AND SYSTEMS****15**

Continuous time signals (CT signals) - Discrete time signals (DT signals) – Step, Ramp, Pulse, Impulse, Exponential, basic operation on signals, classification of CT and DT signals –periodic and aperiodic signals, Energy & Power signals - CT systems and DT systems -Properties - LTI system Properties. .

**UNIT II ANALYSIS OF CONTINUOUS TIME SIGNALS****15**

Fourier series - definition, properties and analysis - Fourier transform - definition, properties and analysis - Laplace Transform – definition, ROC, properties and signal Analysis – Unilateral Laplace Transform.

**UNIT III LINEAR TIME INVARIANT – CONTINUOUS TIME SYSTEMS****15**

Differential Equation - impulse response, Step response and output response - Fourier and Laplace transforms in analysis of continuous time (CT)systems - Block diagram representation - Direct Form I Direct Form II - Cascade and Parallel Realization

**UNIT IV ANALYSIS OF DISCRETE TIME SIGNALS****15**

Sampling Theorem – Reconstruction – Aliasing - DTFT and properties - z-transform - Region of Convergence - Properties of ROC - Properties of z-transform - Inverse z-transform using Partial fraction expansion.

**UNIT V LINEAR TIME INVARIANT – DISCRETE TIME SYSTEMS****15**

Difference Equations using Z transform - Impulse response - Analysis of Discrete time systems using DTFT and Z Transform - Block diagram representation -Direct Form I - Direct Form II - Cascade and Parallel Realization.

**TOTAL PERIODS****75****COURSE OUTCOMES**

At the end of the course, the students will be able to

- explain the basic concepts of solving problems in continuous time and discrete time signals and systems
- analyze signals and systems using different transforms
- analyze problems and solutions relating to LTI – continuous time systems
- demonstrate the analysis of Sampling and Z transform .
- elaborate about LTI – discrete time systems

## REFERENCES

1. S.K.Poornachandra, —Signals and Systems, Third edition, Tata McGraw-Hill.
2. B P Lathi, —Linear Systems and Signals, Oxford University Press Inc, Chennai, 2004
3. H P Hsu, Rakesh Ranjan, —Signals and Systems, Schaum's Outlines, Tata McGraw Hill, Indian Reprint 2007.
4. John Alan Stuller, —An Introduction to Signals and Systems, Thomson, 2007

| Mapping of Course Outcomes with Programme Outcomes:<br>(1/2/3 indicates strength of correlation) 3-Strong, 2-Medium , 1-Weak |                         |     |     |     |     |     |     |     |     |      |      |      |      |      |
|------------------------------------------------------------------------------------------------------------------------------|-------------------------|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|
| COs                                                                                                                          | Programme Outcomes(POs) |     |     |     |     |     |     |     |     |      |      |      |      |      |
|                                                                                                                              | PO1                     | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
| CO1                                                                                                                          | 3                       | 3   | 3   | 3   | 3   | 2   | -   | -   | -   | -    | -    | 3    | 3    | 3    |
| CO2                                                                                                                          | 3                       | 3   | 3   | 3   | 3   | 2   | -   | -   | -   | -    | -    | 3    | 3    | 3    |
| CO3                                                                                                                          | 3                       | 3   | 3   | 3   | 3   | 2   | -   | -   | -   | -    | -    | 3    | 3    | 3    |
| CO4                                                                                                                          | 3                       | 3   | 3   | 3   | 3   | 2   | -   | -   | -   | -    | -    | 3    | 3    | 3    |
| CO5                                                                                                                          | 3                       | 3   | 3   | 3   | 3   | 2   | -   | -   | -   | -    | -    | 3    | 3    | 3    |



## COURSE OBJECTIVES

To enable the students to

- learn the theories of DC machines
- understand concepts and construction of transformers
- study the concepts and construction in electrical generators, motors
- learn the concepts of Electronic measurement systems
- gain knowledge of the importance of digital instruments in measurements

### UNIT I                      DC MACHINES                      9

Construction of DC machines – Theory of operation of DC generators – types— emf equation-Characteristics of DC generators - Operating principle of DC motors –torque equation- Types of DC motors and their characteristics – Speed control of DC motors – Applications.

### UNIT II                      TRANSFORMERS                      9

Single phase transformer- construction and principle of operation – EMF equation of transformer- Transformer on no load– Transformer on load –Equivalent circuit of transformer- Transformer losses and efficiency-All day efficiency –open circuit test- short circuit test-auto transformer.

### UNIT III                      AC MACHINES                      9

Construction of single-phase induction motors, Types of single phase induction motors—Equivalent circuit-Torque equation- Principles of alternator – Construction- Equation of induced EMF- synchronous motors- V curves applications

### UNIT IV                      MEASUREMENT SYSTEMS                      9

Measurement systems –Static and dynamic characteristics –error - moving coil, moving iron meters Multimeter - Bridge measurements: Wheat stone, Maxwell, Hay, Schering, Anderson and Wien bridge

### UNIT V                      DIGITAL INSTRUMENTS AND DATA ACQUISITION SYSTEMS                      9

Digital Voltmeter-Digital Multimeter-Digital RLC meters-Digital Storage Oscilloscope Digital frequency meterUniversal counter timer-Digital Data Acquisition System-Overview of PC Based instrumentation.

**TOTAL PERIODS                      45**

## COURSE OUTCOMES

At the end of the course, the students will be able to

- explain the concept of DC machines
- elaborate the concepts of transformers
- comprehend the concepts of AC machines



## **COURSE OBJECTIVES**

To enable the students to

- learn the systematic way of solving problems
- understand the different methods of organizing large amounts of data To understand Object oriented concepts in generic programming
- introduce linear, non-linear data structures and their applications
- introduce linear, non-linear data structures and their applications
- efficiently implement the different data structures

### **UNIT I PRINCIPLES OF OOP** **9**

Programming Paradigms- Basic concepts and benefits of OOP- Structure of C++ program – Tokens - Data types Dynamic initialization - Reference variables- Scope resolution operator - Member dereferencing operators Memory management operators - Type casting- Function Prototyping- call by value, call by reference- Inline function- Default arguments – Function overloading.

### **UNIT II CLASSES AND OBJECTS** **9**

Class specification- Access qualifiers - Static data members and member functions - Array of objects- Objects as function arguments - Friend functions - Returning objects - Local classes - **Constructors and Parameterized Constructors - Overloaded Constructors - Constructors with default arguments - Copy constructors – Dynamic constructors - Dynamic initialization using constructors-** Destructors - Operator Overloading: Operator function – Overloading unary and binary operator - Type Conversion- this pointer

### **UNIT III INHERITANCE AND POLYMORPHISM** **9**

Basic Principle – Use of Inheritance-Defining Derived classes- Single Inheritance-Protected Data with private Inheritance - Multiple Inheritance - Multi level inheritance - Hierarchical Inheritance - Hybrid Inheritance Multipath inheritance - virtual functions - Array of pointer to base class objects - Abstract classes – Virtual destructors – Dynamic Binding - Virtual Base Class – Templates – function templates and class templates Exception handling.

### **UNIT IV LINEAR DATA STRUCTURES** **9**

**Abstract Data Types (ADTs) – List ADT – array-based implementation – linked list implementation – singly linked lists –Polynomial Manipulation - Stack ADT – Queue ADT -Evaluating arithmetic expressions**

### **UNIT V NON-LINEAR DATA STRUCTURES** **9**

Trees – Binary Trees – Binary tree representation and traversals – AVL trees – Graph and its representations Graph Traversals - Representation of Graphs - Breadth first search- Depth first search- Connected components

**TOTAL PERIODS** **45**

## **COURSE OUTCOMES**

At the end of the course, the students will be able to

- design problem solutions using object oriented techniques

- apply the concepts of data abstraction, encapsulation and inheritance for problem solutions
- use the control structures of c++ appropriately
- critically analyze the various algorithms.
- apply the different data structures to problem solutions

### TEXT BOOKS

1. E.Balagurusamy, —Object Oriented Programming with C++I, Tata McGraw Hill, Sixth Edition, 2013
2. Mark Allen Weiss, —Data Structures and Algorithm Analysis in C++I, Third Edition, AddisonWesley, 200

### REFERENCES

1. Bhushan Trivedi, 'Programming with ANSI C++, A Step-By-Step approachI', Oxford University Press, 2010.
2. BjarneStroustrup, —The C++ Programming LanguageI, 3rd Edition, Pearson Education, 2007.
3. Ellis Horowitz, SartajSahni and Dinesh Mehta, —Fundamentals of Data Structures in C++I, Galgotia Publications, 2007.
4. Goodrich, Michael T., Roberto Tamassia, David Mount, —Data Structures and Algorithms in C++I, 7th Edition, Wiley. 2004.

| Mapping of Course Outcomes with Programme Outcomes:<br>(1/2/3 indicates strength of correlation) 3-Strong, 2-Medium , 1-Weak |                         |     |     |     |     |     |     |     |     |      |      |      |      |      |
|------------------------------------------------------------------------------------------------------------------------------|-------------------------|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|
| COs                                                                                                                          | Programme Outcomes(POs) |     |     |     |     |     |     |     |     |      |      |      |      |      |
|                                                                                                                              | PO1                     | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
| CO1                                                                                                                          | 3                       | 3   | 3   | 3   | 3   | 2   | -   | -   | 3   | -    | -    | 3    | 3    | 3    |
| CO2                                                                                                                          | 3                       | 3   | 3   | 3   | 3   | 2   | -   | -   | 3   | -    | -    | 3    | 3    | 3    |
| CO3                                                                                                                          | 3                       | 3   | 3   | 3   | 3   | 2   | -   | -   | 3   | -    | -    | 3    | 3    | 3    |
| CO4                                                                                                                          | 3                       | 3   | 3   | 3   | 3   | 2   | -   | -   | 3   | -    | -    | 3    | 3    | 3    |
| CO5                                                                                                                          | 3                       | 3   | 3   | 3   | 3   | 2   | -   | -   | 3   | -    | -    | 3    | 3    | 3    |



**COURSE OBJECTIVES**

To enable students to

- gain knowledge about frequency response of different types of amplifiers
- learn about transfer characteristics of Differential and power amplifiers
- know about the response of amplifiers
- understand about different types of rectifiers

**LIST OF EXPERIMENTS**

1. Design of biasing methods using BJT
2. Determination of the Frequency response of any one configuration (CE/CB/CC) of BJT amplifier
3. Determination of the Frequency response of any one configuration (CS/CG/CD) of FET amplifier
4. Design Class A power amplifiers and determination its efficiency
5. Design Class B power amplifiers and determination its efficiency
6. Measurement of CMRR of differential amplifier
7. Determination of the bandwidth of Cascade/Cascode amplifier
8. Determination of the efficiency and ripple factor of half wave/full wave rectifier

**SIMULATION USING PSPICE /MULTISIM/EQUIVALENT SOFTWARE PACKAGE**

9. Simulation of BJT amplifier Configurations (CE/CB/CC)
10. Simulation of differential amplifiers

**TOTAL PERIODS 60**

**COURSE OUTCOMES**

Upon the completion of the course, students will be able to

- explain the working condition and frequency response of different types of Amplifiers
- comprehend the Differential and power amplifiers
- analyse the bandwidth of multi-stage, Cascade and Cascode amplifiers elaborate about measurement of CMRR
- determine the efficiency and ripple factor of half and full wave rectifier

Mapping of Course Outcomes with Programme Outcomes:  
(1/2/3 indicates strength of correlation) 3-Strong, 2-Medium , 1-Weak

| COs | Programme Outcomes(POs) |     |     |     |     |     |     |     |     |      |      |      |      |      |
|-----|-------------------------|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|
|     | PO1                     | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
| CO1 | 3                       | 3   | 3   | 3   | 3   | 3   | -   | -   | 3   | -    | -    | -    | 3    | 3    |
| CO2 | 3                       | 3   | 3   | 3   | 3   | 3   | -   | -   | 3   | -    | -    | -    | 3    | 3    |
| CO3 | 3                       | 3   | 3   | 3   | 3   | 3   | -   | -   | 3   | -    | -    | -    | 3    | 3    |
| CO4 | 3                       | 3   | 3   | 3   | 3   | 3   | -   | -   | 3   | -    | -    | -    | 3    | 3    |



**COURSE OBJECTIVES**

To enable students to

- design and implement Adders and Subtractors
- design and implement code converters
- get the knowledge about design and implementation of combinational and sequential logic circuits
- acquire the knowledge about simulation of digital circuits with Verilog HDL

**List of Experiments**

1. Design and implementation of Full and Half Adders and Full and Half Subtractors using logic gates.
2. Design and implementation of code converters using logic gates
  - i. BCD to excess-3 code convertors and vice versa.
  - ii. Binary to gray code convertors and vice-versa.
3. Design and implementation of 4 bit binary Adder/ Subtractor and BCD adder using IC 7483.
4. Design and implementation of 2 Bit Magnitude Comparator using logic gates
5. Design and implementation of 16 bit odd/even parity checker generator using IC74180.
6. Design and implementation of Multiplexer and De-multiplexer using basic logic gates and study of IC 74160 and IC 74164.
7. Design and implementation of encoder and decoder using logic gates and study of IC7445 and IC74147.
8. Construction and verification of 4 bit ripple counter and Mod-n Ripple counters.
9. Design and implementation of 3-bit synchronous up (or) down counter.
- 10 Implementation of 3- bit shift registers using Flip flops
- 11 Design and Simulation of Full and Half Adders, Full and Half Subtractors, Multiplexer and De-multiplexer.
- 12 Encoder and Decoder, 4 bit Ripple Counter using Verilog HDL.

**TOTAL PERIODS****60****COURSE OUTCOMES**

Upon the completion of the course, students will be able to

- design Adders and Subtractors using basic logic gates and karnaugh map
- create code converters using basic logic gates
- analyze the combinational and sequential logic circuits
- Simulate digital circuits with Verilog HDL

Mapping of Course Outcomes with Programme Outcomes:  
(1/2/3 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak

| COs | Programme Outcomes(POs) |     |     |     |     |     |     |     |     |      |      |      |      |      |
|-----|-------------------------|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|
|     | PO1                     | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
| CO1 | 3                       | 3   | 3   | 3   | 3   | 3   | -   | -   | 3   | -    | -    | -    | 3    | 3    |
| CO2 | 3                       | 3   | 3   | 3   | 3   | 3   | -   | -   | 3   | -    | -    | -    | 3    | 3    |
| CO3 | 3                       | 3   | 3   | 3   | 3   | 3   | -   | -   | 3   | -    | -    | -    | 3    | 3    |
| CO4 | 3                       | 3   | 3   | 3   | 3   | 3   | -   | -   | 3   | -    | -    | -    | 3    | 3    |



**COURSE OBJECTIVES**

To enable students to

- be familiarized with good programming design methods, particularly Top- Down design.
- getting exposure in implementing the different data structures using C++
- efficiently implement the different data structures
- analyze solutions for specific problems

**LIST OF EXPERIMENTS**

1. Write C++ Programs using Classes and Objects.
2. Write C++ classes with static members, methods with default arguments, friend functions.
3. Develop C++ Programs using Operator Overloading.
4. Develop C++ Programs using constructor, destructor, and copy constructor.
5. Develop C++ Programs using Inheritance, Polymorphism and its types.
6. Develop C++ Programs using Templates and Exceptions.
7. Design C++ Program for Array implementation of List Abstract Data Type (ADT).
8. Design C++ Program for Linked list implementation of List ADT.
9. Design C++ Program for Stack ADT - Array and linked list implementations.
10. Design C++ Program for Queue ADT – Array and linked list implementations.
11. Design C++ Program for Search Tree ADT - Binary Search Tree.

**TOTAL PERIODS 60**

**COURSE OUTCOMES**

Upon the completion of the course, students will be able to

- identify and apply object oriented concepts like abstraction, encapsulation, modularity, hierarchy.
- estimate various metrics specific to object oriented development
- design and implement C++ programs for manipulating stacks, queues, linked lists, trees, and graphs.
- apply the different data structures for implementing solutions to practical problems.

## RECOMMENDED SYSTEM/SOFTWARE REQUIREMENTS

**Software:** Turbo C++.

**Hardware:** Flavor of any WINDOWS or LINUX and Standalone desktops 30 Nos.

| Mapping of Course Outcomes with Programme Outcomes:<br>(1/2/3 indicates strength of correlation) 3-Strong, 2-Medium , 1-Weak |                         |     |     |     |     |     |     |     |     |      |      |      |      |      |
|------------------------------------------------------------------------------------------------------------------------------|-------------------------|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|
| COs                                                                                                                          | Programme Outcomes(POs) |     |     |     |     |     |     |     |     |      |      |      |      |      |
|                                                                                                                              | PO1                     | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
| CO1                                                                                                                          | 3                       |     |     |     |     |     |     |     |     |      |      |      | 3    | 3    |
| CO2                                                                                                                          |                         | 3   | 3   |     |     |     |     |     |     |      |      |      | 3    | 3    |
| CO3                                                                                                                          |                         |     |     | 3   | 3   | 3   |     | 3   |     |      |      |      | 3    | 3    |
| CO4                                                                                                                          |                         |     |     | 3   | 3   |     | 3   |     | 3   |      |      | 3    | 3    | 3    |



**COURSE OBJECTIVES**

To enable the students to

- To acquire knowledge about the feedback amplifiers
- To learn about tuned amplifiers
- To study the concepts of oscillator
- To study the wave shaping and multivibrator circuits
- To acquire the basics of blocking oscillators

**UNIT I FEEDBACK AMPLIFIERS****9**

Classification of Basic Amplifiers, Basic Concept of Feedback, General Characteristics of Negative feedback Amplifiers, Transfer Gain with Feedback, Effect of Negative Feedback on Input Resistance and Output Resistance, Method of Identifying Feedback Topology, Voltage Series Feedback, Current-Series Feedback, Current-Shunt Feedback, Voltage-Shunt Feedback, Stability of Feedback Amplifiers.

**UNIT II OSCILLATORS****9**

Classification of Oscillators, Conditions for Oscillation, General form of an LC Oscillator Hartley Oscillator, Colpitts Oscillator, Clapp Oscillator, RC Oscillators, RC Phase Shift Oscillators, Wien-Bridge Oscillator, TwinT Oscillator, Crystal Oscillators.

**UNIT III TUNED AMPLIFIERS****9**

Small Signal Tuned Amplifiers, Effect of Cascading Single Tuned & Double tuned Amplifiers on Bandwidth, Stagger Tuned Amplifiers, Comparison of Tuned Amplifiers, Large Signal Class – C Tuned Amplifiers – Stability of Tuned Amplifiers, Hazeltine Neutralization.

**UNIT IV WAVE SHAPING AND MULTIVIBRATOR CIRCUITS****9**

Waveform Shaping Circuits - Diode clippers – Clampers – Multivibrators - Triggering Methods for Bistable Multivibrators- Schmitt Trigger

**UNIT V BLOCKING OSCILLATORS AND TIME BASE GENERATORS****9**

UJT Sawtooth Generator - Pulse Transformers - Blocking Oscillator and its types –Voltage and Current Time Base Circuits

**TOTAL PERIODS 45****COURSE OUTCOMES**

At the end of the course, the students will be able to

- explain the concept of feedback amplifiers
- elaborate the concept of oscillators
- comprehend the concept of tuned amplifiers
- analyse various types of multivibrators
- explain the basic concepts of blocking oscillators

**TEXT BOOKS**

1. Donald L.Schilling, Charles Belove, —Electronic CircuitsI, 3<sup>rd</sup> edition, McGraw Hill, 1989.
2. Salivahanan.S, Sureshkumar.N, —Electronic Devices and CircuitsI, 3<sup>rd</sup> edition, McGraw Hill, 2014

## REFERENCES

1. JacobMillman, Christos C.Halkias, —Electronic Devices and CircuitsI, Tata McGraw Hill, 1991.
2. F.Bogart Jr., —Electronic Devices and CircuitsI, 6<sup>th</sup> edition, Pearson Education, 2007.
3. Donald.A.Neamen, —Electronic Circuit Analysis and DesignI, 2<sup>nd</sup> edition, Tata McGraw Hill, 2007.
4. Adel.S.Sedra, Kenneth C.Smith, —Micro Electronic CircuitsI, 5<sup>th</sup> edition, Oxford University Press, 2004.

Mapping of Course Outcomes with Programme Outcomes:  
(1/2/3 indicates strength of correlation) 3-Strong, 2-Medium , 1-Weak

| COs | Programme Outcomes(POs) |     |     |     |     |     |     |     |     |      |      |      |      |      |
|-----|-------------------------|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|
|     | PO1                     | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
| CO1 | 3                       | 3   | -   | -   | 3   | -   | -   | -   | -   | -    | -    | -    | 3    | 3    |
| CO2 | 3                       | 3   | -   | -   | 3   | -   | -   | -   | -   | -    | -    | -    | 3    | 3    |
| CO3 | 3                       | 3   | -   | -   | 3   | -   | -   | -   | -   | -    | -    | -    | 3    | 3    |
| CO4 | 3                       | 3   | -   | -   | 3   | -   | -   | -   | -   | -    | -    | -    | 3    | 3    |
| CO5 | 3                       | 3   | -   | -   | 3   | -   | -   | -   | -   | -    | -    | -    | 3    | 3    |



**COURSE OBJECTIVES**

To enable students to

- know the basics of communication
- understand various Amplitude modulation and demodulation systems
- acquire knowledge about various Angle modulation and demodulation systems
- know the working of transmitters and receivers.
- understand the effect of noise on communication systems.

**UNIT I      AMPLITUDE MODULATION** **9**

Elements of an Electrical communication system-Communication channel and their characteristics  
Need for modulation- Amplitude Modulation – Definition- single tone modulation-Phasor representations- power relations in AM waves- Generation of AM waves- Detection of AM Waves  
DSB MODULATION : Double side band suppressed carrier modulators- time domain and frequency domain description-Generation of SSB AM Modulated Wave - Demodulation of SSB Waves-principles of Vestigial Side Band modulation, comparison of AM system.

**UNIT II      ANGLE MODULATION** **9**

Basic concepts- Frequency Modulation & Phase Modulation: Single tone frequency modulation  
Spectrum Analysis of Sinusoidal FM Wave- Narrow band FM- Phasor representation - Wide band FM  
Constant Average Power- Transmission bandwidth of FM Wave - Generation of FM Waves: Direct and Indirect FM- Detection of FM Waves: Balanced Slope detector- Foster Seeley discriminator- Ratio detector- Phase locked loop method of FM detection- Comparison of FM and AM.

**UNIT III      RADIO TRANSMITTERS AND RECEIVERS** **9**

Radio Transmitter - Classification of Transmitter: AM Transmitter- FM Transmitter – Variable reactance type and phase modulated FM Transmitter- frequency stability in FM Transmitter-Radio Receiver - Receiver Types - Tuned radio frequency receiver- Super heterodyne receiver- RF section and Characteristics - Frequency changing and tracking- Intermediate frequency- AGC- FM Receiver Amplitude limiting- Comparison with AM Receiver.

**UNIT IV      NOISE** **9**

Noise sources and types -Noise figure- Calculation of noise figure- noise bandwidth- Equivalent noise resistance - Noise figure of cascaded stages-noise figure measurement- Noise temperature- Available Noise Power Noise in Analog communication System- Noise in DSB, SSB, AM and FM Systems  
Threshold effect in FM System- Pre-emphasis & De-Emphasis in FM.

**UNIT V      INFORMATION THEORY** **9**

Entropy - Discrete Memory less channels - Channel Capacity - Hartley - Shannon law - Source coding theorem - Huffman & Shannon - Fano codes.

**TOTAL PERIODS      45**

**COURSE OUTCOMES**

Upon the completion of the course, students will be able to

- explain the basics of AM communication systems
- design Angle modulated communication systems

- elaborate the transmission and reception concept of communication system
- analyze the noise performance of AM and FM systems
- explain the concepts of Discrete Memoryless channels

### TEXT BOOKS

1. Wayne Tomasi, "Electronic Communication Systems Fundamentals through Advanced", 5th Edition, Pearson Education Inc, 2004.

### REFERENCES

1. H Taub & D. Schilling, Gautam Sahe, "Principles of Communication Systems", Tata McGraw Hill, 3rd Edition, 2007.
2. Simon Haykin, "Communication Systems", John Wiley, 5th Edition, 2009.
3. B.P. Lathi, "Communication Systems", BS Publication, 2006.

### WEB LINKS

1. <http://nptel.ac.in/video.php?subjectId=117102059>
2. <https://www.youtube.com/watch?v=GqBSyLRHDeE>
3. <https://www.youtube.com/watch?v=Z-Hw3CpPVj0>

| Mapping of Course Outcomes with Programme Outcomes:<br>(1/2/3 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak |                         |     |     |     |     |     |     |     |     |      |      |      |      |      |
|-----------------------------------------------------------------------------------------------------------------------------|-------------------------|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|
| COs                                                                                                                         | Programme Outcomes(POs) |     |     |     |     |     |     |     |     |      |      |      |      |      |
|                                                                                                                             | PO1                     | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
| CO1                                                                                                                         | 3                       | 3   | -   | -   | -   | -   | -   | -   | -   | -    | 3    | -    | 3    | 3    |
| CO2                                                                                                                         | 3                       | 3   | -   | -   | -   | -   | -   | -   | -   | -    | 3    | -    | 3    | 3    |
| CO3                                                                                                                         | 3                       | 3   | -   | -   | -   | -   | -   | -   | -   | -    | 3    | -    | 3    | 3    |
| CO4                                                                                                                         | 3                       | 3   | -   | -   | -   | -   | -   | -   | -   | -    | 3    | -    | 3    | 3    |
| CO5                                                                                                                         | 3                       | 3   | -   | -   | -   | -   | -   | -   | -   | -    | 3    | -    | 3    | 3    |



**COURSE OBJECTIVES**

To enable students to

- know the basics of operational amplifier
- learn linear and nonlinear applications of operational amplifier
- study the applications of analog multiplier and PLL
- understand the theory of analog and digital conversion
- know basic knowledge of special function IC's

**UNIT I INTEGRATED CIRCUIT FABRICATION AND BASICS OF OPERATIONAL AMPLIFIER 9**

Integrated Circuit classification, Fundamentals of Monolithic IC Technology, Basic Fabrication process Fabrication of a typical circuit – Active and passive components of ICs - **Operational amplifier** – Basic information of Op-Amps – **Ideal Op Amp** –operational amplifier Internal circuit– Examples of IC Op-Amps - DC, AC Characteristics of Op-Amp –virtual ground, frequency compensation techniques - slew rate.

**UNIT II APPLICATIONS OF OPERATIONAL AMPLIFIERS 9**

Basic Op-Amp applications (sign changer, scale changer, voltage follower, adder and subtractor) – **Instrumentation amplifier – Voltage-to-Current and Current-to-Voltage converter – Logarithmic amplifier - Anti-logarithmic amplifiers Differentiator - Integrator - Comparator – Schmitt trigger – Active filters – Design of Low pass, high pass and band pass filters – Precision rectifiers.**

**UNIT III ANALOG MULTIPLIER AND PLL 9**

Analog multiplier IC – applications - Analysis of four quadrant and variable Trans-conductance multipliers –PLL: Basic principles-Phase Detector/Comparator- Voltage controlled Oscillator – Monolithic PLL - PLL applications – Frequency multiplier - AM, FM and FSK demodulators - Frequency synthesizers – Frequency translation.

**UNIT IV ANALOG TO DIGITAL AND DIGITAL TO ANALOG CONVERTORS 9**

Introduction - basic DAC techniques: **Binary weighted resistor type – R-2R ladder type – sample and hold circuits – Analog to-Digital converters: Flash type ADC – Counter type ADC –Successive approximation register type ADC- Dual slope ADC – DAC / ADC Specifications.**

**UNIT V SPECIAL FUNCTION ICS 9**

Waveform generators – Basic principles of sine wave oscillators – Astable and monostable multivibrators using Op-Amp ICL8038 Function Generator – 555 timer: description of functional diagram – Astable, monostable operation – IC 723 general purpose voltage regulator – switching regulator – Switched capacitor filter – LM380 audio amplifier – Opto couplers and fiber optic ICs.

**TOTAL PERIODS 45**

**COURSE OUTCOMES**

Upon the completion of the course, students will be able to

- explain the basic concepts of operational amplifier
- elaborate the working and applications of operational amplifier

- explain about PLL applications in modulator circuits
- elaborate the working of analog and digital communication circuits
- demonstrate the working of special function IC's

### TEXT BOOKS

1. D.Roy Choudhry, Shail Jain, "Linear Integrated Circuits", New Age International Pvt. Ltd., Fourth edition 2010.
2. Sergio Franco, "Design with operational amplifiers and analog integrated circuits", McGraw Hill, 3<sup>rd</sup> edition 2007.

### REFERENCES

1. William D.Stanely, "Operational Amplifiers with Linear Integrated Circuits", Pearson Education, 2004.
2. David L.Terrell, "Op Amps-Design, Application, and Troubleshooting", Elsevier publications 2005.
3. Ramakant A. Gayakwad, "OP - AMP and Linear IC's", Prentice Hall, 1994.
4. Botkar K.R., "Integrated Circuits", Khanna Publishers, 1996.

### WEB LINKS

1. [http://www.ee.iisc.ernet.in/new/people/faculty/prasantg/downloads/opamp\\_circuits.pdf](http://www.ee.iisc.ernet.in/new/people/faculty/prasantg/downloads/opamp_circuits.pdf)
2. [http://cc.ee.ntu.edu.tw/~lhlu/eecourses/Electronics1/Electronics\\_Ch2.pdf](http://cc.ee.ntu.edu.tw/~lhlu/eecourses/Electronics1/Electronics_Ch2.pdf)
3. <http://www.electronics.dit.ie/staff/ypanarin/Lecture%20Notes/DT0214/7AnalogMultipliers%284p%29.pdf>
4. <http://astro.temple.edu/~silage/Chapter8MS.pdf>

| Mapping of Course Outcomes with Programme Outcomes:<br>(1/2/3 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak |                         |     |     |     |     |     |     |     |     |      |      |      |      |      |
|-----------------------------------------------------------------------------------------------------------------------------|-------------------------|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|
| COs                                                                                                                         | Programme Outcomes(POs) |     |     |     |     |     |     |     |     |      |      |      |      |      |
|                                                                                                                             | PO1                     | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
| CO1                                                                                                                         | 3                       | 3   | -   | -   | 3   | -   | -   | -   | -   | -    | -    | -    | 3    | 3    |
| CO2                                                                                                                         | 3                       | 3   | -   | -   | 3   | -   | -   | -   | -   | -    | -    | -    | 3    | 3    |
| CO3                                                                                                                         | 3                       | 3   | -   | -   | 3   | -   | -   | -   | -   | -    | -    | -    | 3    | 3    |
| CO4                                                                                                                         | 3                       | 3   | -   | -   | 3   | -   | -   | -   | -   | -    | -    | -    | 3    | 3    |
| CO5                                                                                                                         | 3                       | 3   | -   | -   | 3   | -   | -   | -   | -   | -    | -    | -    | 3    | 3    |



**COURSE OBJECTIVES**

To enable the students to

- gain knowledge on control system modelling
- understand the concept of time domain analysis of control systems
- Acquire knowledge about the frequency response analysis using various plots
- study methods to analyze the stability of control systems
- know the concept of state variable analysis in control systems

**UNIT I CONTROL SYSTEM MODELING 9**

Basic Elements of Control System – Open loop and Closed loop systems - Differential equation – Transfer function concept- Modelling of Electric systems, Translational and rotational mechanical systems – Block diagram reduction Techniques – Signal flow graph – Mason's gain formula

**UNIT II TIME RESPONSE ANALYSIS 9**

Standard Test Signals - Time response analysis - First Order Systems - Impulse and Step Response analysis of second order systems - Steady state errors – P, PI, PD and PID Compensation

**UNIT III FREQUENCY RESPONSE ANALYSIS 9**

Frequency Response - Bode Plot, Polar Plot, Nyquist Plot - Frequency Domain specifications from the plots - Constant M and N Circles - Nichol's Chart - Nichol's Chart in Control System Analysis Series, Parallel, seriesparallel Compensators

**UNIT IV STABILITY ANALYSIS 9**

Stability-Location of roots in S plane for stability, Routh-Hurwitz Criterion, Root Locus Technique, Construction of Root Locus, Nyquist Stability Criterion.

**UNIT V STATE VARIABLE ANALYSIS 9**

State space representation of Continuous Time systems – State equations- Transfer function from state Variable representation – Solutions of the state equations- Concepts of Controllability and Observability

**TOTAL PERIODS 45**

**COURSE OUTCOMES**

At the end of the course, the students will be able to

- determine the models of control systems and their representation
- Learn time domain techniques to design a control system
- understand the basic frequency response plots
- identify the major causes that affect the stability of a control system

- know the concept of state variable analysis of control systems

### TEXT BOOKS

1. J.Nagrath and M.Gopal, —Control System Engineeringl, New Age International Publishers, 5th Edition, 2007.
2. Katsuhiko Ogata, —Modern Control Engineeringl, second edition, Prentice Hall of India Private Limited, New Delhi, 1995.

### REFERENCES

1. Benjamin.C.Kuo, —Automatic control systemsl, Prentice Hall of India, 7<sup>th</sup> Edition,1995
2. M.Gopal, —Control System – Principles and Designl, Tata McGraw Hill, 2<sup>nd</sup> Edition, 2002
3. Schaum's Outline Series, —Feedback and Control Systemsl, Tata McGraw-Hill, 200
4. John J.D'azzo& Constantine H.Houpis, —Linear control system analysis and designl, Tata McGraw-Hill Inc., 1995
5. Richard C. Dorf& Robert H. Bishop, —Modern Control Systemsl, Addidon –Wesley, 1999

Mapping of Course Outcomes with Programme Outcomes:  
(1/2/3 indicates strength of correlation) 3-Strong, 2-Medium , 1-Weak

| COs | Programme Outcomes(POs) |     |     |     |     |     |     |     |     |      |      |      |      |      |
|-----|-------------------------|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|
|     | PO1                     | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
| CO1 | 3                       | 3   | -   | 3   | -   | -   | -   | -   | -   | -    | -    | -    | 3    | 3    |
| CO2 | 3                       | 3   | -   | 3   | -   | -   | -   | -   | -   | -    | -    | -    | 3    | 3    |
| CO3 | 3                       | 3   | -   | 3   | -   | -   | -   | -   | -   | -    | -    | -    | 3    | 3    |
| CO4 | 3                       | 3   | -   | 3   | -   | -   | -   | -   | -   | -    | -    | -    | 3    | 3    |
| CO5 | 3                       | 3   | -   | 3   | -   | -   | -   | -   | -   | -    | -    | -    | 3    | 3    |



**EC16405 ELECTROMAGNETIC FIELDS AND WAVES**  
**COURSE OBJECTIVES**

**3 0 0 3**

To enable the students to

- study the fields and potentials due to static charges
- know about static magnetic fields
- understand how materials affect electric and magnetic fields
- learn the relation between the fields under time varying situations
- gain the knowledge of the propagation of uniform plane waves

**UNIT I ELECTRICSTATIC FIELDS 9**

Co-ordinate systems, Vector differential operators, Coulombs law, Divergence theorem, Stokes theorem, Electric field intensity – charge distribution, electric flux density –Applications of Gauss’s law, Electric potential, Electric dipole, Energy and Energy density.

**UNIT II ELECRIC FIELDS IN MATERIAL SPACE 9**

Conductors – Polarization in dielectrics, Dielectric constant and strength, Uniqueness theorem - continuity equation, Boundary conditions, Poisson’s and Laplace’s equation – General procedure for solving Poisson’s and Laplace’s equation– Resistance and Capacitance, Method of images.

**UNIT III MAGNETOSTATIC FIELDS 9**

Biot – Savart’s law, Ampere’s circuit law - Magnetic flux Density and Field intensity – applications of Ampere’s Law –Magnetic scalar and vector potentials -Force due to magnetic fields -Magnetic Torque and moment, Magnetization in materials, magnetic boundary conditions, Inductors and Inductances magnetic Energy – magnetic circuits.

**UNIT IV TIME VARYING FIELDS AND MAXWELL’S EQUATIONS 9**

Faradays law, Transformer and motional electromotive forces, The equation of continuity for time varying fields – Inconsistency of Ampere’s Law - Maxwell’s equation, Displacement current, time varying potentials – time harmonic fields – Electromagnetic spectrum.

**UNIT V ELECTROMAGNETIC WAVE PROPAGATION 9**

Wave propagation in lossy dielectric – plane waves in lossless dielectrics-plane waves in free space-plane waves in good conductors-power and the Poynting vector-Reflection of plane waves at normal incidence\ Reflection of plane wave at oblique incidence- Transmission line analogy-Application Note- microwaves.

**TOTAL PERIODS 45**

**COURSE OUTCOMES**

At the end of the course, the students will be able to

- analyze field potentials due to static changes
- analyze the effect of field on materials

- analyze field intensity due to static magnetic fields
- analyze the relation between the fields under time varying situations □
- explain the principles of propagation of uniform plane waves

### TEXT BOOKS

1. Mathew.N.O.Sadiku, —Principles of ElectromagneticsI, Oxford UniversityPress,2011
2. E.C. Jordan and K.G. Balmain, —Electromagnetic Waves and Radiating SystemsI, Printice-hall of India/PHI , 2nd edition, 2007.

### REFERENCES

1. Kraus, Fleisch, —Electromagnetics with ApplicationsI, McGraw-Hill, 2005
2. David .K.Cheng, —Field and wave ElectromagneticsI, 2nd edition, Pearson education, 2004.
3. Karl E.Longman and Sava V.Savov, —Fundamentals of Electro-MagneticsI, Prentice Hall of India, 2006
4. W.H.Hayt and A.Buck, —Engineering ElectroMagneticsI, 7th Edition, McGraw Hill, 2006

| Mapping of Course Outcomes with Programme Outcomes:<br>(1/2/3 indicates strength of correlation) 3-Strong, 2-Medium , 1-Weak |                         |     |     |     |     |     |     |     |     |      |      |      |      |      |
|------------------------------------------------------------------------------------------------------------------------------|-------------------------|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|
| COs                                                                                                                          | Programme Outcomes(POs) |     |     |     |     |     |     |     |     |      |      |      |      |      |
|                                                                                                                              | PO1                     | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
| CO1                                                                                                                          | 3                       | 3   | -   | -   | 3   | -   | -   | -   | -   | -    | -    | -    | 3    | 3    |
| CO2                                                                                                                          | 3                       | 3   | -   | -   | 3   | -   | -   | -   | -   | -    | -    | -    | 3    | 3    |
| CO3                                                                                                                          | 3                       | 3   | -   | -   | 3   | -   | -   | -   | -   | -    | -    | -    | 3    | 3    |
| CO4                                                                                                                          | 3                       | 3   | -   | -   | 3   | -   | -   | -   | -   | -    | -    | -    | 3    | 3    |
| CO5                                                                                                                          | 3                       | 3   | -   | -   | 3   | -   | -   | -   | -   | -    | -    | -    | 3    | 3    |



**COURSE OBJECTIVES**

To enable students to

- gain hands on experience in designing feedback amplifiers
- acquire the knowledge about the design of oscillators
- learn the simulation software used for circuit design
- understand the concepts of Multivibrators

**LIST OF EXPERIMENTS**

1. Design of Feedback amplifier circuits
2. Frequency response of class C tuned amplifier
3. Design of integrator and differentiator
4. Design of RC oscillators (RC Phase shift / Wien bridge/Twin-T)
5. Design of LC oscillators (Hartley /Colpitts /Clapp)
6. Design of multivibrators (Astable / monostable / bistable)
7. Design of clippers and clampers

**SIMULATION USING PSPICE /MULTISIM/EQUIVALENT SOFTWARE PACKAGE**

1. Simulation of clippers and clampers
2. Simulation of Multivibrators
3. Simulation of integrator and differentiator

**TOTAL PERIODS****60****COURSE OUTCOMES**

Upon the completion of the course, students will be able to

- Analyze feedback amplifiers
- Learn about differential and power amplifiers
- Design of oscillators and Multivibrators for the given specifications
- Analyze electronic circuits through simulation

Mapping of Course Outcomes with Programme Outcomes:  
(1/2/3 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak

| COs | Programme Outcomes(POs) |     |     |     |     |     |     |     |     |      |      |      |      |      |
|-----|-------------------------|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|
|     | PO1                     | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
| CO1 | -                       | 3   | 3   | -   | 3   | 3   | -   | -   | -   | -    | -    | -    | 3    | 3    |
| CO2 | -                       | 3   | 3   | -   | 3   | 3   | -   | -   | -   | -    | -    | -    | 3    | 3    |
| CO3 | -                       | 3   | 3   | -   | 3   | 3   | -   | -   | -   | -    | -    | -    | 3    | 3    |
| CO4 | -                       | 3   | 3   | -   | 3   | 3   | -   | -   | -   | -    | -    | -    | 3    | 3    |



**COURSE OBJECTIVES**

To enable students to

- study the application of operational amplifier
- know the design of multivibrators using operational amplifier and 555 timer
- design oscillators and active filters in various applications.
- simulate the Op-Amp application circuits using PSPICE software

**LIST OF EXPERIMENTS****Design and testing of**

1. Inverting, Non inverting amplifier and differential amplifier
2. Instrumentation amplifier
3. Integrator and Differentiator
4. Active low pass, High pass and band pass filters.
5. Astable, Monostable Multivibrators and Schmitt trigger (using IC 741)
6. Phase shift Oscillator and Wien bridge oscillators (using IC 741)
7. Astable and monostable Multivibrators using NE555 Timer
8. Frequency multiplier using PLL IC
9. Voltage regulation using LM317 and LM723

**Simulation Experiments**

10. Simulation of (i) Instrumentation amplifier, (ii) Integrator and Differentiator, (iii) Active low pass, High pass and band pass filters, (iv) Astable, Monostable Multivibrators and Schmitt trigger (using IC 741), (v) Phase shift Oscillator and Wien bridge oscillators (using IC 741)

**TOTAL PERIODS****60****COURSE OUTCOMES**

Upon the completion of the course, students will be able to

- design and test the Op-amp applications
- design oscillators and multivibrators for various applications
- analyze the working of power supply
- simulate circuits using Op-amp

| Mapping of Course Outcomes with Programme Outcomes:<br>(1/2/3 indicates strength of correlation) 3-Strong, 2-Medium , 1-Weak |                         |     |     |     |     |     |     |     |     |      |      |      |      |      |
|------------------------------------------------------------------------------------------------------------------------------|-------------------------|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|
| COs                                                                                                                          | Programme Outcomes(POs) |     |     |     |     |     |     |     |     |      |      |      |      |      |
|                                                                                                                              | PO1                     | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
| CO1                                                                                                                          | 3                       | 3   | -   | 3   | 3   | -   | -   | -   | -   | -    | -    | 3    | 3    | 3    |
| CO2                                                                                                                          | 3                       | 3   | -   | 3   | 3   | -   | -   | -   | -   | -    | -    | 3    | 3    | 3    |
| CO3                                                                                                                          | 3                       | 3   | -   | 3   | 3   | -   | -   | -   | -   | -    | -    | 3    | 3    | 3    |
| CO4                                                                                                                          | 3                       | 3   | -   | 3   | 3   | -   | -   | -   | -   | -    | -    | 3    | 3    | 3    |



**COURSE OBJECTIVES**

To enable the students to

- understand the architecture of 8086 microprocessor.
- learn the design aspects of I/O and Memory Interfacing circuits.
- acquire the knowledge about programming of 8086 microprocessor.
- study the architecture of 8051 microcontroller.
- know the concepts of interfacing microcontroller

**UNIT I 8086 MICROPROCESSOR****9**

Introduction to microprocessor - Bus-Address bus- Data bus and Control bus- 8086 Microprocessor architecture - Pipelining - Memory Segmentation - Addressing modes - Instruction set and assembler directives – Connecting Microprocessor and I/O devices - Interrupts - Assembly language programming.

**UNIT II 8086 SYSTEM BUS STRUCTURE****9**

8086 signals - Basic configurations - System bus timing - System design using 8086 - I/O programming Multiprogramming - Multiprocessor configurations - Closely coupled and loosely Coupled configurations Coprocessor.

**UNIT III I/O INTERFACING****9**

Memory Interfacing and I/O interfacing - Parallel communication interface - Serial communication interface - D/A and A/D Interface - Timer - Keyboard /display controller - Interrupt controller - DMA controller Programming and applications Case studies: Traffic Light control- Washing Machine and Stepper Motor.

**UNIT IV 8051 MICROCONTROLLER****9**

Architecture of 8051 - Special Function Registers (SFRs) - Ports of 8051 - Addressing modes - Instruction set Assembly language programming.

**UNIT V INTERFACING MICROCONTROLLER****9**

Keyboard Interfacing - ADC- DAC Interfacing - External Memory Interface - Case studies: Traffic light controller Stepper Motor - Washing Machine.

**TOTAL PERIODS****45****COURSE OUTCOMES**

Upon the completion of the course, students will be able to

- synthesize programs in 8086 microprocessor.

- analyze and design multiprocessor system
- apply the concept of I/O devices.
- evaluate the memory interfacing circuits.
- examine the 8051 microcontroller based systems.

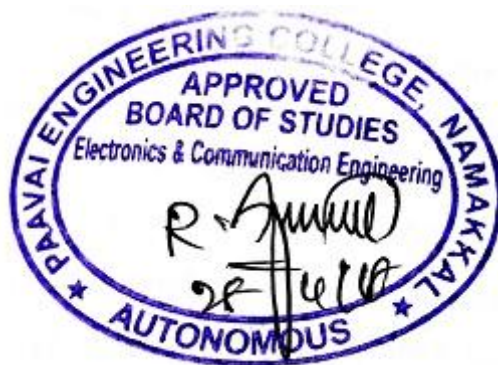
#### TEXT BOOKS

1. Krishna Kant- “Microprocessors and Microcontrollers Architecture- programming and system design using 8085- 8086- 8051 and 896”. PHI 2007.
2. Kenneth J.Ayala- “The 8051 Microcontroller Architecture- Programming and applications”- Second edition- Penram International

#### REFERENCES

1. Mohamed Ali Mazidi- Janice GillispieMazidi- RolinMcKinlay- “The 8051 Microcontroller and Embedded Systems: Using Assembly and C”- Second Edition- Pearson education- 2011
2. DoughlasV.Hall- “Microprocessors and Interfacing- Programming and Hardware”-TMH-2012
3. Yu-Cheng Liu- Glenn A.Gibson- “Microcomputer Systems: The 8086 / 8088 Family Architecture- Programming and Design”- Second Edition- Prentice Hall of India- 2007.

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|------------------------------------------------------------------------------------------------------------------------------|-------------------------|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|
| COs                                                                                                                          | Programme Outcomes(POs) |     |     |     |     |     |     |     |     |      |      |      |      |      |
|                                                                                                                              | PO1                     | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
| CO1                                                                                                                          | 3                       | 1   | 1   | 2   | -   | -   | -   | -   | -   | -    | -    | 1    | 2    | 1    |
| CO2                                                                                                                          | 3                       | 1   | 1   | 2   | -   | -   | -   | -   | -   | -    | -    | 1    | 2    | 1    |
| CO3                                                                                                                          | 3                       | 1   | 1   | 2   | 1   | -   | 2   | -   | -   | -    | 1    | 1    | 2    | 1    |
| CO4                                                                                                                          | 3                       | 1   | 1   | 2   | -   | -   | -   | -   | -   | -    | -    | 1    | 2    | 1    |
| CO5                                                                                                                          | 3                       | 1   | 1   | 2   | 1   | -   | 2   | -   | -   | -    | 1    | 1    | 2    | 1    |



**COURSE OBJECTIVES**

To enable the students to

- learn discrete Fourier transform and its properties
- know the characteristics of IIR filters- learn the design of infinite impulse response filters for filtering the undesired signals
- know the characteristics of FIR filters- learn the design of finite impulse response filters for filtering the undesired signals
- understand Finite word length effects
- study the concept of Digital signal processors and applications

**UNIT I                      DISCRETE FOURIER TRANSFORM                      15**

DFT and its properties- Relation between DTFT and DFT- Radix-2 FFT algorithms - butterfly diagram – DFT computation using Decimation in time and Decimation in frequency algorithms- Overlap-add and save Methods.

**UNIT II                      INFINITE IMPULSE RESPONSE FILTER DESIGN                      15**

Design of analogue Butterworth and Chebyshev Filters- Frequency transformation in analogue domain – Design of IIR digital filters using impulse invariance technique - Design of digital filters using bilinear transform – pre warping - Realization of IIR Digital filters- Realization using direct- cascade and parallel forms.

**UNIT III                      FINITE IMPULSE RESPONSE FILTER DESIGN                      15**

Linear phase FIR filters - Design using Rectangular- Hamming- Hanning and Blackmann Windows – Frequency sampling method - Realization of FIR filters - Direct form I and II- and Lattice structure.

**UNIT IV                      FINITE WORDLENGTH EFFECTS IN DIGITAL FILTERS                      15**

Fixed point and floating point number representations - Comparison - Quantization - Quantization Error Quantization Noise Power - Zero input Limit Cycle Oscillations - Overflow Limit Cycle Oscillations – Signal Scaling.

**UNIT V                      DIGITAL SIGNAL PROCESSORS AND APPLICATION                      15**

Overview of Digital Signal Processors - Selecting Digital Signal Processors - Applications of PDSPs – Von Neumann Architecture - Harvard Architecture - VLIW Architecture - Multiply Accumulate Unit (MAC) - Pipelining - Architecture of TMS320C50.

**TOTAL PERIODS                      75**

**COURSE OUTCOMES**

Upon the completion of the course, students will be able to

- apply DFT for the analysis of digital signals and systems
- analyze the design of IIR filters

- synthesize the design of IIR filters
- characterize finite word length effect in filters
- understand the working of digital signal processors

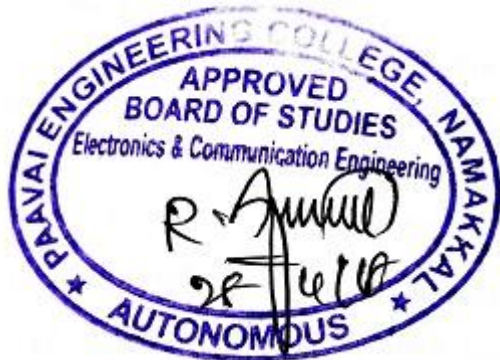
### TEXT BOOKS

1. John G. Proakis & Dimitris G. Manolakis- “Digital Signal Processing-Principles- Algorithms & Applications”- Fourth Edition- Pearson Education / Prentice Hall- 2007.
2. P. Ramesh Babu “ Digital Signal Processing”- Fourth Edition- Scitech-2007.

### REFERENCES

1. Emmanuel C. Ifeakor- & Barrie W. Jervis- “Digital Signal Processing”- Second Edition- Pearson Education / Prentice Hall- 2002.
2. Sanjit K. Mitra- “Digital Signal Processing-A Computer Based Approach”- Tata McGraw Hill- 2007.
3. A.V. Oppenheim- R.W. Schaffer and J.R. Buck- “Discrete-Time Signal Processing”- 8<sup>th</sup> Indian Reprint- Pearson- 2004.
4. Andreas Antoniou- “Digital Signal Processing”- Tata McGraw Hill- 2006.

| Mapping of Course Outcomes with Programme Outcomes:<br>(1/2/3 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak |                         |     |     |     |     |     |     |     |     |      |      |      |      |      |
|-----------------------------------------------------------------------------------------------------------------------------|-------------------------|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|
| COs                                                                                                                         | Programme Outcomes(POs) |     |     |     |     |     |     |     |     |      |      |      |      |      |
|                                                                                                                             | PO1                     | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
| CO1                                                                                                                         | 3                       | 1   | 2   | 2   | 1   | -   | -   | -   | -   | -    | -    | 1    | 2    | 1    |
| CO2                                                                                                                         | 3                       | 1   | 2   | 2   | 1   | -   | -   | -   | -   | -    | -    | 1    | 2    | 1    |
| CO3                                                                                                                         | 3                       | 1   | 2   | 2   | 1   | -   | 2   | -   | -   | -    | 1    | 1    | 2    | 1    |
| CO4                                                                                                                         | 3                       | 1   | 2   | 2   | -   | -   | -   | -   | -   | -    | -    | 1    | 2    | 1    |
| CO5                                                                                                                         | 3                       | 1   | 2   | -   | -   | -   | 2   | -   | -   | -    | 1    | 1    | 2    | 1    |



**COURSE OBJECTIVES**

To enable the students to

- understand the network functionalities of different layers.
- be familiar with flow and error control protocols and techniques.
- know about the routing protocols
- learn the concepts of congestion control algorithms and Quality of Service
- study about various applications and network security.

**UNIT I DATA COMMUNICATION AND PHYSICAL LAYER 9**

Data Communication - Components - Data flow; Networks - Criteria- Physical Structure - Topology - OSI Model- Transmission Impairment- Transmission media: Guided media -Twisted pair cable- Coaxial cable- Fiber optic cable- Unguided media - Switching - Circuit switching networks - Packet switching networks.

**UNIT II DATA LINK LAYER 9**

Services- Link-Layer Addressing - Framing- Noiseless Channels - Noisy channel protocols - HDLC- CSMA/CD- CSMA/CA- IEEE 802.3- IEEE802.11- Bluetooth.

**UNIT III NETWORK LAYER 9**

Services- Performance - IPV4 addresses - Classful Addressing- Classless Addressing- DHCP- ICMP- IGMP- IPV6- Routing algorithm - Distance-Vector Routing- Link-State Routing - Unicasting - RIP- OSPF, Multicast routing DVMRP- PIM.

**UNIT IV TRANSPORT LAYER 9**

Services - Connectionless and Connection - Oriented Protocols - Port Numbers- UDP- TCP; Flow Control- Error Control- TCP Congestion control. QoS-Token bucket and Leaky bucket

**UNIT V APPLICATION AND NETWORK SECURITY 9**

Domain Name Space- E-Mail - SMTP- POP- IMAP - WWW- HTTP- Network Security - Categories- Symmetric- Key Cryptography- Asymmetric-Key Cryptography.

**TOTAL PERIODS 45**

**COURSE OUTCOMES**

Upon the completion of the course, students will be able to

- analyze the different types of layers in a networks.
- elaborate flow and error control techniques to send data in a network.

- acquire knowledge about the routing algorithms.
- synthesize the congestion control techniques.
- elucidate about the various applications and security issues.

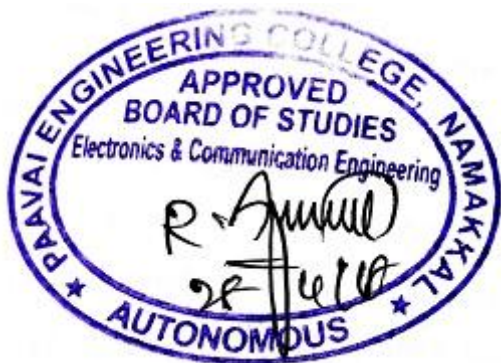
### TEXT BOOKS

1. Behrouz A. Forouzan- Data communications and Networking- The McGraw-Hill Companies Inc. 4<sup>th</sup> edition. (2013)
2. William Stallings- Data and Computer Communication- (2010).

### REFERENCES

1. Larry L.Peterson&S.Peter Davie- Computer Networks- Harcourt- (2008).
2. James F.Kurose& Keith W.Ross- Computer Networking A Top-down Approach Featuring the Internet- PHI- (2007).
3. Andrew S.Tannenbaum- Computer Networks- PHI- (2010).

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|------------------------------------------------------------------------------------------------------------------------------|-------------------------|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|
| COs                                                                                                                          | Programme Outcomes(POs) |     |     |     |     |     |     |     |     |      |      |      |      |      |
|                                                                                                                              | PO1                     | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
| CO1                                                                                                                          | 2                       | 1   | -   | -   | 3   | 2   | 1   | -   | -   | 1    | 1    | 1    | 2    | 1    |
| CO2                                                                                                                          | 2                       | 1   | -   | -   | 3   | 2   | 1   | -   | -   | 1    | 1    | 1    | 2    | 1    |
| CO3                                                                                                                          | 2                       | 1   | -   | -   | 3   | 2   | 1   | -   | -   | 1    | 1    | 1    | 2    | 1    |
| CO4                                                                                                                          | 2                       | 1   | -   | -   | 3   | 2   | 1   | -   | -   | 1    | 1    | 1    | 2    | 1    |
| CO5                                                                                                                          | 2                       | 1   | -   | -   | 3   | 2   | 1   | -   | -   | 1    | 1    | 1    | 2    | 1    |



**COURSE OBJECTIVES**

To enable the students to

- be familiar with propagation of signals through lines.
- understand signal propagation with suitable properties.
- study the filters for network system.
- know the radio propagation in guided systems.
- learn about resonators.

**UNIT I                      TRANSMISSION LINE THEORY AND PARAMETERS                      9**

Introduction to different types of transmission lines - Transmission line Equation -Solution -Infinite line concept - Distortion less line -Loading -Input impedance- Losses in Transmission lines-Reflection loss Insertion loss- Return loss- Transmission line parameters at radio frequencies.

**UNIT II                      IMPEDENCE MATCHING AND TRANSFORMATION                      9**

Reflection Phenomena -Standing waves - $\lambda/8$ -  $\lambda/4$  &  $\lambda/2$  lines-  $\lambda/4$  Impedance transformers- Stub Matching Single and Double Stub -Smith Chart and Applications - Solution of Problems using smith chart.

**UNIT III                      FILTER DESIGN                      9**

Characteristic impedance of symmetrical networks - Filter fundamentals- Design of filters: Constant K LPF- HPF and BPF Filter design- m-derived filters - Composite filters-Fundamentals of Attenuators and Equalizers.

**UNIT IV                      RECTANGULAR WAVEGUIDES                      9**

Waves between Parallel Planes -Characteristic of TE - TM and TEM waves -Velocities of propagation Solution of wave Equation in Rectangular guides -TE and TM modes - Dominant Mode- Attenuation Mode Excitation- Rectangular cavity resonator.

**UNIT V                      CYLINDRICAL WAVE GUIDES                      9**

Solution of wave equation in circular guides- TE and TM wave in circular wave guides- Wave impedance Attenuation- Phase velocity and Group velocity - Mode excitation- Formation of cylindrical cavity- Cavity resonator and Q for dominant mode.

**TOTAL PERIODS                      45**

**COURSE OUTCOMES**

Upon the completion of the course, students will be able to

- examine the propagation of signals through transmission lines.
- analyse the signal propagation with suitable properties.

- synthesis knowledge about filter system
- apply the concept of radio propagation in guided systems.
- evaluate waveguides and cavity resonators in several applications.

### TEXT BOOKS

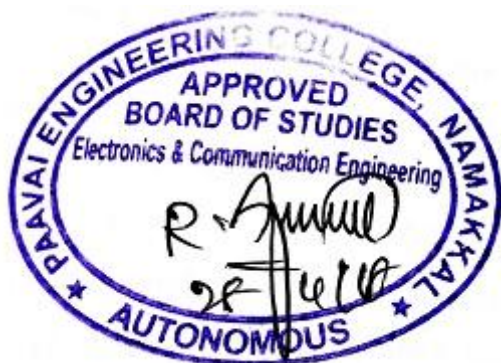
1. John D Ryder “Networks lines and fields” Prentice Hall of India- 2005.
2. G.S.N Raju ”Electro Magnetic Field Theory and Transmission Lines ” Pearson Education- First edition 2005.

### REFERENCES

1. Reinhold Ludwig and Gene Bogdanov- “RF Circuit Design: Theory and Applications”- Pearson Education Inc.2011
2. Bhag Guru &Hiziroglu-”Electromagnetic Field Theory Fundamentals” Second edition Cambridge University press-2005

Mapping of Course Outcomes with Programme Outcomes:  
(1/2/3 indicates strength of correlation) 3-Strong, 2-Medium , 1-Weak

| COs | Programme Outcomes(POs) |     |     |     |     |     |     |     |     |      |      |      |      |      |
|-----|-------------------------|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|
|     | PO1                     | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
| CO1 | 3                       | 2   | -   | -   | -   | -   | -   | -   | -   | -    | 1    | 1    | 1    | 1    |
| CO2 | 3                       | 2   | 2   | -   | 2   | 2   | 2   | -   | -   | -    | 1    | 1    | 1    | 1    |
| CO3 | 3                       | 2   | 2   | -   | 2   | 2   | 2   | -   | -   | -    | 1    | 1    | 1    | 1    |
| CO4 | 3                       | 2   | 2   | -   | -   | -   | 2   | -   | -   | -    | 1    | 1    | 1    | 1    |
| CO5 | 3                       | 2   | 2   | -   | -   | -   | 2   | -   | -   | -    | 1    | 1    | 1    | 1    |



**COURSE OBJECTIVES**

To enable the students to

- understand the concepts of error-control coding.
- analyze the encoding and decoding of digital data streams
- learn the methods for the generation of codes and decoding techniques.
- acquire the knowledge of compression and decompression techniques
- gain the knowledge of concepts in multimedia communication.

**UNIT I INFORMATION THEORY 9**

Uncertainty- Information and Entropy - Source coding Theorem - Huffman coding -Shannon Fano coding  
Discrete Memory less channels - channel capacity - channel coding Theorem - Channel capacity Theorem.

**UNIT II DATA AND VOICE CODING 9**

Differential Pulse code Modulation - Adaptive Differential Pulse Code Modulation - Adaptive sub band coding - Delta Modulation - Adaptive Delta Modulation - Coding of speech signal at low bit rates (Vocoders- LPC).

**UNIT III ERROR CONTROL CODING 9**

Linear Block codes - Syndrome Decoding - Minimum distance consideration - cyclic codes – Generator Polynomial- Parity checks polynomial - Encoder for cyclic codes - calculation of syndrome- Convolutional codes.

**UNIT IV COMPRESSION TECHNIQUES 9**

Principles - Text compression - Static Huffman Coding - Dynamic Huffman coding - Arithmetic coding  
Image Compression - Graphics Interchange format - Tagged Image File Format - Digitized documents  
Introduction to JPEG standards.

**UNIT V AUDIO AND VIDEO CODING 9**

Linear Predictive coding - code excited LPC - Perceptual coding- MPEG audio coders - Dolby audio coders  
- Video compression - Principles - Introduction to H.261 & MPEG Video standards.

**TOTAL PERIODS 45**

## COURSE OUTCOMES

Upon the completion of the course, students will be able to

- examine an application with error-control.
- apply the audio and video compression techniques
- analyse text and image compression techniques
- compare compression and decompression techniques.
- synthesize the concepts of multimedia communication

## TEXT BOOKS

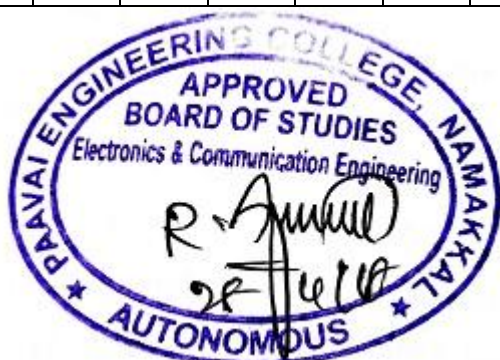
1. Simon Haykin- “Communication Systems”- 4th Edition- John Wiley and Sons- 2001.
2. Fred Halsall- “Multimedia Communications- Applications Networks Protocols and Standards”- Pearson Education- Asia 2002; Chapters: 3-4-5.

## REFERENCES

1. Mark Nelson- “Data Compression Book”- BPB Publication 1992.
2. Watkinson J- “Compression in Video and Audio”- Focal Press- London- 1995.
3. K Sayood- “Introduction to Data Compression” 3/e- Elsevier 2006
4. S Gravano- “Introduction to Error Control Codes”- Oxford University Press 2007
5. Amitabha Bhattacharya- “Digital Communication”- TMH 2006

Mapping of Course Outcomes with Programme Outcomes:  
(1/2/3 indicates strength of correlation) 3-Strong, 2-Medium , 1-Weak

| COs | Programme Outcomes(POs) |     |     |     |     |     |     |     |     |      |      |      |      |      |
|-----|-------------------------|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|
|     | PO1                     | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
| CO1 | 3                       | 1   | -   | -   | 2   | -   | -   | -   | -   | -    | -    | -    | 1    | 1    |
| CO2 | 3                       | 1   | 2   | -   | 1   | -   | -   | -   | -   | -    | -    | -    | 1    | 1    |
| CO3 | 3                       | 2   | 2   | -   | 2   | 2   | -   | -   | -   | -    | -    | -    | 1    | 1    |
| CO4 | 3                       | 1   | 2   | -   | 1   | -   | -   | -   | -   | -    | -    | -    | 1    | 1    |
| CO5 | 2                       | 3   | -   | -   | 2   | -   | -   | -   | -   | -    | -    | -    | 1    | 1    |



**COURSE OBJECTIVES**

To enable the students to

- generate the basic types of signals using MATLAB
- implement Linear and Circular Convolution using MATLAB
- implement FIR and IIR filters
- know the generation and convolution of signals using TMS320C5X/TMS320C 67XX DSP processors.

**LIST OF EXPERIMENTS: MATLAB /SCILAB / EQUIVALENT SOFTWARE PACKAGE**

1. Generation of Signals
2. Linear Convolution
3. Circular Convolution
4. Spectrum Analysis using DFT
5. FIR filter design
6. IIR filter design

**DSP PROCESSOR TMS320C5X/TMS320C 67XX BASED IMPLEMENTATION**

1. Study of Digital Signal Processor architecture
2. Waveform generation
3. Linear convolution
4. Circular convolution

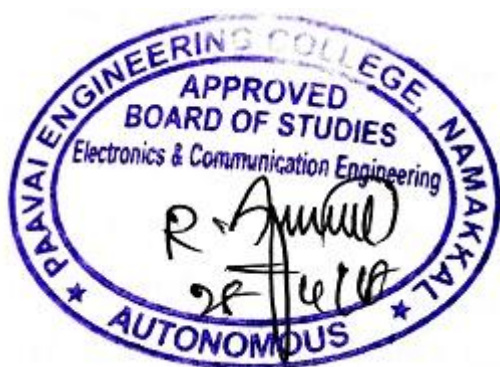
**TOTAL PERIODS****60****COURSE OUTCOMES**

Upon the completion of the course, students will be able to

- generate the basic types of signals using MATLAB
- analyze Linear and Circular Convolution using MATLAB
- implement FIR and IIR filters
- generate and convolute the signals using TMS320C5X/TMS320C 67XX DSP processors.

Mapping of Course Outcomes with Programme Outcomes:  
(1/2/3 indicates strength of correlation) 3-Strong, 2-Medium , 1-Weak

| COs | Programme Outcomes(POs) |     |     |     |     |     |     |     |     |      |      |      |      |      |
|-----|-------------------------|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|
|     | PO1                     | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
| CO1 | 1                       | 1   | -   | 2   | 3   | -   | -   | -   | -   | -    | 2    | 1    | 2    | -    |
| CO2 | 1                       | 1   | -   | 2   | 3   | -   | -   | -   | -   | -    | 2    | 1    | 2    | -    |
| CO3 | 1                       | 1   | -   | 2   | 3   | -   | -   | -   | -   | -    | 2    | 1    | 2    | -    |
| CO4 | 1                       | 1   | -   | 2   | 3   | -   | -   | -   | -   | -    | 2    | 1    | 2    | -    |



## COURSE OBJECTIVES

To enable the students to

- introduce ALP concepts and features
- write ALP for arithmetic and logical operations in 8086 and 8051
- differentiate Serial and Parallel Interface
- interface different I/O s with Microprocessors

### 8086 Programs using kits

1. Basic arithmetic and Logical operations
2. Move a data block without overlap
3. Code conversion and decimal arithmetic.
4. String manipulations- Sorting and Searching
5. Counters and Time Delay

### 8086 Programs using MASM

1. Basic arithmetic and Logical operations
2. Move a data block without overlap
3. String manipulations- Sorting and Searching

### Peripherals and Interfacing Experiments

1. Traffic light control
2. Stepper motor control
3. Key board and Display Control
4. Serial interface and Parallel interface
5. A/D- D/A interface and Waveform Generation

### 8051 Experiments using kits

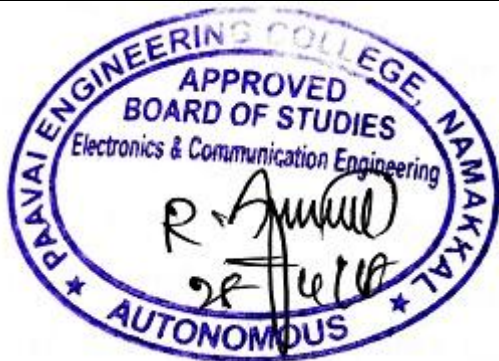
1. Basic arithmetic and Logical operations
2. A/D- D/A interface and Waveform Generation

## COURSE OUTCOMES

Upon the completion of the course- students will be able to

- write ALP Programs for fixed- Floating Point and Arithmetic
- interface different I/O s with processor
- generate waveforms using Microprocessors
- execute Programs in 8051

| Mapping of Course Outcomes with Programme Outcomes:<br>(1/2/3 indicates strength of correlation) 3-Strong, 2-Medium , 1-Weak |                         |     |     |     |     |     |     |     |     |      |      |      |      |      |
|------------------------------------------------------------------------------------------------------------------------------|-------------------------|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|
| COs                                                                                                                          | Programme Outcomes(POs) |     |     |     |     |     |     |     |     |      |      |      |      |      |
|                                                                                                                              | PO1                     | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
| CO1                                                                                                                          | 1                       | 1   | -   | 2   | 3   | -   | -   | -   | -   | -    | 2    | 1    | 2    | -    |
| CO2                                                                                                                          | 1                       | 1   | -   | 2   | 3   | -   | -   | -   | -   | -    | 2    | 1    | 2    | -    |
| CO3                                                                                                                          | 1                       | 1   | -   | 2   | 3   | -   | -   | -   | -   | -    | 2    | 1    | 2    | -    |
| CO4                                                                                                                          | 1                       | 1   | -   | 2   | 3   | -   | -   | -   | -   | -    | 2    | 1    | 2    | -    |



**COURSE OBJECTIVES**

To enable the students to

- know the basics of different digital communication techniques.
- acquire the concept of various waveform coding.
- study the concept of Eye pattern to analyze ISI.
- learn the performance of various digital modulation techniques.
- understand the error control coding techniques for data transmission.

**UNIT I BASEBAND FORMATTING TECHNIQUES 9**

Sampling process - Impulse sampling- Natural sampling- Sampler implementation - Aliasing – Quantization Uniform Quantization- Non-Uniform Quantization-Logarithmic Companding of speech signal - Pulse Code Modulation - Noise Consideration in PCM Systems - Time Division Multiplexing.

**UNIT II WAVEFORM CODING TECHNIQUES 9**

Pulse Amplitude Modulation - Pulse Width Modulation - Pulse Position Modulation - Prediction filtering and Differential Pulse Code Modulation - Delta Modulation - Adaptive Differential Pulse Code Modulation and Adaptive Delta Modulation - Linear Predictive Coding.

**UNIT III BASEBAND TRANSMISSION 9**

Properties of Line Codes - Power Spectral Density of Unipolar / Polar RZ and NRZ - Bipolar NRZ – ISI Nyquist criterion for distortion less transmission - Pulse shaping - Correlative coding - Eye Pattern Equalizers: Linear and Non Linear Equalizers - Adaptive Equalization - LMS Algorithm.

**UNIT IV DIGITAL MODULATION TECHNIQUES 9**

Signaling scheme- Generation- Detection- Probability of error and Power Spectral Density of Coherent Modulation Techniques: BPSK- BFSK- QPSK- QAM - Non Coherent Binary Modulation Technique: FSK Differential Phase Shift Keying.

**UNIT V ERROR CONTROL CODING 9**

Channel coding theorem - Linear Block Codes: Hamming Codes - Cyclic Codes: Systematic Cyclic Codes Non- Systematic Cyclic Codes - Convolution Codes - Viterbi Algorithm- Trellis Coded Modulation – Turbo Codes

**TOTAL PERIODS 45**

## COURSE OUTCOMES

Upon the completion of the course, students will be able to

- apply the concept of sampling and pulse code modulation for analog signals.
- examine the concept of various coding techniques.
- synthesize the concept of Eye pattern to analyze in ISI.
- analyze knowledge about different types of digital modulation technique.
- evaluate various error control coding

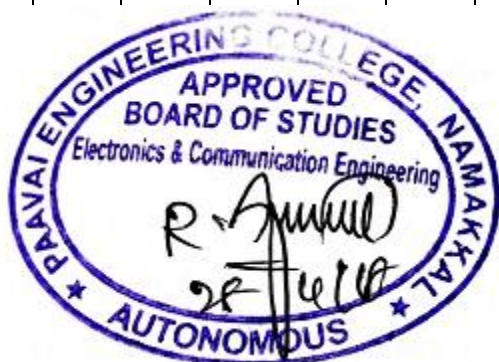
## TEXT BOOKS

1. Simon Haykin- “Digital Communication”- John Willey- student reprint- 2006.
2. John G.Proakis- “Digital Communication”- McGraw Hill Fourth Edition- 2008.

## REFERENCES

1. Bernard Sklar- “Digital Communication- Fundamentals and Applications” - Pearson Education Asia- Second Edition- reprint- 2002.
2. B.P.Lathi- “Modern Digital and Analog Communication Systems”- Third Edition- Oxford Press- 2007.

| Mapping of Course Outcomes with Programme Outcomes:<br>(1/2/3 indicates strength of correlation) 3-Strong, 2-Medium , 1-Weak |                         |     |     |     |     |     |     |     |     |      |      |      |      |      |
|------------------------------------------------------------------------------------------------------------------------------|-------------------------|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|
| COs                                                                                                                          | Programme Outcomes(POs) |     |     |     |     |     |     |     |     |      |      |      |      |      |
|                                                                                                                              | PO1                     | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
| CO1                                                                                                                          | 3                       | 2   | 2   | 2   | -   | -   | -   | -   | -   | -    | -    | 1    | 1    | -    |
| CO2                                                                                                                          | 3                       | 2   | 1   | 2   | 2   | -   | -   | -   | -   | -    | -    | 1    | 1    | -    |
| CO3                                                                                                                          | 3                       | 2   | 1   | 2   | 1   | -   | -   | -   | -   | -    | -    | 1    | 1    | -    |
| CO4                                                                                                                          | 3                       | 2   | 1   | 2   | 1   | -   | -   | -   | -   | -    | -    | 1    | 1    | -    |
| CO5                                                                                                                          | 3                       | 2   | 2   | 2   | 2   | -   | -   | -   | -   | -    | -    | 1    | 1    | -    |



**COURSE OBJECTIVES**

To enable the students to

- learn the antenna basic concepts.
- know the radiation characteristics of different types of antennas.
- acquire the knowledge of antenna arrays.
- study about the special antennas and their measurements.
- understand the RADARs at different frequencies.

**UNIT I      ANTENNA FUNDAMENTALS      9**

Antenna parameters - Gain and Directivity- Radiation intensity- Beam solid angle -Effective aperture- Radiation Resistance- Beam width- Input Impedance. Reciprocity Principle- Polarization- Antenna noise Temperature- Radiation from Hertzian dipole- Half wave dipole.

**UNIT II      APERTURE AND LENS ANTENNAS      9**

Radiation from rectangular apertures- Uniform and Tapered aperture- Horn antenna- Reflector antenna Types and feed systems- Dielectric lens and metal plane lens antennas- Slot antennas.

**UNIT III      ANTENNA ARRAYS      9**

N element linear array- Broadside and End fire array - Concept of Phased arrays- Adaptive array- Basic principle of antenna Synthesis-Binomial array.

**UNIT IV      SPECIAL ANTENNAS AND ANTENNA MEASUREMENTS      9**

Special Antennas: Helical- Log periodic- Yagi-Uda and Micro-strip patch antenna and its application. Antenna Measurements- Radiation Pattern- Gain & Directivity Measurements.

**UNIT V      INTRODUCTION TO RADARS      9**

Basic Introduction of Radar and Simple form of Radar Equation-Radar Block Diagram and its Frequencies. Introduction to Doppler effect-CW Radar- FMCW Radar-MTI Radar-Delay- Line Cancellers -Applications of Radar.

**TOTAL PERIODS      45**

**COURSE OUTCOMES**

Upon the completion of the course, students will be able to

- compare the various types of radiations.

- synthesize about aperture and lens antennas.
- analyze the various antenna arrays.
- examine special antennas and their measurements.
- evaluate the different types of radars

### TEXT BOOKS

1. John D Kraus-” Antennas for all Applications”- 3rd Edition- McGraw Hill- (2005).
2. Edward C.Jordan and Keith G.Balmain” Electromagnetic Waves and Radiating Systems” Prentice Hall of India- 2006.

### REFERENCES

1. K.D. Prasad- "Antennas and Wave Propagation"- Sathyaprakasan Tech India Publications- New Delhi 2015.
2. Peyton Z. Peebles- "Radar Principles"- John wiley- 2004.
3. J.C Toomay- “Principles of Radar”- 2nd Edition -Prentice Hall of India- 2004.
4. RajeswariChatterjee- “Antenna Theory and Practice” Revised Second Edition New Age International Publishers- 2006.

Mapping of Course Outcomes with Programme Outcomes:  
(1/2/3 indicates strength of correlation) 3-Strong, 2-Medium , 1-Weak

| COs | Programme Outcomes(POs) |     |     |     |     |     |     |     |     |      |      |      |      |      |
|-----|-------------------------|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|
|     | PO1                     | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
| CO1 | 3                       | 2   | 2   | 2   | -   | -   | -   | -   | -   | -    | -    | 1    | 1    | -    |
| CO2 | 3                       | 2   | -   | 2   | 2   | -   | -   | -   | -   | -    | -    | 1    | 1    | -    |
| CO3 | 3                       | 2   | -   | 2   | 1   | -   | -   | -   | -   | -    | -    | 1    | 1    | -    |
| CO4 | 3                       | 2   | -   | 2   | 1   | -   | -   | -   | -   | -    | -    | 1    | 1    | -    |
| CO5 | 3                       | 2   | -   | 2   | 2   | -   | -   | -   | -   | -    | -    | 1    | 1    | -    |



**COURSE OBJECTIVES**

To enable the students to

- understand the MOS circuit realization and various processing technologies.
- study the transistor circuit level design and realization for digital operation.
- learn the circuit characteristics and performance estimation.
- gain the knowledge about testing of CMOS.
- acquire the basics of Verilog in different types of Modeling.

**UNIT I MOS TRANSISTOR THEORY AND PROCESS TECHNOLOGY 9**

NMOS and PMOS transistors -Threshold voltage -Body effect -MOS device design equations-Second order effects -MOS models and small signal AC characteristics -Basic CMOS Technology.

**UNIT II INVERTERS AND LOGIC GATES 9**

NMOS and CMOS inverters - Stick diagram -Inverter ratio -DC characteristics -Transmission gates – CMOS logic structures -Static CMOS design -Dynamic CMOS design.

**UNIT III CIRCUIT CHARACTERISATION AND PERFORMANCE ESTIMATION 9**

Resistance estimation - Capacitance estimation- Inductance - Switching characteristics - Transistor sizing – Power dissipation and design margining -Charge sharing -Scaling.

**UNIT IV CMOS TESTING 9**

Need for testing-Fault models-observability- controllability- fault coverage-Design for testability- Ad-Hoc testing- Scan based test techniques-self test techniques-Boundary scan.

**UNIT V VERILOG HARDWARE DESCRIPTION LANGUAGE 9**

Overview of digital design with Verilog HDL -Hierarchical modeling concepts-Modules and port definitions - Gate level modeling- Data flow modeling - Behavioral modelling - HDL programs for simple combinational and sequential circuits.

**TOTAL PERIODS 45**

**COURSE OUTCOMES**

Upon the completion of the course, students will able to

- apply the basic concepts of MOS transistor logic.
- compare different CMOS designs.

- analyze the performance of CMOS circuits.
- synthesize the testing methods of CMOS.
- examine the modeling concepts of hardware description language.

### TEXT BOOKS

1. Neil H. E. Weste and Kamran Eshraghian- “Principles of CMOS VLSI Design”-2nd edition- Pearson Education.
2. Wayne Wolf- “Modern VLSI Design System on chip”- Pearson Education- 2002.

### REFERENCES

1. John P. Uyemura- “Introduction to VLSI Circuits and Systems”- John Wiley and Sons- Inc.- 2002.
2. Samir Palnitkar- “Verilog HDL”- 2nd Edition- Pearson Education- 2004.
3. Pucknell- “Basic VLSI Design”- Prentice Hall of India Publication- 1995.
4. Bhasker J.- “A Verilog HDL Primer”- 2nd Edition- B. S. Publications- 2001.

Mapping of Course Outcomes with Programme Outcomes:  
(1/2/3 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak

| COs | Programme Outcomes(POs) |     |     |     |     |     |     |     |     |      |      |      |      |      |
|-----|-------------------------|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|
|     | PO1                     | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
| CO1 | 3                       | -   | 2   | 2   | -   | -   | -   | -   | -   | -    | -    | 1    | 1    | -    |
| CO2 | 3                       | -   | 2   | 2   | 2   | -   | -   | -   | -   | -    | -    | 1    | 1    | -    |
| CO3 | 3                       | -   | 2   | 2   | 2   | -   | -   | -   | -   | -    | -    | 1    | 1    | -    |
| CO4 | 3                       | -   | 2   | 2   | 2   | -   | -   | -   | -   | -    | -    | 1    | 1    | -    |
| CO5 | 3                       | -   | 2   | 2   | 2   | -   | -   | -   | -   | -    | -    | 1    | 1    | -    |



**COURSE OBJECTIVES**

To enable students to

- understand the basic human values for a professional.
- discuss the significance of ethics in engineering and the theories related to it.
- familiarize oneself with the role of engineer as responsible experimenters.
- expose the students to their roles and responsibilities in assessing safety and reducing risks.
- describe the global issues in ethics and role of engineers as manager and consultants.

**UNIT I HUMAN VALUES****9**

Morals, Values and Ethics - Integrity - Work Ethic - Service Learning - Civic Virtue - Respect for Others – Living Peacefully - caring - Sharing - Honesty - Courage - Valuing Time - Cooperation - Commitment - Empathy – Self Confidence - Character - Spirituality.

**UNIT II ENGINEERING ETHICS****9**

Senses of 'Engineering Ethics' - variety of moral issues - types of inquiry - moral dilemmas- moral autonomy - Kohlberg's theory - Gilligan's theory - consensus and controversy - Models of Professional Roles – theories about right action - Self-interest - customs and religion - uses of ethical theories.

**UNIT III ENGINEERING AS SOCIAL EXPERIMENTATION****9**

Engineering as experimentation - engineers as responsible experimenters - codes of ethics - a balanced outlook on law - the challenger case study.

**UNIT IV SAFETY, RESPONSIBILITIES AND RIGHTS****9**

Safety and risk - assessment of safety and risk - risk benefit analysis and reducing risk - the Three Mile Island and Chernobyl case studies. Collegiality and loyalty - respect for authority - collective bargaining confidentiality - conflicts of interest - occupational crime - professional rights - employee rights Intellectual Property Rights (IPR) - discrimination.

**UNIT V GLOBAL ISSUES****9**

Multinational corporations - Environmental ethics - computer ethics - weapons development - engineers as managers-consulting engineers-engineers as expert witnesses and advisors - moral leadership-sample code of Ethics like ASME, ASCE, IEEE, Institution of Engineers(India), Indian Institute of Materials Management, Institution of electronics and telecommunication engineers(IETE),India, etc.

**TOTAL PERIODS****45****COURSE OUTCOMES**

Upon the completion of the course, students will be able to

- Describe the basic human values for a professional.

- Understand the significance of ethics in engineering and the theories related to it.
- Be familiar with the role of engineer as responsible experimenters.
- Acquire knowledge about their roles and responsibilities in assessing safety and reducing risks.
- Discuss the global issues in ethics and role of engineers as manager and consultants.

### TEXT BOOKS

1. Mike Martin and Roland Schinzinger, "Ethics in Engineering", McGraw Hill, New York (2005).
2. Charles E Harris, Michael S Pritchard and Michael J Rabins, "Engineering Ethics -Concepts and Cases", Thompson Learning, (2000).

### REFERENCES

1. Charles D Fleddermann, "Engineering Ethics", Prentice Hall, New Mexico, (1999).
2. John R Boatright, "Ethics and the Conduct of Business", Pearson Education, (2003).
3. Edmund G Seebauer and Robert L Barry, "Fundamentals of Ethics for Scientists and Engineers", Oxford University Press, (2001).
4. Prof. (Col) P S Bajaj and Dr. Raj Agrawal, "Business Ethics - An Indian Perspective", Biztantra, New Delhi, (2004).
5. David Ermann and Michele S Shauf, "Computers, Ethics and Society", Oxford University Press, (2003).

| Mapping of Course Outcomes with Programme Outcomes:<br>(1/2/3 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak |                         |     |     |     |     |     |     |     |     |      |      |      |      |      |
|-----------------------------------------------------------------------------------------------------------------------------|-------------------------|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|
| COs                                                                                                                         | Programme Outcomes(POs) |     |     |     |     |     |     |     |     |      |      |      |      |      |
|                                                                                                                             | PO1                     | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
| CO1                                                                                                                         | 3                       | -   | -   | -   | -   | -   | 2   | 3   | -   | 2    | -    | 1    | 1    | -    |
| CO2                                                                                                                         | 3                       | -   | -   | -   | -   | -   | 2   | 3   | -   | 2    | -    | 1    | 1    | -    |
| CO3                                                                                                                         | 3                       | -   | -   | -   | -   | -   | 2   | 3   | -   | 2    | -    | 1    | 1    | -    |
| CO4                                                                                                                         | 3                       | -   | -   | -   | -   | -   | 2   | 3   | -   | 2    | -    | 1    | 1    | -    |
| CO5                                                                                                                         | 3                       | -   | -   | -   | -   | -   | 2   | 3   | -   | 2    | -    | 1    | 1    | -    |



**COURSE OBJECTIVES**

To enable the students to

- know about the drivers for 5G
- learn the basics of 5G Internet.
- study about the small cells and mobile clouds for 5G
- acquire the knowledge about cognitive radio for 5G wireless networks
- understand the security issues and basics of self-Organizing Network for 5G communication

**UNIT I DRIVERS FOR 5G****9**

Historical trend of wireless communication - Evolution of LTE technology to beyond 4G - 5G roadmap – 10 pillars of 5G - 5G Architecture

**UNIT II THE 5G INTERNET****9**

Internet of Things - Networking Reconfiguration and Virtualization support - Mobility - Quality of Service control - Emerging approach for resource over- provisioning

**UNIT III SMALL CELLS AND MOBILE CLOUDS FOR 5G****9**

Small Cells - WiFi and femtocells - Capacity limits and achievable gains - Mobile data demand - Small cell Challenges - The Mobile cloud - Mobile cloud enablers - Network coding

**UNIT IV COGNITIVE RADIO FOR 5G WIRELESS NETWORKS****9**

Overview of Cognitive Radio technology in 5G wireless - Spectrum optimization using cognitive Radios Spectrum Optimization literature in 5G - Cognitive Radio and Carrier Aggregation - Energy efficient Cognitive Radio technology.

**UNIT V SECURITY AND SELF ORGANIZING NETWORK FOR 5G COMMUNICATION****9**

System Architecture - security issues and challenges in 5G communication - SON in UMTS and LTE – Need for SON in 5G - Evolution towards small cell dominant HetNets.

**TOTAL PERIODS****45****COURSE OUTCOMES**

Upon the completion of the course- students will be able to

- analyze the drivers for 5G
- describe the basics of 5G Internet.

- elucidate about small cells and mobile clouds for 5G
- synthesize cognitive radio for 5G wireless networks
- identify the security issues and basics of self-Organizing Network for 5G communication

### TEXT BOOKS

1. Jonathan Rodriguez- “Fundamentals of 5G Mobile Network”- John Wiley- First Edition- 2015.
2. Yang Yang- Jing Xu- “ 5G wireless Systems- Simulation and Evaluation Techniques”- Springer- 2015

### REFERENCES

1. SassanAhmadi- "LTE-Advanced: A Practical Systems Approach to Understanding 3GPP LTE Releases 10 and 11 Radio Access Technologies" 1st Edition -Elsevier
2. Vincent W.S. Wong “ Key Technologies for 5G Wireless systems”- ISBN -13:978-1107172418.

| Mapping of Course Outcomes with Programme Outcomes:<br>(1/2/3 indicates strength of correlation) 3-Strong, 2-Medium , 1-Weak |                         |     |     |     |     |     |     |     |     |      |      |      |      |      |
|------------------------------------------------------------------------------------------------------------------------------|-------------------------|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|
| COs                                                                                                                          | Programme Outcomes(POs) |     |     |     |     |     |     |     |     |      |      |      |      |      |
|                                                                                                                              | PO1                     | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
| CO1                                                                                                                          | 3                       | -   | -   | 2   | 2   | -   | -   | -   | -   | -    | -    | 1    | 2    | 1    |
| CO2                                                                                                                          | 3                       | -   | -   | 2   | 2   | -   | -   | -   | -   | -    | -    | 1    | 2    | 1    |
| CO3                                                                                                                          | 3                       | -   | -   | 2   | 2   | -   | -   | -   | -   | -    | -    | 1    | 2    | 1    |
| CO4                                                                                                                          | 3                       | -   | -   | 2   | 2   | -   | -   | -   | -   | -    | -    | 1    | 2    | 1    |
| CO5                                                                                                                          | 3                       | -   | -   | 2   | 2   | -   | -   | -   | -   | -    | -    | 1    | 2    | 1    |



**COURSE OBJECTIVES**

To enable the students to

- know the various networking protocol simulation
- understand the basic techniques for error detection
- learn to simulate various Flow control and Error Control protocols
- study and implement the various routing algorithms

**A.Networks Experiments**

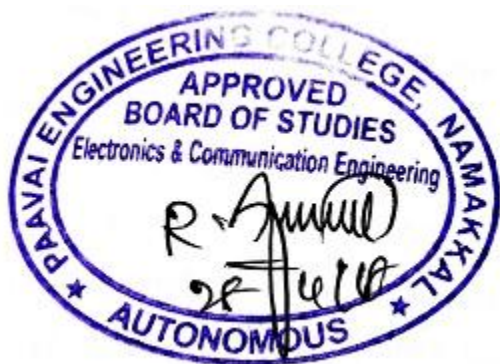
1. To create scenario and study the performance of CSMA/CD protocol NetSim
2. To create scenario and study the performance of token bus and token ring protocol using NetSim
3. To create scenario and study the performance of network with CSMA / CA protocol and compare with CSMA/CD protocols.
4. Implementation of Error Detecting Codes.
5. Implementation of Stop and wait protocol
6. Implementation of Go-back-N protocol
7. Implementation of Selective repeat protocol
8. Implementation of Data encryption and decryption.
9. Simulation and analysis of Distance vector routing protocol
10. Simulation and analysis of Link state routing protocol

**TOTAL PERIODS****60****COURSE OUTCOMES**

Upon the completion of the course, students will be able to

- design and implement various LAN protocols.
- implement error detecting codes.
- simulate the Flow control and Error control protocols.
- implement various routing algorithms.

| Mapping of Course Outcomes with Programme Outcomes:<br>(1/2/3 indicates strength of correlation) 3-Strong, 2-Medium , 1-Weak |                         |     |     |     |     |     |     |     |     |      |      |      |      |      |
|------------------------------------------------------------------------------------------------------------------------------|-------------------------|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|
| COs                                                                                                                          | Programme Outcomes(POs) |     |     |     |     |     |     |     |     |      |      |      |      |      |
|                                                                                                                              | PO1                     | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
| CO1                                                                                                                          | 1                       | 1   | -   | 2   | 3   | -   | -   | -   | -   | -    | 2    | 1    | 2    | -    |
| CO2                                                                                                                          | 1                       | 1   | -   | 2   | 3   | -   | -   | -   | -   | -    | 2    | 1    | 2    | -    |
| CO3                                                                                                                          | 1                       | 1   | -   | 2   | 3   | -   | -   | -   | -   | -    | 2    | 1    | 2    | -    |
| CO4                                                                                                                          | 1                       | 1   | -   | 2   | 3   | -   | -   | -   | -   | -    | 2    | 1    | 2    | -    |
| CO5                                                                                                                          | 1                       | 1   | -   | 2   | 3   | -   | -   | -   | -   | -    | 2    | 1    | 2    | -    |



**COURSE OBJECTIVES**

To enable the students to

- study the basics of combinational and sequential circuits
- know the design of combinational and sequential circuits using FPGA
- learn the implementation of real time clock using FPGA
- study and implement CMOS circuits using Microwind.

**List of Experiments**

1. Design and Simulation of Combinational circuits
2. Design and Simulation of Sequential Circuits
3. Implementation of Combinational circuits using FPGA
4. Implementation of Sequential Circuits using FPGA
5. Design and Implementation of Combinational circuits using Schematic entry
6. To study pin assignment- placement and routing using FPGA
7. Implementation of Real time clock using FPGA
8. Design and Simulation of Inverter using Microwind
9. Design and Simulation of basic logic gates using Microwind
10. To study the characteristics of CMOS sequential circuits using Microwind

**TOTAL PERIODS****60****COURSE OUTCOMES**

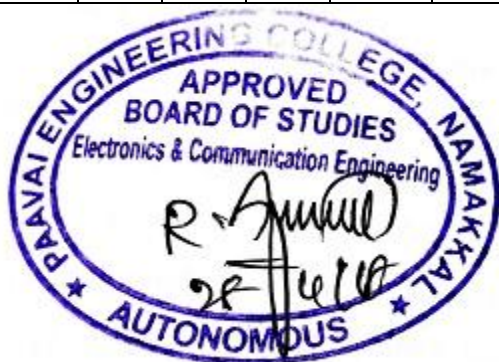
Upon the completion of the course, students will be able to

- design various Combinational and Sequential Circuits
- analyze pin assignment- placement and routing using FPGA
- implement Real time clock using FPGA
- acquire the knowledge about CMOS circuits and basic logic gates using Microwind

Mapping of Course Outcomes with Programme Outcomes:

(1/2/3 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak

| COs | Programme Outcomes(POs) |     |     |     |     |     |     |     |     |      |      |      |      |      |
|-----|-------------------------|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|
|     | PO1                     | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
| CO1 | 1                       | 1   | -   | 2   | 3   | -   | -   | -   | -   | -    | 2    | 1    | 2    | -    |
| CO2 | 1                       | 1   | -   | 2   | 3   | -   | -   | -   | -   | -    | 2    | 1    | 2    | -    |
| CO3 | 1                       | 1   | -   | 2   | 3   | -   | -   | -   | -   | -    | 2    | 1    | 2    | -    |
| CO4 | 1                       | 1   | -   | 2   | 3   | -   | -   | -   | -   | -    | 2    | 1    | 2    | -    |



**COURSE OBJECTIVES**

To enable the students to

- Study the overview of embedded system Architecture
- learn various embedded communication protocols
- be exposed to the basic concepts of real time Operating system.
- learn the architecture and programming of ARM processor.
- know the concept of embedded applications.

**UNIT I ARCHITECTURE OF EMBEDDED SYSTEMS 9**

Embedded Systems-Specifications of Embedded Systems-Recent trends in Embedded Systems-Hardware Architecture-Software Architecture-Communication Software-Process of generation of executable image-development/testing tools.

**UNIT II PROCESS OF EMBEDDED SYSTEM DEVELOPMENT 9**

.Development Process-Requirements Engineering-Design-Implementation-Integration and Testing-Packaging-Configuration Management-Managing Embedded System Development Project.

**UNIT III REAL-TIME OPERATING SYSTEM CONCEPTS 9**

Architecture of the Kernel-task and task Scheduler-Interrupt Service Routines-Semaphores- Mutex Mailboxes-Message Queues-Event Registers-Pipes-Signals Timers-Memory Management- Priority Inversion Problem.

**UNIT IV SOFTWARE DEVELOPMENT TOOLS 9**

Software Development environment-IDE, assembler, compiler, linker, simulator, debugger, in-circuit simulator, Target Hardware Debugging, Need for Hardware-Software Partitioning and Co-Design. Overview of UML, Scope of UML modelling.

**UNIT V APPLICATION OF EMBEDDED SYSTEMS 9**

Data compressor-Alarm Clock-Audio player-Software modem-Digital still camera-Telephone answering machine-Engine control unit-Video accelerator.

**TOTAL PERIODS 45**

**COURSE OUTCOMES**

Upon the completion of the course, the students will be able to

- describe the hardware and software architectures of Embedded Systems.
- introduce the devices and buses used for Embedded Networking
- interpret the concepts of a Real Time Operating System

- elucidate the special features of ARM architecture
- model real-time applications using embedded-system concepts

### TEXT BOOKS

1. K.V.K.K. Prasad “Embedded /Real-Time Systems: Concepts, Design and Programming“ Dreamtech, Wiley 2003.
2. Raj Kamal, “Embedded Systems Architecture Programming and Design”, Second Edition, MH, 2010

### REFERENCES

1. Andrew N. Sloss, Dominic Symes, Chris Wright, “ARM System Developer ‘s Guide and Optimizing system Software”, Morgan Kaufmann Publishers, Elsevier, 2004.
2. Jonathan W.Valvano, “Embedded Microcomputer Systems Real Time Interfacing”, Third EditioCengage learning,2012
3. David. E. Simon, “An Embedded Software Primer”, 1st Edition, Fifth Impression, Addison-Wesley Professional, 2007.

| Mapping of Course Outcomes with Programme Outcomes:<br>(1/2/3 indicates strength of correlation) 3-Strong, 2-Medium , 1-Weak |                         |     |     |     |     |     |     |     |     |      |      |      |      |      |
|------------------------------------------------------------------------------------------------------------------------------|-------------------------|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|
| COs                                                                                                                          | Programme Outcomes(POs) |     |     |     |     |     |     |     |     |      |      |      |      |      |
|                                                                                                                              | PO1                     | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
| CO1                                                                                                                          | 3                       | 1   | 2   | 2   | -   | -   | -   | -   | -   | -    | -    | -    | 2    | 1    |
| CO2                                                                                                                          | 3                       | 1   | 2   | 2   | -   | -   | -   | -   | -   | -    | -    | -    | 2    | 1    |
| CO3                                                                                                                          | 3                       | 1   | 1   | 2   | -   | -   | -   | -   | -   | -    | -    | -    | 1    | 1    |
| CO4                                                                                                                          | 3                       | 1   | 1   | 2   | 3   | -   | -   | -   | -   | -    | -    | -    | 1    | 1    |
| CO5                                                                                                                          | 3                       | 1   | 1   | 2   | 2   | -   | -   | -   | -   | -    | -    | -    | 1    | 1    |



**COURSE OBJECTIVES**

To enable the students to

- impart knowledge on fundamentals of Microwave components.
- understand Microwave sources and amplifiers.
- study about Microwave Semiconductor devices.
- learn with the concepts of Microwave Integrated Circuits
- know the concepts of Microwave Measurements

**UNIT I MICROWAVE COMPONENTS****9**

**Microwave Frequencies - S Parameters:** Properties, - Passive devices: Waveguide corners - bends and twists, Waveguide Tees E, H and Magic Tees, Rat-race Coupler, Directional Couplers, Two Hole Directional Couplers, Circulators and Isolators - **S Matrix of Waveguide Tees and Directional Coupler.**

**UNIT II MICROWAVE LINEAR-BEAM TUBES & CROSSED-FIELD TUBES****9**

Klystrons - Reentrant Cavities-Velocity Modulation Process - Bunching Process, Reflex Klystrons Velocity Modulation, Helix Traveling Wave Tubes – Slow Wave structures Amplification Process - Convection Current- Axial Electric Field - Wave Modes - Gain Consideration, Microwave Crossed Field Tubes -Cylindrical Magnetron

**UNIT III MICROWAVE SEMICONDUCTOR DEVICES****9**

Transferred Electron Devices: Gunn Effect Diodes - Ridley-Watkins-Hilsum Theory, **Modes of Operation. Avalanche Transit-Time Devices: Read Diode - IMPATT Diodes – TRAPATT Diodes - Parametric Amplifiers - Non-linear Reactance and Manley-Rowe Power Relations.**

**UNIT IV MICROWAVE INTEGRATED CIRCUITS****9**

Introduction -micro strip lines-characteristic impedance-losses-quality factor Q, parallel strip lines **Distributed Parameters**-Attenuation, coplanar strip Lines, shielded strip Lines, **monolithic microwave Integrated circuits**-Introduction-Materials-Substrate Materials-Conductor Materials-Dielectric Materials Resistive Materials-Monolithic Microwave Integrated-circuit growth-MMICF fabrication Techniques Fabrication Examples.

**UNIT V MICROWAVE MEASUREMENTS AND APPLICATIONS****9**

**SWR Measurement - Power Measurement – Frequency Measurement - Impedance Measurement - Insertion Loss and Attenuation Measurements -** Dielectric Constant Measurement of a Solid Using Waveguide Method - Industrial Applications of microwaves.

**TOTAL PERIODS 45****COURSE OUTCOMES**

Upon the completion of the course, the students will be able to

- describe the various waveguide components.

- classify the microwave tubes (Linear beam tubes and Crossed field tubes)
- discuss the various microwave semiconductor device Performance.
- design of waveguide components and microwave transmission lines for a given set of parameters.
- identify the measurement techniques for different parameters like VSWR, impedance, frequency, power of microwave sources and loads. .

#### TEXT BOOKS

1. Samuel Y.Liao - “Microwave Devices and Circuits” - Pearson Education Inc. 2011
2. Annapurna Das and Sisir K Das - “Microwave Engineering” - Tata McGraw Hill

#### REFERENCE BOOK

1. Reinhold Ludwig and Gene Bogdanov- “RF Circuit Design: Theory and Applications”-Pearson Education Inc. 2011
2. Robert E Colin – “Foundations for Microwave Engineering”- John Wiley & Sons Inc – 2005.
3. Thomas H Lee – Planar Microwave Engineering: A Practical Guide to Theory- Measurements and Circuits”- Cambridge University Press- 2004.

| Mapping of Course Outcomes with Programme Outcomes:<br>(1/2/3 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak |                         |     |     |     |     |     |     |     |     |      |      |      |      |      |
|-----------------------------------------------------------------------------------------------------------------------------|-------------------------|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|
| COs                                                                                                                         | Programme Outcomes(POs) |     |     |     |     |     |     |     |     |      |      |      |      |      |
|                                                                                                                             | PO1                     | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
| CO1                                                                                                                         | 3                       | -   | 2   | -   | -   | -   | -   | -   | -   | -    | -    | -    | 1    | 1    |
| CO2                                                                                                                         | 3                       | -   | 2   | -   | -   | -   | -   | -   | -   | -    | -    | -    | 1    | 1    |
| CO3                                                                                                                         | 3                       | -   | 2   | -   | -   | -   | -   | -   | -   | -    | -    | -    | 1    | 1    |
| CO4                                                                                                                         | 3                       | -   | 2   | -   | 2   | -   | -   | -   | -   | -    | -    | -    | 1    | 1    |
| CO5                                                                                                                         | 3                       | -   | 2   | -   | 2   | -   | -   | -   | -   | -    | -    | -    | 1    | 1    |



**COURSE OBJECTIVES**

To enable the students to

- gain the knowledge about optical fiber sources and transmission techniques
- learn the principle of light propagation through optical fibers
- understand signal distortion mechanisms in the fiber
- study optical transmitters and receivers for fiber /free space links
- acquire optical network concepts and components involved.

**UNIT I INTRODUCTION TO OPTICAL FIBERS 9**

Evolution of fiber optic System-Element of an Optical Fiber Transmission Link-Total internal reflection- Acceptance Angle-Numerical Aperture-Skew Rays Ray Optics-Optical Fiber Modes and Configurations-Mode theory of Circular Wave Guides-Overview of Modes-Key Modal Concepts-Linearly Polarized Modes-Single Mode fibers-Graded Index fiber structure.

**UNIT II SIGNAL DEGRADATION OPTICAL FIBERS 9**

Attenuation-Absorption Losses-Scattering Losses-Bending Losses-Core and Cladding Losses- Signal Distortion in Optical Wave Guides-Information Capacity Determination-Group Delay- Material Dispersion-Wave Guide Dispersion-Signal distortion in SM fibers-Polarization Mode dispersion-Intermodal dispersion-Pulse Broadening in GI fibers-Mode Coupling, Design Optimization of SM fibers-RI profile and cut-off wavelength.

**UNIT III FIBER OPTICAL SOURCES AND COUPLING 9**

Direct and indirect Band gap materials-LED Structures-Light Source Materials-Quantum efficiency and LED Power-Modulation of a LED-lasers Diodes-Modes and Threshold Condition-Rate Equations- External Quantum Efficiency-Resonant Frequencies-Laser Diodes Temperature Effects-Introduction to Quantum Laser-Fiber Amplifiers-Power Launching and coupling-Lensing Schemes-Fiber-to-Fiber Joints-Fiber splicing-Signal to Noise ratio-Detector response time.

**UNIT IV FIBER OPTIC RECEIVER AND MEASUREMENTS 9**

Fundamental receiver operation-Pre Amplifiers-Error Sources-Receiver Configuration Probability of Error- Quantum limit. Fiber Attenuation Measurements-Dispersion Measurements-Fiber Refractive index profile Measurements-Fiber Cut-off Wave Length Measurements-Fiber Numerical Aperture Measurements-Fiber diameter measurements.

**UNIT V OPTICAL NETWORKS AND SYSTEM TRANSMISSION 9**

Basic Networks: SONET / SDH-Broadcast and select WDM Networks- Wavelength Routed Networks - Non-linear effects on Network Performance-Link Power Budget-Rise time Budget-Noise Effects on System Performance-Operational Principles of WDM Performance of WDM + EDFA System- Solutions-Optical CDMA-Ultra High Capacity Networks.

**TOTAL PERIODS 45**

**COURSE OUTCOMES**

Upon the completion of the course, the students will be able to

- examine the various optical fiber modes, configurations.

- evaluate the various signal degradation factors associated with Optical fiber.
- apply the various optical sources and optical detectors and their use in the optical communication system.
- compare the fiber optic receiver and measurements.
- analyze the digital transmission and its associated parameters on system performance.

#### TEXT BOOKS

1. Gerd Keiser, "Optical Fiber Communication" McGraw -Hill International, 4th Edition, 2010.
2. John M.Senior, "Optical Fiber Communication", Second Edition, Pearson Education, 2007.

#### REFERENCES

1. Ramaswami, Sivarajan and Sasaki "Optical Networks", Morgan Kaufmann, 2009.
2. J. Senior, "Optical Communication, Principles and Practice", Prentice Hall of India, 3<sup>rd</sup> Edition, 2008.
3. J.Gower, "Optical Communication System", Prentice Hall of India, 2001.

| Mapping of Course Outcomes with Programme Outcomes:<br>(1/2/3 indicates strength of correlation) 3-Strong, 2-Medium , 1-Weak |                         |     |     |     |     |     |     |     |     |      |      |      |      |      |
|------------------------------------------------------------------------------------------------------------------------------|-------------------------|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|
| COs                                                                                                                          | Programme Outcomes(POs) |     |     |     |     |     |     |     |     |      |      |      |      |      |
|                                                                                                                              | PO1                     | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
| CO1                                                                                                                          | 3                       | 1   | 2   | 1   | -   | -   | -   | -   | -   | -    | -    | -    | 2    | 1    |
| CO2                                                                                                                          | 3                       | 1   | 2   | 2   | -   | -   | -   | -   | -   | -    | -    | -    | 2    | 1    |
| CO3                                                                                                                          | 3                       | 1   | 1   | 1   | 2   | -   | -   | -   | -   | -    | -    | -    | 2    | 1    |
| CO4                                                                                                                          | 3                       | 1   | 1   | 1   | 2   | -   | -   | -   | -   | -    | -    | -    | 2    | 1    |
| CO5                                                                                                                          | 3                       | 1   | 1   | 2   | 2   | -   | -   | -   | -   | -    | -    | -    | 2    | 1    |



**COURSE OBJECTIVES**

The student should be made to

- gain knowledge about digital image fundamentals
- be exposed to simple image enhancement techniques
- be familiar with image restoration and segmentation techniques
- know about wavelets and image compression techniques
- learn to represent image in form of features

**UNIT I DIGITAL IMAGE FUNDAMENTALS****8**

Introduction-Origin-Steps in Digital Image Processing-Components-Elements of Visual Perception Image Sensing and Acquisition-Image Sampling and Quantization-Relationships between pixels colour models.

**UNIT II IMAGE ENHANCEMENT****10**

Spatial Domain: Gray level transformations-Histogram processing-Basics of Spatial Filtering Smoothing and Sharpening Spatial Filtering-Frequency Domain: Introduction to Fourier Transform Smoothing and Sharpening frequency domain filters-Ideal, Butterworth and Gaussian filters.

**UNIT III IMAGE RESTORATION AND SEGMENTATION****9**

Noise models-Mean Filters-Order Statistics-Adaptive filters-Band reject Filters-Band pass Filters Notch Filters- Optimum Notch Filtering-Inverse Filtering-Wiener filtering. Segmentation: Detection of Discontinuities-Edge Linking and Boundary Detection Region based segmentation Morphological processing-erosion and dilation.

**UNIT IV WAVELETS AND IMAGE COMPRESSION****9**

Wavelets - Sub Band Coding - Multi resolution Expansions - Compression: Fundamentals – Image Compression Models - Error Free Compression - Variable Length Coding – Bit Plane Coding - Lossless Predictive Coding - Lossy Compression - Lossy Predictive Coding - Compression Standards.

**UNIT V IMAGE REPRESENTATION AND RECOGNITION****9**

Boundary representation - Chain Code - Polygonal approximation, signature, boundary segments Boundary description - Shape number - Fourier Descriptor, moments - Regional Descriptor Topological feature, Texture- Patterns and Pattern classes - Recognition based on matching.

**TOTAL PERIODS 45****COURSE OUTCOMES**

Upon the completion of the course, the students will be able to

- elucidate the digital image fundamentals.
- apply the concepts of image enhancement techniques

- use image restoration and segmentation techniques
- analyse wavelets and image compression techniques
- .represent features of images

#### TEXT BOOKS

1. Rafael C. Gonzales, Richard E. Woods, “Digital Image Processing”, Third Edition, Pearson Education, 2010.
2. Anil Jain K. “Fundamentals of Digital Image Processing”, PHI Learning Pvt. Ltd., 2011.

#### REFERENCES

1. Rafael C. Gonzalez, Richard E. Woods, Steven L. Eddins, “Digital Image Processing Using MATLAB”, Third Edition Tata McGraw Hill Pvt. Ltd., 2011.
2. William K Pratt, “Digital Image Processing”, John Willey, 2002.
3. Malay K. Pakhira, “Digital Image Processing and Pattern Recognition”, First Edition, PHI Learning Pvt. Ltd., 2011.

| Mapping of Course Outcomes with Programme Outcomes:<br>(1/2/3 indicates strength of correlation) 3-Strong, 2-Medium , 1-Weak |                         |     |     |     |     |     |     |     |     |      |      |      |      |      |
|------------------------------------------------------------------------------------------------------------------------------|-------------------------|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|
| COs                                                                                                                          | Programme Outcomes(POs) |     |     |     |     |     |     |     |     |      |      |      |      |      |
|                                                                                                                              | PO1                     | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
| CO1                                                                                                                          | 3                       | 3   | 3   | -   | 3   | -   | -   | -   | -   | -    | -    |      | 3    | 3    |
| CO2                                                                                                                          | 3                       | 3   | 3   | -   | 3   | -   | -   | -   | -   | -    | -    |      | 3    | 3    |
| CO3                                                                                                                          | 3                       | 3   | 3   | -   | 3   | -   | -   | -   | -   | -    | -    |      | 3    | 3    |
| CO4                                                                                                                          | 3                       | 3   | 3   | -   | 3   | -   | -   | -   | -   | -    | -    |      | 3    | 3    |
| CO5                                                                                                                          | 3                       | 3   | 3   | -   | 3   | -   | -   | -   | -   | -    | -    |      | 3    | 3    |



**COURSE OBJECTIVES**

To enable the students to

- introduce speech production and related parameters of speech
- understand the time domain methods for speech processing
- develop frequency domain techniques for estimating speech parameters
- introduce the predictive technique for speech compression.
- understand speech recognition, synthesis and speaker identification

**UNIT I NATURE OF SPEECH SIGNAL 9**

Speech production Mechanism-Classification of Speech-Sounds-Nature of speech Signal- Models for speech production. Speech signal processing: purpose of speech Processing- Digital models for speech Signal-Digital processing of speech Signals-Significance-Short time analysis.

**UNIT II TIME DOMAIN METHODS FOR SPEECH PROCESSING 9**

Time domain parameters for speech-methods for extracting the Parameters-Zero Crossings- Auto correlation function-Pitch estimation.

**UNIT III FREQUENCY DOMAIN METHODS FOR SPEECH PROCESSING 9**

Short time Fourier analysis-filter bank analysis-spectrographic Analysis-Format extraction-pitch Extraction-Analysis- Synthesis systems.

**UNIT IV LINEAR PREDICTIVE CODING OF SPEECH 9**

Formulation of linear prediction problem in time domain-solution of LPC Equations-Interpretation of Linear Prediction in auto correlation and spectral domain

**UNIT V SPEECH SYNTHESIS AND ANALYSIS 9**

Central analysis of speech-format and pitch Estimation-Applications of speech Processing-Speech Recognition- Speech synthesis and speaker verification.

**TOTAL PERIODS 45**

**COURSE OUTCOMES**

Upon the completion of the course, the students will be able to

- apply the basics of speech production and related speech parameters.
- understand the time domain methods of speech processing
- explain the frequency domain techniques for speech parameters estimation
- learn the predictive techniques for speech compression
- use different speech synthesis techniques

## TEXT BOOKS

1. L.R.Rabiner and R.E.Schafer, “Digital processing of speech signals, Dorling Kindersley (India) Private Limited, 2011
2. J.L.Flanagan, “Speech Analysis Synthesis and Perception”, 2nd Edition- Springer Verlag, 1972.

## REFERENCES

1. L.Rabiner and Biling Hwang Juang, “Fundamentals of Speech recognition”, Pearson Education ,2003.
2. I.H.Witten, “Principles of Computer Speech”, Academic press, 1983
3. Thomas F.Quateri, “Discrete-Time Speech Processing – Principles and Practice” , Pearson Education, 2004.

Mapping of Course Outcomes with Programme Outcomes:  
(1/2/3 indicates strength of correlation) 3-Strong, 2-Medium , 1-Weak

| COs | Programme Outcomes(POs) |     |     |     |     |     |     |     |     |      |      |      |      |      |
|-----|-------------------------|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|
|     | PO1                     | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
| CO1 | 3                       | 1   | 2   | 1   | -   | -   | -   | -   | -   | -    | -    | -    | 1    | 1    |
| CO2 | 3                       | 1   | 2   | 2   | -   | -   | -   | -   | -   | -    | -    | -    | 1    | 1    |
| CO3 | 3                       | 1   | 1   | 1   | 2   | -   | -   | -   | -   | -    | -    | -    | 1    | 1    |
| CO4 | 3                       | 1   | 1   | 1   | 2   | -   | -   | -   | -   | -    | -    | -    | 1    | 1    |
| CO5 | 3                       | 1   | 1   | 2   | 2   | -   | -   | -   | -   | -    | -    | -    | 1    | 1    |



**COURSE OBJECTIVES**

To enable the students to

- know the basics of EMI and EMC Environment
- study about EMI and EMC Coupling Principles
- acquire EMI used in instrumentation system
- understand the control techniques involved in Electromagnetic Interference
- learn the electromagnetic interference specification standards and Limit

**UNIT I EMI ENVIRONMENT 9**

Concepts of EMI and EMC and Definitions-Sources of EMI-Celestial Electromagnetic Noise Lightning discharge- Switches Electrostatic Discharge-Electromagnetic Pulse-Electromagnetic Emission-Noise from relays and- Nonlinearities in Circuits

**UNIT II EMI COUPLING PRINCIPLES 9**

Capacitive Coupling-Inductive coupling- Common impedance ground Coupling-Ground Loop Coupling-Transients in power supply Lines-Radiation coupling, Conduction Coupling-Common- mode and Differential mode.

**UNIT III EMI MEASUREMENTS 9**

Open area test site Measurements-Measurement Precautions-Open area test Site-Anechoic Chamber-TEM Reverberating TEM-GTEM Cell-Comparisons

**UNIT IV EMI CONTROL TECHNIQUES 9**

EMC Technology-Grounding-Shielding-Electrical Bonding-Power line filter-CM filter-DM filter-EMI suppression Cables- EMC Connectors -Isolation transformer.

**UNIT V EMI AND EMC STANDARDS 9**

Introduction- Standards for EMI/EMC- MIL-STD-461/462-IEEE/ANSI standard-CISPR/IEC standard FCC Regulations-British standards-VDE Standards-Euro Norms-Performance standards-some comparisons

**TOTAL PERIODS 45**

**COURSE OUTCOMES**

Upon the completion of the course, the students will be able to

- apply the concepts of EMI and EMC
- synthesize solutions to EMI Sources
- evaluate the measurements in EMI
- examine, test and implement EMI system

- .compare the different EMI and EMC standards

### TEXT BOOKS

1. Prasad Kodali – “Engineering Electromagnetic Compatibility – Principles, Measurements, and Technologies”, IEEE press.
2. Clayton R.Paul, “Introduction to Electromagnetic Compatibility”, John Wiley Publications, 2008.

### REFERENCES

1. Don R.J.White Consultant Incorporate, “Handbook of EMI/EMC”, Vol I-V.
2. Bernhard Keiser, “Principles of Electromagnetic Compatibility”, 3rd Ed, Artech house, Norwood, 1987
3. Edward C.Jordan and Keith G.Balmain” Electromagnetic Waves and Radiating Systems” Prentice Hall of India, 2006.

| Mapping of Course Outcomes with Programme Outcomes:<br>(1/2/3 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak |                         |     |     |     |     |     |     |     |     |      |      |      |      |      |
|-----------------------------------------------------------------------------------------------------------------------------|-------------------------|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|
| COs                                                                                                                         | Programme Outcomes(POs) |     |     |     |     |     |     |     |     |      |      |      |      |      |
|                                                                                                                             | PO1                     | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
| CO1                                                                                                                         | 3                       | -   | -   | 2   | -   | 1   | -   | -   | -   | -    | -    | -    | 1    | 1    |
| CO2                                                                                                                         | 3                       | -   | -   | 2   | -   | 1   | -   | -   | -   | -    | -    | -    | 1    | 1    |
| CO3                                                                                                                         | 3                       | -   | -   | 2   | 2   | 1   | -   | -   | -   | -    | -    | -    | 1    | 1    |
| CO4                                                                                                                         | 3                       | -   | -   | 2   | 2   | 1   | -   | -   | -   | -    | -    | -    | 1    | 1    |
| CO5                                                                                                                         | 3                       | -   | -   | 2   | 2   | 1   | -   | -   | -   | -    | -    | -    | 1    | 1    |



**COURSE OBJECTIVES**

To enable the students to

- understand the simulation techniques.
- learn the concept of random variables and random process simulation.
- learn the concept of radio communication channel modeling.
- understand the process of estimating the performance measure.
- analyze the simulation environment and considerations.

**UNIT I SIMULATION METHODOLOGY****9**

Introduction-Aspects of Methodology-Performance Estimation-Sampling Frequency-Low pass equivalent models for band pass signals-multicarrier signals-Non-linear and time varying systems-Post processing-Basic Graphical techniques and estimations

**UNIT II SIMULATION OF RANDOM VARIABLES RANDOM PROCESS****9**

Generation of random numbers and **sequence-Gaussian and uniform random numbers** Correlated Random Sequences-**Testing of random numbers Generators**-Stationary and uncorrelated Noise- Goodness of fit test.

**UNIT III MODELING OF COMMUNICATION SYSTEMS****9**

**Radio frequency and optical Sources**-Analog and Digital Signals-**Communication channel and Models** **Free Space Channels**-**Multipath channel and discrete channel noise and interference.**

**UNIT IV ESTIMATION OF PERFORMANCE MEASURE FOR SIMULATION****9**

Quality of estimator, **Estimation of SNR-Probability density function and bit error rate**-Monte Carlo method-Importance sampling method-Extreme value theory.

**UNIT V SIMULATION AND MODELING METHODOLOGY****9**

Simulation environment-Modeling considerations-**Performance evaluation techniques**-error source simulation-Validation.

**TOTAL PERIODS****45****COURSE OUTCOMES**

Upon the completion of the course, the students will be able to

- synthesize programs in simulation techniques.
- analyse and design communication channels
- apply the concept of modeling of communication systems
- examine the simulation methodologies and performance
- analyze error source simulation

## TEXT BOOKS

1. MC.Jeruchim, P.Balaban and Sam K Shanmugam, Simulation of communication Systems: Modeling, Methodology and Techniques, Plenum Press, New York, 2001.
2. Geoffrey Gorden, System Simulation, 2nd Edition, Prentice Hall of India, 1992.

## REFERENCES

1. Averill.M.Law and W.DavidKelton,Simulation Modeling and Analysis, McGraw-Hill Inc., 2000.
2. W.Turin, Performance Analysis of Digital Communication Systems, Computer Science Press, New York, 1990.
3. Jerry banks and John S.Carson, Discrete Event System Simulation, Prentice Hall ofIndia, 1984.
4. William H. Tranter, K. Sam shanmugam, Theodore s. Rappaport, K.KurtL.Kosbar, Principles of Communication Systems Simulation, Pearson Education (Singapore)Pvt Ltd, 2004.

| Mapping of Course Outcomes with Programme Outcomes:<br>(1/2/3 indicates strength of correlation) 3-Strong, 2-Medium , 1-Weak |                         |     |     |     |     |     |     |     |     |      |      |      |      |      |
|------------------------------------------------------------------------------------------------------------------------------|-------------------------|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|
| COs                                                                                                                          | Programme Outcomes(POs) |     |     |     |     |     |     |     |     |      |      |      |      |      |
|                                                                                                                              | PO1                     | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
| CO1                                                                                                                          | 3                       | -   | -   | 2   | 2   | 1   | -   | -   | -   | -    | -    | -    | 1    | 1    |
| CO2                                                                                                                          | 3                       | -   | -   | 2   | 2   | 1   | -   | -   | -   | -    | -    | -    | 1    | 1    |
| CO3                                                                                                                          | 3                       | -   | -   | 2   | 2   | 1   | -   | -   | -   | -    | -    | -    | 1    | 1    |
| CO4                                                                                                                          | 3                       | -   | -   | 2   | 2   | 1   | -   | -   | -   | -    | -    | -    | 1    | 1    |
| CO5                                                                                                                          | 3                       | -   | -   | 2   | 2   | 1   | -   | -   | -   | -    | -    | -    | 1    | 1    |



**COURSE OBJECTIVES**

To enable the students to

- gain the knowledge about the fundamental analysis of TV Pictures, Composite Video Signal, Receiver, Picture Tubes and Television Camera Tubes.
- know the principles and operation of Studio Equipment.
- learn the principles of Transmission and Propagation Systems.
- understand the various Digital Television Standard.
- acquire the concept of Modern Technology of Television.

**UNIT I FUNDAMENTALS OF TELEVISION 9**

Television System and Scanning Principles: Sound and Picture Transmission Video Signals Characteristics of Human Eye-Aspect Ratio and Rectangular Scanning-Persistence of Vision and Flicker-Vertical Resolution- Kell Factor-Horizontal Resolution and Video Bandwidth- Interlaced Scanning. Camera Tubes: Vidicon-Plumbicon- Silicon Diode Array Vidicon-CCD-Solid State Image Scanners

**UNIT II TELEVISION STANDARDS AND STUDIO EQUIPMENTS 9**

Composite Video Signal-Horizontal and Vertical Synchronous-Blanking Standards-Reception of VSB Signals- TV Broadcast Channels-CCIR-B Standards. Various TV Broadcast Systems: NTSC, PAL and SECAM System.

**UNIT III TELEVISION TRANSMISSION SYSTEM, PROPAGATION AND ANTENNA 9**

Requirements of TV Broadcast Transmission-Block diagram of TV Transmitters-Transmitting Antennas- Propagation Phenomena-Space Wave Propagation-Line of Sight Range-Shadow Zones Co Channel Interference- Ghost Images Interference Problems-Parasitic Elements-Receiving Antennas.

**UNIT IV DIGITAL TELEVISION 9**

Digital TV: Introduction-Digital System Hardware-Signal Quantization and Encoding, Digital Satellite Television-Direct to Home Satellite Television-Digital TV Receivers-Merits of Digital TV Receivers Geo Stationary Satellite-Satellite Communication Systems-Colour picture Tube-PIL-Delta Gun Trinitron-Operation.

**UNIT V MODERN TV TECHNOLOGIES 9**

Stereo Sound Systems-Projection Television-Flat panel Display TV receivers-3-D Television Picture EDTV-HDTV-CATV-Cable signal Processing, Cable signal Distribution-Displays devices-LCD LEDOLED-Operation.

**TOTAL PERIODS 45**

**COURSE OUTCOMES**

Upon the completion of the course, the students will be able to

- examine the fundamental analysis of TV Pictures, Composite Video Signal, Receiver, Picture Tubes and Television Camera Tubes

- analyze the principles and operation of Studio Equipment.
- evaluate the principles of transmission and propagation systems.
- compare various Digital Television Standards.
- synthesize the modern technologies of Television.

### TEXT BOOKS

1. R-R-Gulati-"Modern Television Practice -Technology and Servicing – Third Edition – New age International publishes -2012.
2. R-R-Gulati-"Monochrome and Colour Television – Second Edition – New age International publishes -2009.

### REFERENCES

1. A-M-Dhake-" Television and video Engineering" Second Edition TMH 2003. R.G.Gupta, "Television Engineering and Video systems," First Edition, TMH India 2007. 3. S-P-
2. Bali-" Colour Television -Theory and practice "- TMH 1994
3. Bernard Grob," Basic Television Principles and Servicing"- Second Edition, New age International Publisher 2004.

| Mapping of Course Outcomes with Programme Outcomes:<br>(1/2/3 indicates strength of correlation) 3-Strong, 2-Medium , 1-Weak |                         |     |     |     |     |     |     |     |     |      |      |      |      |      |
|------------------------------------------------------------------------------------------------------------------------------|-------------------------|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|
| COs                                                                                                                          | Programme Outcomes(POs) |     |     |     |     |     |     |     |     |      |      |      |      |      |
|                                                                                                                              | PO1                     | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
| CO1                                                                                                                          | 3                       | 1   | -   | 2   | 2   |     | -   | -   | -   | -    | -    | -    | 1    | 1    |
| CO2                                                                                                                          | 3                       | 1   | -   | 2   | 2   |     | -   | -   | -   | -    | -    | -    | 1    | 1    |
| CO3                                                                                                                          | 3                       | 1   | -   | 2   | 2   |     | -   | -   | -   | -    | -    | -    | 1    | 1    |
| CO4                                                                                                                          | 3                       | 1   | -   | 2   | 2   |     | -   | -   | -   | -    | -    | -    | 1    | 1    |
| CO5                                                                                                                          | 3                       | 1   | -   | 2   | 2   |     | -   | -   | -   | -    | -    | -    | 1    | 1    |



**COURSE OBJECTIVES**

To enable the students to

- acquire the knowledge on coding schemes for space-time Wireless Communications.
- understand the concepts of transmission and decoding techniques in Wireless Communications.
- learn the diversity performance in extended channels
- gain knowledge in coding of multiple antenna and receivers
- study the Spread Spectrum and MIMO Multiuser Detection

**UNIT I MULTIPLE ANTENNA PROPAGATION AND ST CHANNEL CHARACTERIZATION**

9

Wireless channel-Scattering model in macro cells-Channel as a ST random field-Scattering functions Polarization and field diverse channels-Antenna array topology-Degenerate channels reciprocity and its implications-Channel definitions-Physical scattering model- Extended channel models-Channel measurements-sampled signal model-ST Multiuser and ST interference channels ST channel estimation.

**UNIT II CAPACITY OF MULTIPLE ANTENNA CHANNELS**

9

Capacity of frequency flat deterministic MIMO channel: Channel unknown to the transmitter Channel known to the transmitter-capacity of random MIMO channels-Influence of Rician fading fading correlation-XPD and degeneracy on MIMO capacity-Capacity of frequency selective MIMO channels.

**UNIT III SPATIAL DIVERSITY**

9

Diversity gain-Receive antenna diversity-Transmit antenna diversity-Diversity order and channel variability-Diversity performance in extended channels-Combined space and path diversity-Indirect transmit diversity-Diversity of a space-time-frequency selective fading channel.

**UNIT IV MULTIPLE ANTENNA CODING AND RECEIVERS**

9

Coding and interleaving architecture-ST coding for frequency flat channels-ST coding for frequency selective channels-Receivers: SISO, SIMO, MIMO-Iterative MIMO receivers Exploiting channel knowledge at the transmitter: linear pre-filtering-optimal pre-filtering for maximum rate-optimal prefiltering for error rate minimization-selection at the transmitter Exploiting imperfect channel knowledge.

**UNIT V ST OFDM, SPREAD SPECTRUM AND MIMO MULTIUSER DETECTION**

9

SISO-OFDM modulation-MIMO-OFDM modulation-Signalling and receivers for MIMO-OFDM, SISO SS modulation-MIMO-SS modulation-Signalling and receivers for MIMO-SS. MIMO MAC MIMO-BCO utage performance for MIMO-MU and MIMO-MU with OFDM, CDMA and multiple antennas.

TOTAL PERIODS

45

## COURSE OUTCOMES

Upon the completion of the course, the students will be able to

- examine the coding schemes for space-time Wireless Communications.
- evaluate the capacity of multiple antenna channels
- explain the antenna diversity schemes
- compare the coding of multiple antenna and receivers
- analyze the concepts of Spread Spectrum and MIMO Multiuser Detection

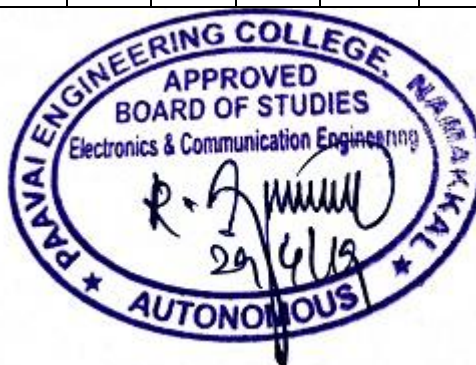
## TEXT BOOKS

1. Andrea Goldsmith, “Wireless Communications”, Cambridge University Press, 2005
2. Paulraj, RohitNabar, Dhananjay Gore., “Introduction to Space Time Wireless Communication Systems”, Cambridge University Press, 2003

## REFERENCES

1. Andre Viterbi “ Principles of Spread Spectrum Techniques” Addison Wesley 1995
2. Jafarkhani, Hamid. Space-time coding: Theory and Practice. Cambridge University press, 2005.
3. Sergio Verdu “ Multi User Detection” Cambridge University Press, 1998

| Mapping of Course Outcomes with Programme Outcomes:<br>(1/2/3 indicates strength of correlation) 3-Strong, 2-Medium , 1-Weak |                         |     |     |     |     |     |     |     |     |      |      |      |      |      |
|------------------------------------------------------------------------------------------------------------------------------|-------------------------|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|
| COs                                                                                                                          | Programme Outcomes(POs) |     |     |     |     |     |     |     |     |      |      |      |      |      |
|                                                                                                                              | PO1                     | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
| CO1                                                                                                                          | 3                       | 1   | -   | 2   | 1   | -   | -   | -   | -   | -    | -    | -    | 1    | -    |
| CO2                                                                                                                          | 3                       | 1   | -   | 2   | 1   | -   | -   | -   | -   | -    | -    | -    | 1    | -    |
| CO3                                                                                                                          | 3                       | 1   | -   | 2   | 1   | -   | -   | -   | -   | -    | -    | -    | 1    | -    |
| CO4                                                                                                                          | 3                       | 1   | -   | 2   | 1   | -   | -   | -   | -   | -    | -    | -    | 1    | -    |
| CO5                                                                                                                          | 3                       | 1   | -   | 2   | 1   | -   | -   | -   | -   | -    | -    | -    | 1    | -    |



**COURSE OBJECTIVES**

To enable the students to

- learn the concepts and architecture of the world wide web
- understand and practice mark-up languages
- understand the web design
- study the basic concepts of java programming
- gain knowledge of web services

|               |                            |          |
|---------------|----------------------------|----------|
| <b>UNIT I</b> | <b>INTRODUCTION TO WWW</b> | <b>9</b> |
|---------------|----------------------------|----------|

Internet Standards-Introduction to WWW-WWW Architecture-SMTP-POP3-File Transfer Protocol  
Overview of HTTP, HTTP request-response-Generation of dynamic web pages.

|                |                    |          |
|----------------|--------------------|----------|
| <b>UNIT II</b> | <b>HTML BASICS</b> | <b>9</b> |
|----------------|--------------------|----------|

Development Process-Requirements Engineering-Design-Implementation-Integration and Testing Packaging-  
Configuration Management-Managing Embedded System Development Project.

|                 |                              |          |
|-----------------|------------------------------|----------|
| <b>UNIT III</b> | <b>CASCADING STYLE SHEET</b> | <b>9</b> |
|-----------------|------------------------------|----------|

Cascading Style Sheet (CSS3): The need for CSS-Basic syntax and structure Inline Styles Embedding  
Style Sheets Linking External Style Sheets-Introduction to CSS3-Backgrounds Manipulating text-  
Margins and Padding Positioning using CSS-Responsive Web Design.

|                |                    |          |
|----------------|--------------------|----------|
| <b>UNIT IV</b> | <b>JAVA BASICS</b> | <b>9</b> |
|----------------|--------------------|----------|

Introduction to Java-Test-driving a java application-Input / Output and operators-Classes, Objects, Methods  
and strings-control statements-Methods: A deeper look-Arrays and Array Lists-classed and objects: A deeper  
look Inheritance-polymorphism and Interfaces-Exception handling.

|               |                             |          |
|---------------|-----------------------------|----------|
| <b>UNIT V</b> | <b>XML AND WEB SERVICES</b> | <b>9</b> |
|---------------|-----------------------------|----------|

XML-Introduction-Form Navigation-XML Documents-DTD-Namespace-XSL-XSLT-Web services UDDI-  
WSDLJava web Services-Web resources.

|                      |           |
|----------------------|-----------|
| <b>TOTAL PERIODS</b> | <b>45</b> |
|----------------------|-----------|

**COURSE OUTCOMES**

Upon the completion of the course, the students will be able to

- understand the technologies used in web programming
- create a basic website using HTML
- design and implement simple web page using Cascading Style Sheets.
- analyze the salient features of Java over C++ and write programs using fundamental Concepts
- .build web-based application and to present data in XML format.

## TEXT BOOKS

1. Harvey & Paul Deitel& Associates, Harvey Deitel and Abbey Deitel, “Internet and World Wide Web-How to Program”, Fifth Edition, Pearson Education,2011
2. Herbert schildt java The complete Reference 7th Edition. Tata McGraw Hill Edition
3. Thomas A. Powell, “HTML & CSS: The Complete Reference”, Fifth Edition, 2010

## REFERENCES

1. Thomas A Powell, Fritz Schneider, “JavaScript: The Complete Reference”, Third Edition, Tata McGraw Hill, 2013
2. Michael Morrison XML Unleashed Tech media SAMS.

| Mapping of Course Outcomes with Programme Outcomes:<br>(1/2/3 indicates strength of correlation) 3-Strong, 2-Medium , 1-Weak |                         |     |     |     |     |     |     |     |     |      |      |      |      |      |
|------------------------------------------------------------------------------------------------------------------------------|-------------------------|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|
| COs                                                                                                                          | Programme Outcomes(POs) |     |     |     |     |     |     |     |     |      |      |      |      |      |
|                                                                                                                              | PO1                     | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
| CO1                                                                                                                          | 3                       | 1   | -   | 2   | 1   | -   | -   | -   | -   | -    | -    | -    | 1    | 1    |
| CO2                                                                                                                          | 3                       | 1   | -   | 2   | 1   | -   | -   | -   | -   | -    | -    | -    | 1    | 1    |
| CO3                                                                                                                          | 3                       | 1   | -   | 2   | 1   | -   | -   | -   | -   | -    | -    | -    | 1    | 1    |
| CO4                                                                                                                          | 3                       | 1   | -   | 2   | 1   | -   | -   | -   | -   | -    | -    | -    | 1    | 1    |
| CO5                                                                                                                          | 3                       | 1   | -   | 2   | 1   | -   | -   | -   | -   | -    | -    | -    | 1    | 1    |



**COURSE OBJECTIVES**

To enable the students to

- study the characteristics of biomedical signals
- know the principles of noise filtering and Interference cancellation
- learn the event detection and extraction techniques
- know the modeling of biomedical systems
- understand the pattern classification and diagnostic decision

**UNIT I BIOMEDICAL SIGNALS**

9

Introduction to Biomedical Signals-ECG, EEG, EMG, ENG etc. Event related Potentials- Biomedical Signal Analysis- Computer Aided Diagnosis. Concurrent, coupled and correlated processes-illustration with Case studies.

**UNIT II NOISE FILTERING**

9

Random noise structured noise and physiological interference-noise and artifacts in ECG. Time domain filters- Frequency domain filters-Principles of adaptive filters-Wiener Filtering- Steepest Descent algorithms Widrow Hopf, Least mean square adaptive algorithms-Adaptive noise canceller-Interference cancellation in Electrocardiography- noise cancellation in electro surgery.

**UNIT III EVENT DETECTION AND EXTRACTION**

9

Detection of PQRS and T waves in ECG-EEG Rhythms-Detection of EEG spike and wave complex esdensity- Homomorphic filtering. Analysis of event related Potential-Morphological analysis of ECG Waves-Envelope extraction and Analysis-Analysis of activity: zero crossing rates. Fourier Spectrum, Estimation of power spectral moments and spectral power ratio.

**UNIT IV MODELING OF BIOMEDICAL SYSTEMS**

9

Point Processes-Parametric System Modelling-All-pole, pole zero modelling, electromechanical models of signal generation. Analysis of non-stationary signals: Characterization-Fixed segmentation-Short Time Fourier Transform-Adaptive segmentation- Adaptive filters for segmentation-RLS and Lattice Filter.

**UNIT V PATTERN CLASSIFICATION AND DIAGNOSTIC DECISION**

9

Supervised and unsupervised pattern Classification-Probabilistic models and statistical Decisions Logistic of regression analysis-training and test steps neural Networks-Measures of diagnostic accuracy and Cost Reliability classifiers and decisions. Application: Normal versus Ectopic ECG beats-Detection of Knee Joint cartilage Pathology.

**TOTAL PERIODS****45****COURSE OUTCOMES**

Upon the completion of the course, the students will be able to

- examine the basics of biomedical signals
- compare the noise filtering techniques
- analyze event detection and extraction of bio signals
- apply the different models of biomedical systems.
- evaluate the pattern classification and decision making techniques.

## TEXT BOOKS

1. Rangaraj M. Rangayyan, “Biomedical Signal Analysis - A case study approach”, Wiley- Interscience /IEEE Press, 2002
2. D.C.Reddy, “Biomedical Signal Processing: Principles and techniques”, Tata McGraw Hill, New Delhi, 2005.

## REFERENCES

1. MetinAkay, “Biomedical Signal Processing”, Academic press, Inc
2. Bruce, “Biomedical Signal Processing & Signal Modeling,” Wiley, 2001
3. KhandpurR.S, “Hand Book of Biomedical Instrumentation”, Tata McGraw Hill publication, New Delhi 2<sup>nd</sup> edition 2003.

| Mapping of Course Outcomes with Programme Outcomes:<br>(1/2/3 indicates strength of correlation) 3-Strong, 2-Medium , 1-Weak |                         |     |     |     |     |     |     |     |     |      |      |      |      |      |
|------------------------------------------------------------------------------------------------------------------------------|-------------------------|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|
| COs                                                                                                                          | Programme Outcomes(POs) |     |     |     |     |     |     |     |     |      |      |      |      |      |
|                                                                                                                              | PO1                     | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
| CO1                                                                                                                          | 3                       | 1   | -   | 2   | 2   | -   | -   | -   | -   | -    | -    | -    | 1    | 1    |
| CO2                                                                                                                          | 3                       | 1   | -   | 2   | 2   | -   | -   | -   | -   | -    | -    | -    | 1    | 1    |
| CO3                                                                                                                          | 3                       | 1   | -   | 2   | 2   | -   | -   | -   | -   | -    | -    | -    | 1    | 1    |
| CO4                                                                                                                          | 3                       | 1   | -   | 2   | 2   | -   | -   | -   | -   | -    | -    | -    | 1    | 1    |
| CO5                                                                                                                          | 3                       | 1   | -   | 2   | 2   | -   | -   | -   | -   | -    | -    | -    | 1    | 1    |



**COURSE OBJECTIVES**

To enable the students to

- gain knowledge about RADAR theory and equations.
- learn the moving target indicator and pulse Doppler RADAR
- study the concept of RADAR signal detection and propagation
- understand about radio navigation techniques
- know the various types of RADAR transmitter and receivers

**UNIT I BASICS OF RADAR 9**

RADAR block diagram-Operation & Applications-RADAR frequencies-RADAR range equation-Detection of signals in noise-RADAR cross section of targets-RADAR cross section fluctuations-Transmitter power-Pulse repetition frequency-System losses and Propagation effects

**UNIT II MOVING TARGET INDICATOR (MTI) AND PULSE DOPPLER RADAR 9**

Audio compression-DPCM-Adaptive PCM-adaptive predictive coding-linear Predictive coding code excited LPC-perceptual coding Video compression-principles-H.261-H.263-MPEG 1, 2,4.

**UNIT III RADAR SIGNAL DETECTION & PROPAGATION 9**

Compression principles-source encoders and destination encoders-lossless and lossy compression entropy encoding-source encoding-text compression-static Huffman coding dynamic coding-arithmetic coding-Lempel ziv-welsh Compression-image compression

**UNIT IV RADIO NAVIGATION 9**

Adcock directional finder-Automatic directional finder-Radio Compass-Decca Navigation System Tactical Air Navigation-Instrument Landing System-Ground Controlled approach-Microwave Landing system.

**UNIT V RADAR TRANSMITTER AND RECEIVER 9**

RADAR Transmitter-Linear beam power tubes-Solid state RF power sources-solid state devices used in RADAR- Magnetron-crossed field amplifiers-other aspects of radar transmitter-RADAR receiver - Receiver noise figure- Super heterodyne receiver-Dynamic range-RADAR Displays.

**TOTAL PERIODS 45**

**COURSE OUTCOMES**

Upon the completion of the course, the students will be able to

- analyze the basic principles of RADAR
- apply the concept of moving target indicator and pulse Doppler RADAR
- elaborate the concept of RADAR signal detection and propagation
- identify the issues related to radio navigation
- examine the various RADAR transmitters and receivers

## TEXT BOOKS

1. Skolnik.M.I, “Introduction to RADAR systems”, Mc-Graw Hill, 3rd Edition, 2001
2. Nagaraja.N.S. “Elements of Electronic Navigation”, Tata Mc-Graw Hill, 2nd Edition, 2009

## REFERENCES

1. Mark, Richards.A, “Fundamentals of radar signal processing”, Mc-Graw Hill, Electronic Engineering, 1<sup>st</sup> Edition, 2005
2. Brookner, “RADAR Technology”, Artech House, 1<sup>st</sup> edition, 1986.
3. Bagad.V.S, “Radar Systems”, Technical publications, 1<sup>st</sup> edition,2008
4. NadavLevanon, “RADAR Principles”, John Wiley and Sons, 3<sup>rd</sup> Edition,1989

| Mapping of Course Outcomes with Programme Outcomes:<br>(1/2/3 indicates strength of correlation) 3-Strong, 2-Medium , 1-Weak |                         |     |     |     |     |     |     |     |     |      |      |      |      |      |
|------------------------------------------------------------------------------------------------------------------------------|-------------------------|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|
| COs                                                                                                                          | Programme Outcomes(POs) |     |     |     |     |     |     |     |     |      |      |      |      |      |
|                                                                                                                              | PO1                     | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
| CO1                                                                                                                          | 3                       | 1   | -   | 2   | 2   | -   | -   | -   | -   | -    | -    | 1    | 1    | 1    |
| CO2                                                                                                                          | 3                       | 1   | -   | 2   | 2   | -   | -   | -   | -   | -    | -    | 1    | 1    | 1    |
| CO3                                                                                                                          | 3                       | 1   | -   | 2   | 2   | -   | -   | -   | -   | -    | -    | 1    | 1    | 1    |
| CO4                                                                                                                          | 3                       | 1   | -   | 2   | 2   | -   | -   | -   | -   | -    | -    | 1    | 1    | 1    |
| CO5                                                                                                                          | 3                       | 1   | -   | 2   | 2   | -   | -   | -   | -   | -    | -    | 1    | 1    | 1    |



**COURSE OBJECTIVES**

To enable the students to

- learn the requirements of automation systems and their importance
- introduce the automation components and their applications
- study regarding the concept of computer aided measurement techniques
- understand the basics about programmable logic controllers
- know the working of distributed control systems and its advantages

**UNIT I INTRODUCTION TO AUTOMATION SYSTEMS 9**

**Automation Overview-Requirement of automation** Systems-Architecture of Industrial Automation system- Introduction of PLC and supervisory control and data acquisition (SCADA). Industrial bus systems: Modbus and Profibus.

**UNIT II AUTOMATION COMPONENTS 9**

**Sensors for temperature-pressure-force-displacement-speed-flow-level-humidity** and pH measurement. Actuators-process control valves-power electronics devices DIAC-TRIAC-power MOSFET and IGBT. Introduction of DC and AC servo drives for motion control.

**UNIT III COMPUTER AIDED MEASUREMENT AND CONTROL SYSTEMS 9**

Role of computers in measurement and control-**Elements of computer aided measurement** and control, man-**machine interface**-computer aided process control hardware-process related interfaces Communication and networking-**Industrial communication** systems-Data transfer techniques-Computer aided process control software-Computer based data acquisition system-Internet of things (IoT) for plant automation

**UNIT IV PROGRAMMABLE LOGIC CONTROLLERS 9**

Programmable controllers-**Programmable logic controllers-Analog digital input and output modules**-PLC programming-Ladder diagram-Sequential flow chart-PLC Communication and networking-PLC selection-PLC Installation-Advantage of using PLC for Industrial automation-Application of PLC to process control industries

**UNIT V DISTRIBUTED CONTROL SYSTEM 9**

Overview of DCS-**DCS software configuration-DCS communication-DCS Supervisory Computer TasksDCS integration with PLC** and Computers-Features of DCS-Advantages of DCS.

**TOTAL PERIODS 45**

**COURSE OUTCOMES**

Upon the completion of the course, the students will be able to

- design automation systems for various applications
- implement the detail knowledge on data acquisition system interface and DSC system
- apply the concept of computer aided measurement in several applications

- analyze the PLC selection, installation and its needs for industrial applications
- elaborate the concept of distributed control systems and its advantages

### TEXT BOOKS

1. R.G.Jamkar, Industrial Automation Using PLC SCADA & DCS | PLC and SCADA, Global Education, 2009
2. C D Johnson, "Process Control Instrumentation Technology", Prentice Hall India, 8th Edition, 2006

### REFERENCES

1. Hackworth, 'Programmable Logic Controllers : Programming Methods And Applications, 1/E 2006
2. E.A.Parr, Newnes, New Delhi, "Industrial Control Handbook", 3<sup>rd</sup> Edition, 2000
3. S.K.Singh, "Industrial Instrumentation", Tata McGraw Hill, 2nd edition companies, 2003

| Mapping of Course Outcomes with Programme Outcomes:<br>(1/2/3 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak |                         |     |     |     |     |     |     |     |     |      |      |      |      |      |
|-----------------------------------------------------------------------------------------------------------------------------|-------------------------|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|
| COs                                                                                                                         | Programme Outcomes(POs) |     |     |     |     |     |     |     |     |      |      |      |      |      |
|                                                                                                                             | PO1                     | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
| CO1                                                                                                                         | 3                       | 1   | -   | 2   | 2   | -   | -   | -   | -   | -    | -    | 1    | 1    | 1    |
| CO2                                                                                                                         | 3                       | 1   | -   | 2   | 2   | -   | -   | -   | -   | -    | -    | 1    | 1    | 1    |
| CO3                                                                                                                         | 3                       | 1   | -   | 2   | 2   | -   | -   | -   | -   | -    | -    | 1    | 1    | 1    |
| CO4                                                                                                                         | 3                       | 1   | -   | 2   | 2   | -   | -   | -   | -   | -    | -    | 1    | 1    | 1    |
| CO5                                                                                                                         | 3                       | 1   | +   | 2   | 2   | -   | -   | -   | -   | -    | -    | 1    | 1    | 1    |



**COURSE OBJECTIVES**

To enable the students to

- understand the current challenges in Nano scale MOSFET
- learn about the working principle of Nano scale MOSFET
- study the basics of quantum transport devices
- acquire knowledge regarding CNT devices

**UNIT I CHALLENGES NANO SCALE MOSFETS 9**

Overview of MOS Transistor-Scaling of transistor dimensions and Moore's Law-Challenges for Nano MOSFETs: Sub-threshold Conduction-DIBL-Velocity Saturation-Hot electrons. Emergence of new materials-Hi-k materials and its issues-metal gate-copper interconnect and low-k interlayer dielectric.

**UNIT II NANO SCALE MOSFET 9**

SOI MOSFET-partially depleted and fully depleted SOI-Strained channel MOSFET-Hi-k gate dielectric Metal gate electrode-Double gate MOSFET-FINFET-Ferro electric FET.

**UNIT III QUANTUM TRANSPORT DEVICES 9**

Limitations of classical mechanics-Basics of quantum mechanics-Schrodinger equation- Particle in a box Tunnel Effect-tunnelling through single barrier and double barrier-Coulomb blockade effect-Single Electron Transistor and Resonant Tunnelling Diode.

**UNIT IV CNT DEVICES 9**

Carbon Nano Tube-Electronic properties of CNT-Geometrical structure-Electronic structure of CNT Transport properties-CNTFET-comparison of Si MOSFET with CNT MOSFET.

**UNIT V SPINTRONICS 9**

Principle of Spintronic-Spin valves-SPINFET-Magnetic Tunnel Junctions and MRAM.

**TOTAL PERIODS 45**

**COURSE OUTCOMES**

Upon the completion of the course, the students will be able to

- analyze the various challenges in designing of Nanoscale MOSFET
- apply the basic principles in designing of Nanoscale MOSFET
- elaborate the working concept of Quantum transport devices
- identify the issues associated with CNT devices
- .examine the spintronic concept and design MRAM based devices.

## TEXT BOOKS

1. Rainer Waser (Ed.), "Nano electronics and Information Technology", Wiley-VCH, Third, Completely Revised and Enlarged Edition, 2012.
2. T.Pradeep, "A Textbook of Nanoscience and Nanotechnology", Mc Graw Hill, 2012.

## REFERENCES

1. Ajoy Ghatak and S. Lokanathan, "Quantum Mechanics: Theory and Applications", Fifth Edition, Macmillan Publishers, 2009
2. Yong-Bin Kim, "Challenges for Nanoscale MOSFETs and Emerging Nanoelectronics", KIEEME
3. Transactions on Electrical and Electronic Materials, Vol. 11, No. 3, pp. 93-105, 2010.
4. Kerry Bernstein, "Device and Architecture Outlook for Beyond CMOS Switches", Proceedings

| Mapping of Course Outcomes with Programme Outcomes:<br>(1/2/3 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak |                         |     |     |     |     |     |     |     |     |      |      |      |      |      |
|-----------------------------------------------------------------------------------------------------------------------------|-------------------------|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|
| COs                                                                                                                         | Programme Outcomes(POs) |     |     |     |     |     |     |     |     |      |      |      |      |      |
|                                                                                                                             | PO1                     | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
| CO1                                                                                                                         | 3                       |     |     |     |     |     |     |     |     |      |      |      | 3    | 3    |
| CO2                                                                                                                         |                         | 3   | 3   |     |     |     |     |     |     |      |      |      | 3    | 3    |
| CO3                                                                                                                         |                         |     |     | 3   | 3   | 3   |     | 3   |     |      |      |      | 3    | 3    |
| CO4                                                                                                                         |                         |     |     | 3   | 3   |     | 3   |     | 3   |      |      | 3    | 3    | 3    |
| CO5                                                                                                                         |                         | 3   | 3   | 3   | 3   |     |     |     | 3   | 3    | 3    | 3    | 3    | 3    |



**COURSE OBJECTIVES**

To enable the students to

- learn the basics of batteries and starter system
- understand the principle of charging and light auxiliary system
- study the EEMS and various control modes
- acquire the concept of vehicle control motion
- gain knowledge about the significance of telematics and vehicle diagnosis

**UNIT I BATTERIES AND STARTING SYSTEMS 9**

Vehicle Batteries-Lead acid battery-Battery Rating-Lead Acid battery Charging methods-Testing Methods-Fault Diagnosis-Requirement of a starting System-Starter motor- Construction and **Working of Starter Drive Mechanism**-Starter Motor Fault Diagnosis-New Developments in Battery Technologies and Starting System.

**UNIT II CHARGING SYSTEM AND LIGHTING AUXILIARIES 9**

Alternator-D.C Generator-Alternator Charging Circuits and Rectification of AC to DC-Alternator Testing Methods-Mechanical and **Electronic Voltage regulator-Lighting Fundamentals and Lighting Circuit****Conventional Headlamps and LED Lighting System**-Wiper system and Signaling and Warning system.

**UNIT III ELECTRONIC ENGINE MANAGEMENT SYSTEM 9**

Gasoline Engine Fuel Injectors-Single point & Multi Point Fuel Injections-**Testing of Fuel Injectors****Conventional Ignition System****Electronic Ignition System****Programmed ignition system****Distributor less Ignition System****Digital Engine Control Modes**-EGR Control and variable valve timing-Ignition Controlling-Closed loop ignition timing- Spark Advance Correction Scheme.

**UNIT IV FUNDAMENTALS OF VEHICLE MOTION CONTROL 9**

Cruise **Control System****Adaptive Cruise Control System****Throttle Actuator****Stepper Motor Based Control****Antilock Braking Mechanism****Tire Slip Controller**-Electronic Suspension System-Variable Damping-Variable Spring rate-Electric Power Assisted Steering Mechanism-Four Wheel Steering and Steer-byWire.

**UNIT V TELEMATICS AND VEHICLE DIAGNOSTICS 9**

GPS Navigation-GPS Structure-Dead Reckoning using Inertial Navigation System-Electronic Control System Diagnostics-OBDII-Diagnostics Fault Codes-Introduction to Model-based Sensor Failure Detection-Case Study on MAF Sensor calibration.

**TOTAL PERIODS 45**

## COURSE OUTCOMES

Upon the completion of the course, the students will be able to

- examine the basics of batteries and starting system
- analyze the principle of lighting auxiliaries
- apply the ignition system in various machines
- synthesize the principle of vehicle control

## TEXT BOOKS

1. Tom Denton “Automobile Electrical and Electronic Systems” 3rd edition, Elsevier Butterworth- Heinemann 2004.
2. William.B.Ribbens , “Understanding Automotive Electronics” 7th edition Butterworth-Heinemann publications,2012.

## REFERENCES

1. Allan.W.M.Bonnick “Automotive Computer Controlled System”, Butterworth-Heinemann .2001.
2. Robert Bosch Gmbh “Bosch Automotive Electric and Electronics” 5th edition Springer-Vieweg,2007.

Mapping of Course Outcomes with Programme Outcomes:

(1/2/3 indicates strength of correlation) 3-Strong, 2-Medium , 1-Weak

| COs | Programme Outcomes(POs) |     |     |     |     |     |     |     |     |      |      |      |      |      |
|-----|-------------------------|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|
|     | PO1                     | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
| CO1 | 3                       |     |     |     |     |     |     |     |     |      |      |      | 3    | 3    |
| CO2 |                         | 3   | 3   |     |     |     |     |     |     |      |      |      | 3    | 3    |
| CO3 |                         |     |     | 3   | 3   | 3   |     | 3   |     |      |      |      | 3    | 3    |
| CO4 |                         |     |     | 3   | 3   |     | 3   |     | 3   |      |      | 3    | 3    | 3    |
| CO5 |                         | 3   | 3   | 3   | 3   |     |     |     | 3   | 3    | 3    | 3    | 3    | 3    |



**COURSE OBJECTIVES**

To enable the students to

- learn the working of ARM processor
- understand the Building Blocks of Embedded Systems
- learn the concept of memory map and memory interface
- know the characteristics of Real Time Systems

**LIST OF EXPERIMENTS**

1. Flashing of LEDs.
2. Interface Switches and LED's.
3. Interface LCD and Display "Hello World".
4. Interface 4\*4 Matrix Pad.
5. Interfacing Seven segments and analysis the Interrupts.
6. Interfacing EPROM.
7. Interfacing RTC.
8. Images read and write in GLCD.
9. Interfacing stepper motor with ARM.
10. Interfacing DC Motor with ARM.

**TOTAL PERIODS****60****COURSE OUTCOMES**

Upon the completion of the course, the students will be able to

- write programs in ARM for a specific Application
- interface memory and Write programs related to memory operations
- analyze the performance of interrupt
- write programmes for interfacing keyboard, display, motor.

Mapping of Course Outcomes with Programme Outcomes:

(1/2/3 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak

| COs | Programme Outcomes(POs) |     |     |     |     |     |     |     |     |      |      |      |      |      |
|-----|-------------------------|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|
|     | PO1                     | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
| CO1 | 3                       | 3   | 3   | 3   | -   | 3   | -   | -   | -   | -    | 2    | 3    | 3    | 3    |
| CO2 | 3                       | 3   | 3   | 3   | -   | -   | -   | -   | -   | -    | -    | 3    | 3    | 3    |
| CO3 | 3                       | 3   | 3   | -   | -   | 3   | -   | -   | -   | -    | 2    | -    | 3    | 3    |
| CO4 | 3                       | 3   | 3   | 3   | -   | -   | -   | -   | -   | -    | 2    | 3    | 3    | 3    |



## **COURSE OBJECTIVES**

To enable the students to

- study the performance parameters of optical source and detector.
- become familiar with different modes.
- analyse the radiation pattern of horn and micro strip antennas.
- understand the characteristics of different microwave components.

## **LIST OF EXPERIMENTS**

### **I I.OPTICAL EXPERIMENTS**

1. Determination of numerical aperture for fibers and Attenuation Measurement in Fibers
2. To determine the characteristics of Photo Diode and LED
3. To establish the communication links of Analog and Digital using Fiber optic cables

### **II.COMMUNICATION EXPERIMENTS**

1. Study of signal sampling and reconstruction
2. Study of Delta modulation and Demodulation
3. Study of FM modulator and Demodulator
4. Simulation of Error control coding schemes-Linear block codes using MATLAB
5. Simulation of signal constellations of BPSK, QPSK and QAM using MATLAB

### **III.MICROWAVE EXPERIMENTS**

1. Radiation Pattern measurement of pyramidal Horns and MIC antennas
2. Power Measurement of microwave source
3. Study of characteristics of Gunn diode and Gunn Oscillator
4. Study of characteristics of Directional Couplers and Magic Tee

|                      |           |
|----------------------|-----------|
| <b>TOTAL PERIODS</b> | <b>60</b> |
|----------------------|-----------|

## **COURSEOUTCOMES**

Upon the completion of the course, the students will be able to

- demonstrate the characteristics of Microwave sources and conventional and Micro strip antennas
- analyze the characteristics of optical source and detector. .
- demonstrate a fiber optic communication link and analyze its frequency responses.
- acquire the knowledge in modulation and demodulation scheme through implementation of DM, FM, BPSK, QPSK and QAM and apply various channel coding schemes

Mapping of Course Outcomes with Programme Outcomes:  
(1/2/3 indicates strength of correlation) 3-Strong, 2-Medium , 1-Weak

| COs | Programme Outcomes(POs) |     |     |     |     |     |     |     |     |      |      |      |      |      |
|-----|-------------------------|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|
|     | PO1                     | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
| CO1 | -                       | -   | 3   | -   | 3   | -   | -   | -   |     | -    | -    |      | 3    | 3    |
| CO2 | -                       | -   | 3   | -   | 3   | -   | -   | -   |     | -    | -    |      | 3    | 3    |
| CO3 | -                       | -   | 3   | -   | 3   | -   | -   | -   |     | -    | -    |      | 3    | 3    |
| CO4 | -                       | -   | 3   | -   | 3   | -   | -   | -   |     | -    | -    |      | 3    | 3    |



**COURSE OBJECTIVES**

To enable the students to

- gain knowledge on literature review
- categorize the requirements for the project
- develop hardware solutions for simple applications.
- learn to work in a team.

Every student will be required to undertake a suitable project work in the Department during VII semester, in consultation with the Head of the Department and the guide. Every student will have to prepare and submit the literature review and simulated output of their project at the end of the semester within the stipulated time as announced by the Institute/Department

**COURSE OUTCOMES**

At the end of the course, the students would be able to

- apply knowledge of basic science and engineering to Electronics and Communication engineering problems.
- analyze the requirements for the project.
- identify, formulate simple problem statements and find solutions.
- implement the hardware and test.

**TOTAL PERIODS 60**

Mapping of Course Outcomes with Programme Outcomes:

(1/2/3 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak

| COs | Programme Outcomes(POs) |     |     |     |     |     |     |     |     |      |      |      |      |      |
|-----|-------------------------|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|
|     | PO1                     | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
| CO1 | 3                       | 2   | 3   | 2   | 3   | 2   | 1   | 1   | 2   | 2    | 3    | 1    | 3    | 2    |
| CO2 | 3                       | 2   | 3   | 2   | 3   | 2   | 1   | 1   | 2   | 2    | 3    | 1    | 3    | 2    |
| CO3 | 3                       | 2   | 3   | 2   | 3   | 2   | 1   | 1   | 2   | 2    | 3    | 1    | 3    | 2    |
| CO4 | 3                       | 2   | 3   | 2   | 3   | 2   | 1   | 1   | 2   | 2    | 3    | 1    | 3    | 2    |



**COURSE OBJECTIVES**

To enable the students to

- know the challenges in Wireless Networks.
- study the WLANs standards
- acquire the generations of WWANs
- learn the necessity of Adhoc and sensor networks
- gain the knowledge of advancements in wireless network

**UNIT I CHALLENGES IN WIRELESS NETWORKS 12**

Medium Access Alternatives-Fixed Assignment for Voice Oriented Networks-Random Access for Data Oriented Networks-Handoff and Roaming Support-Security and Privacy.

**UNIT II WIRELESS LANs 12**

802.11b WLAN-Architecture and Services-Installation of WLAN-Other IEEE 802.11 standards and a,g,n-HIPERLAN-Wi-Fi and Wi-Max standards.

**UNIT III WIRELESS WANs 12**

First Generation Analog-Second Generation TDMA-GSM, GPRS-Second Generation CDMA-IS-95 Third Generation Systems WCDMA-CDMA 2000.

**UNIT IV ADHOC AND SENSOR NETWORKS 12**

Characteristics of MANETs-Table-driven and Source initiated On Demand routing protocols Hybrid protocols- Wireless Sensor networks-Classification-Routing protocols-Sensor Network Architecture-Data Dissemination-Data Gathering-MAC Protocols for Sensor Networks-Location Discovery and quality of a Sensor Network.

**UNIT V ADVANCES IN WIRELESS NETWORKS 12**

Introduction of 4G vision-4G features and challenges-Applications of 4G-Bluetooth-ZigBee-Ultra wide Band Radio communication-Optical wireless Networks-Software Defined Radio-Cognitive Radio.

**TOTAL PERIODS 60**

**COURSE OUTCOMES**

Upon the completion of the course, the students will be able to

- examine the challenges in Wireless Networks.
- analyse the different concept of WLAN standards
- design the generations of WWANs
- evaluate the necessity of Adhoc and sensor networks.
- apply the concept of advancements in wireless networks.

### TEXT BOOKS

1. KavehPahlavan, Prashant Krishnamurthy, "Principles of Wireless Networks: A unified approach", Prentice Hall, 2002.
2. Dharma PrakashQing–AnZeng&Agrawal, "Introduction to Wireless and Mobile Systems", 4thEdition,Thomson India Edition, 2015.

### REFERENCES

1. Vijay. K. Garg, "Wireless Communication and Networking", Morgan Kaufmann Publishers, 2007.
2. Clint Smith, P.E. & Daniel Collins, "3G Wireless Networks", 3rd Edition, Tata McGraw Hill, 2014.
3. Gary. S. Rogers & John Edwards, "An Introduction to Wireless Technology", Prentice Hall, 2003.

| Mapping of Course Outcomes with Programme Outcomes:<br>(1/2/3 indicates strength of correlation) 3-Strong, 2-Medium , 1-Weak |                         |     |     |     |     |     |     |     |     |      |      |      |      |      |
|------------------------------------------------------------------------------------------------------------------------------|-------------------------|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|
| COs                                                                                                                          | Programme Outcomes(POs) |     |     |     |     |     |     |     |     |      |      |      |      |      |
|                                                                                                                              | PO1                     | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
| CO1                                                                                                                          | 3                       | 1   | -   | 2   | 2   | 1   | -   | -   | -   | -    | -    | 2    | 3    | 3    |
| CO2                                                                                                                          | 3                       | 1   | -   | 2   | 2   | 1   | -   | -   | -   | -    | -    | 2    | 3    | 3    |
| CO3                                                                                                                          | 3                       | 1   | -   | 2   | 2   | 1   | -   | -   | -   | -    | -    | 2    | 3    | 3    |
| CO4                                                                                                                          | 3                       | 1   | -   | 2   | 2   | 1   | -   | -   | -   | -    | -    | 2    | 3    | 3    |
| CO5                                                                                                                          | 3                       | 1   | -   | 2   | 2   | 1   | -   | -   | -   | -    | -    | 2    | 3    | 3    |



**COURSE OBJECTIVES**

To enable the students to

- understand the basics of solid state physics
- acquire the knowledge of display devices.
- learn the concepts of optical detection devices.
- know the design of optoelectronic integrated circuits.
- gain knowledge about optoelectronic integrated circuits.

**UNIT I ELEMENTS OF LIGHT AND SOLID STATE PHYSICS****9**

Fundamentals of Wave nature of light-Polarization-Interference-Diffraction-Light Source-review of Quantum Mechanical concept-Review of Semiconductor Physics and Semiconductor Junction theory.

**UNIT II DISPLAY DEVICES AND LASERS****9**

Photo Luminescence-Cathode Luminescence-Electro Luminescence-Injection Luminescence Light Emitting Diodes-Plasma Display-Liquid Crystal Displays-Numeric Displays-Laser Emission- Absorption, Radiation- Population Inversion-Optical Feedback-Threshold condition Laser Modes-Classes of Lasers-Mode Locking Laser applications.

**UNIT III DETECTION DEVICES****9**

Photo detection Principle-Photoconductors-Noise in photoconductors-Photodiodes-PIN Photodiode-APD-Detector performance parameters-Detectors for long wavelength operation wavelength-selective detection Charge Coupled Device.

**UNIT IV OPTOELECTRONIC MODULATOR****9**

Analog and Digital Modulation-Electro-optic modulators-Magneto-optic Devices-Acousto-optic devices.

**UNIT V OPTOELECTRONIC INTEGRATED CIRCUITS****9**

Hybrid and Monolithic Integration-Application of Opto Electronic Integrated Circuits- Integrated transmitters and Receivers-Guided wave devices.

**COURSE OUTCOMES**

Upon the completion of the course, the students will be able to

- examine the basics of solid state physics.
- analyze the design of optoelectronic detection devices and modulators.
- evaluate the concepts of optical detection devices.
- synthesize the design of optoelectronic integrated circuits.
- .apply the concepts of Opto electronic and integrated circuits

## TEXT BOOKS

1. Pallab Bhattacharya “Semiconductor Opto Electronic Devices”, Prentice Hall of India Pvt., Ltd., New Delhi
2. Jasprit Singh, “Opto Electronics – As Introduction to Materials and Devices”, McGraw-Hill International Edition, 1998

## REFERENCES

1. S.O.Kasap, “Opto Electronics and Photonics – Principles and Practices”, Pearson, Second Edition
2. S C Gupta, Opto Electronic Devices and Systems, Prentice Hal of India, 2005.
3. J. Wilson and J.Haukes, “Opto Electronics – An Introduction”, Prentice Hall, 1995

| Mapping of Course Outcomes with Programme Outcomes:<br>(1/2/3 indicates strength of correlation) 3-Strong, 2-Medium , 1-Weak |                         |     |     |     |     |     |     |     |     |      |      |      |      |      |
|------------------------------------------------------------------------------------------------------------------------------|-------------------------|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|
| COs                                                                                                                          | Programme Outcomes(POs) |     |     |     |     |     |     |     |     |      |      |      |      |      |
|                                                                                                                              | PO1                     | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
| CO1                                                                                                                          | 3                       | 1   | -   | 2   | 2   | -   | -   | -   | -   | -    | -    | -    | 1    | 1    |
| CO2                                                                                                                          | 3                       | 1   | -   | 2   | 2   | -   | -   | -   | -   | -    | -    | -    | 1    | 1    |
| CO3                                                                                                                          | 3                       | 1   | -   | 2   | 2   | -   | -   | -   | -   | -    | -    | -    | 1    | 1    |
| CO4                                                                                                                          | 3                       | 1   | -   | 2   | 2   | -   | -   | -   | -   | -    | -    | -    | 1    | 1    |
| CO5                                                                                                                          | 3                       | 1   | -   | 2   | 2   | -   | -   | -   | -   | -    | -    | -    | 1    | 1    |



**COURSE OBJECTIVES**

To enable the students to

- learn MEMS and its fabrication methods.
- understand the principle of mechanical sensing.
- study the micro-Opto-electro principles.
- acquire the principle of magnetic sensing.
- gain knowledge about the significance of radio frequency MEMS and its applications.

**UNIT I MEMS AND ITS FABRICATION METHODS 9**

Definition of MEM-MEMS history and development-micro machining-lithography principles and methods- structural and sacrificial materials-thin film deposition-impurity doping-etching-surface micro machining-wafer bonding.

**UNIT II MECHANICAL SENSORS AND ACTUATORS 9**

Principles of sensing and actuation: beam and cantilever-capacitive-piezo electric-strain-pressure- flow-pressure mea by micro phone-MEMS gyroscopes-shear mode piezo actuator-gripping piezo Actuator Inchworm technology.

**UNIT III MICRO-OPTO-ELECTRO MECHANICAL SYSTEMS 9**

Principle of MOEMS technology-properties of light-light modulators-beam splitter-micro lense-mico Mirrors digital micro mirror device-light detector-grating light value-optical switch-wave guide and Tuning-shear stress measurement

**UNIT IV MAGNETIC SENSORS AND ACTUATORS 9**

Magnetic materials for MEMS and properties-magnetic sensing and detection-magneto resistive sensor-more on hall effect-magneto diodes-magneto transistor-MEMS magnetic sensor-MEMS actuators by directional micro ac circuit integrated magnetic actuator-magnetic probe based storage device.

**UNIT V RADIO FREQUENCY MEMS 9**

RF based communication systems-RF MEMS, MEMS inductors-varactors-tuner/filter-resonator clarification of tuner-filter-resonator-MEMS switches-phase shifter.

**TOTAL PERIODS 45**

**COURSE OUTCOMES**

Upon the completion of the course, the students will be able to

- examine the basics of MEMS
- analyze the principle of mechanical sensing.
- apply the micro-opto-electro principles.
- synthesize the principle of magnetic sensing.

- compare the radio frequency MEMS and its application

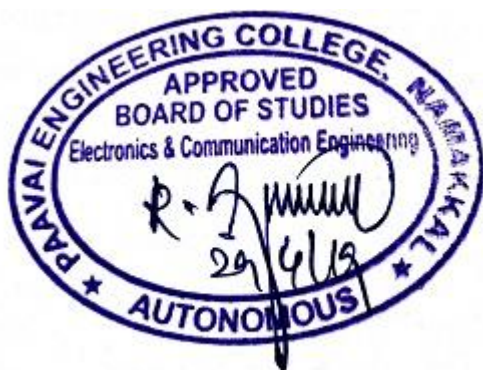
### TEXT BOOKS

1. NitaigourPremchandMahalik, “MEMS”, TMH Publishing co.
2. Tai-Ran Hsu, “MEMS and Micro Systems: Design and Manufacture”, TMH Publishers.

### REFERENCES

1. Chang Liu, “Foundation of MEMS”, Prentice Hall Ltd.
2. Sergey EdwrdsLyshevski, “MEMS and NEMS”, CRC Press, Indian Edition.
3. Mohamed Gad-el-Hak, “MEMS – Introduction and fundamentals”, Taylor and Francis, Second Edition, 2013

| Mapping of Course Outcomes with Programme Outcomes:<br>(1/2/3 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak |                         |     |     |     |     |     |     |     |     |      |      |      |      |      |
|-----------------------------------------------------------------------------------------------------------------------------|-------------------------|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|
| COs                                                                                                                         | Programme Outcomes(POs) |     |     |     |     |     |     |     |     |      |      |      |      |      |
|                                                                                                                             | PO1                     | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
| CO1                                                                                                                         | 3                       | 1   | -   | 2   | 2   | -   | -   | -   | -   | -    | -    | -    | 1    | 1    |
| CO2                                                                                                                         | 3                       | 1   | -   | 2   | 2   | -   | -   | -   | -   | -    | -    | -    | 1    | 1    |
| CO3                                                                                                                         | 3                       | 1   | -   | 2   | 2   | -   | -   | -   | -   | -    | -    | -    | 1    | 1    |
| CO4                                                                                                                         | 3                       | 1   | -   | 2   | 2   | -   | -   | -   | -   | -    | -    | -    | 1    | 1    |
| CO5                                                                                                                         | 3                       | 1   | -   | 2   | 2   | -   | -   | -   | -   | -    | -    | -    | 1    | 1    |



**COURSE OBJECTIVES**

To enable the students to

- understand the basic concepts of mobile computing
- be familiar with the network protocol stack
- learn the basics of mobile telecommunication system
- be exposed to ad-hoc networks
- study about different mobile platforms and application development

**UNIT I MOBILE COMPUTING****9**

Mobile Computing-Mobile Computing vs wireless Networking-Mobile Computing Applications  
Characteristics of Mobile Computing-Structure of Mobile Computing Application. MAC Protocols  
Wireless MAC Issues-Fixed Assignment Schemes-Random Assignment Schemes-Reservation Based  
Schemes.

**UNIT II MOBILE INTERNET PROTOCOL AND TRANSPORT LAYER****9**

Overview of Mobile IP-Features of Mobile IP-Key Mechanism in Mobile IP-route Optimization.  
Overview of TCP/IP-Architecture of TCP/IP-Adaptation of TCP Window Improvement in TCP  
Performance.

**UNIT III MOBILE TELECOMMUNICATION SYSTEM****9**

Global System for Mobile Communication (GSM)-General Packet Radio Service (GPRS) Universal  
Mobile Telecommunication System (UMTS).

**UNIT IV MOBILE AD-HOC NETWORKS****9**

Ad-Hoc Basic Concepts-Characteristics-Applications-Design Issues-Routing-Essential of Traditional  
Routing Protocols-Popular Routing Protocols-Vehicular Ad Hoc networks (VANET)-MANET vs  
VANET-Security.

**UNIT V MOBILE PLATFORMS AND APPLICATIONS****9**

Mobile Device Operating Systems-Special Constrains & Requirements-Commercial Mobile Operating  
Systems- Software Development Kit: Ios-Android, Black Berry Windows Phone - M-Commerce-  
Structure- Pros & Cons- Mobile Payment System Security Issues.

**TOTAL PERIODS 45****COURSE OUTCOMES**

Upon the completion of the course, the students will be able to

- explain the basics of mobile telecommunication system
- choose the required functionality at each layer for given application
- identify solution for each functionality at each layer
- use simulator tools and design ad hoc networks

- develop a mobile application

### TEXT BOOKS

1. Prasant Kumar Pattnaik, Rajib Mall, “Fundamentals of Mobile Computing”, PHI Learning Pvt. Ltd, New Delhi 2012.
2. Abraham Silberschatz, Peter Baer Galvin and Greg Gagne, “Operating System Concept”, 9th Edition, John Wiley and Sons Inc., 2012

### REFERENCES

1. Jochen H. Schller, “Mobile Communications”, Second Edition, Pearson Education, New Delhi, 2007
2. Dharma Prakash Agarwal, Qing and a Zeng, "Introduction to Wireless and Mobile systems", Thomson Asia Pvt Ltd, 2005
3. We Hansmann, Lothar Merk, Martin S. Nicklons and Thomas Stober, “Principles of Mobile Computing”, Springer, 2003

| Mapping of Course Outcomes with Programme Outcomes:<br>(1/2/3 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak |                         |     |     |     |     |     |     |     |     |      |      |      |      |      |
|-----------------------------------------------------------------------------------------------------------------------------|-------------------------|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|
| COs                                                                                                                         | Programme Outcomes(POs) |     |     |     |     |     |     |     |     |      |      |      |      |      |
|                                                                                                                             | PO1                     | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
| CO1                                                                                                                         | 3                       | 1   | -   | 2   | 2   | -   | -   | -   | -   | -    | -    | -    | 1    | 1    |
| CO2                                                                                                                         | 3                       | 1   | -   | 2   | 2   | -   | -   | -   | -   | -    | -    | -    | 1    | 1    |
| CO3                                                                                                                         | 3                       | 1   | -   | 2   | 2   | -   | -   | -   | -   | -    | -    | -    | 1    | 1    |
| CO4                                                                                                                         | 3                       | 1   | -   | 2   | 2   | -   | -   | -   | -   | -    | -    | -    | 1    | 1    |
| CO5                                                                                                                         | 3                       | 1   | -   | 2   | 2   | -   | -   | -   | -   | -    | -    | -    | 1    | 1    |



## COURSE OBJECTIVES

To enable the students to

- have a complete understanding of error-control coding
- understand encoding and decoding of digital data stream
- introduce methods for the generation of these codes and their decoding techniques.
- have a detailed knowledge of compression and decompression techniques.
- introduce the concepts of multimedia communication

### UNIT I      **MULTIMEDIA COMPONENTS**      9

Introduction-Multimedia   Skills-Multimedia   components   and   their   Characteristics-Text-sound images graphics-animation-video-hardware.

### UNIT II      **AUDIO AND VIDEO COMPRESSION**      9

Audio compression-DPCM-Adaptive PCM-adaptive predictive coding-linear Predictive coding code excited LPC-perceptual coding Video compression-principles-H.261-H.263-MPEG 1, 2,4.

### UNIT III      **TEXT AND IMAGE COMPRESSION**      9

Compression principles-source encoders and destination encoders-lossless and lossy compression entropy encoding-source encoding-text compression-static Huffman coding dynamic coding-arithmetic coding-Lempel ziv-welsh Compression-image compression

### UNIT IV      **VOIP TECHNOLOGY**      9

Basics of IP transport-VoIP challenges-H.323/ SIP-Network Architecture-Protocols-Call establishment and release-VOIP and SS7-Quality of Service-CODEC Methods-VOIP applicability

### UNIT V      **MULTIMEDIA NETWORKING**      9

Multimedia   networking-Applications-streamed   stored   and   audio-making   the   best   Effort service protocols for real time interactive Applications-distributing multimedia-beyond best effort services including and policing Mechanism-integrated services-differentiated Services-RSVP.

**TOTAL PERIODS      45**

## COURSE OUTCOMES

Upon the completion of the course, the students will be able to

- examine the multimedia components, both hardware and software
- apply the compression techniques for audio and video
- compare the concepts text and image compression techniques
- evaluate the VOIP networks and protocols
- analyze Implementation and applications of multimedia networking

## TEXT BOOKS

1. Fred HALshall “Multimedia communication - applications, networks, protocols and standards”, Pearson education, 2007.
2. Tay Vaughan, “Multideai: making it work”, 7/e, TMH 2007

## REFERENCES

1. Marcus goncalves “Voice over IP Networks”, Mcgraw hill
2. KR. Rao,Z S Bojkovic, D A Milovanovic, “Multimedia Communication Systems: Techniques, Standards, and Networks”, Pearson Education 2007
3. R. Steimnetz, K. Nahrstedt, “Multimedia Computing, Communications and Applications”, Pearson Education
4. Ranjan Parekh, “Principles of Multimedia”, TMH 2006

| Mapping of Course Outcomes with Programme Outcomes:<br>(1/2/3 indicates strength of correlation) 3-Strong, 2-Medium , 1-Weak |                         |     |     |     |     |     |     |     |     |      |      |      |      |      |
|------------------------------------------------------------------------------------------------------------------------------|-------------------------|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|
| COs                                                                                                                          | Programme Outcomes(POs) |     |     |     |     |     |     |     |     |      |      |      |      |      |
|                                                                                                                              | PO1                     | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
| CO1                                                                                                                          | 3                       | 1   | -   | 2   | 2   | -   | -   | -   | -   | -    | -    | -    | 1    | 1    |
| CO2                                                                                                                          | 3                       | 1   | -   | 2   | 2   | -   | -   | -   | -   | -    | -    | -    | 1    | 1    |
| CO3                                                                                                                          | 3                       | 1   | -   | 2   | 2   | -   | -   | -   | -   | -    | -    | -    | 1    | 1    |
| CO4                                                                                                                          | 3                       | 1   | -   | 2   | 2   | -   | -   | -   | -   | -    | -    | -    | 1    | 1    |
| CO5                                                                                                                          | 3                       | 1   | -   | 2   | 2   | -   | -   | -   | -   | -    | -    | -    | 1    | 1    |



**COURSE OBJECTIVES**

To enable the students to

- study about the various physiological parameters both electrical and non-electrical and the methods of recording
- analyse about the method of transmitting those parameters
- study about the various assist devices used in the hospitals
- know about equipment used for physical medicine and the various recently developed diagnostic and therapeutic technique
- learn about the recent trends in Medical Instrumentation

**UNIT I ELECTRO-PHYSIOLOGY AND BIO-POTENTIAL RECORDING 9**

The origin of Bio-potentials: Bio potential electrodes-Biological amplifier-Difference amplifier and chopper amplifier- ECG-EEG-EMG-PCG-lead systems and recording methods-typical waveforms and signal characteristics

**UNIT II NON ELECTRICAL PARAMETER MEASUREMENT 9**

Auto analyzer-Blood flow meter-Cardiac output-Respiratory measurement-Blood Pressure-Blood cell Counters

**UNIT III ASSIST DEVICES 9**

Cardiac Pacemakers-Classification of Pacemakers-Defibrillator-DC Defibrillator-Dialyzer-Heart lung machine.

**UNIT IV LASER, DIATHERMIES AND ULTRASONIC APPLICATIONs 9**

Principle of Laser action-Different types and clinical applications of laser-Ultrasonic frequency for medical application- Diathermies-Shortwave-Ultrasonic and microwave type and their applications Surgical Diathermy-Radio-pill

**UNIT V RECENT TRENDS IN MEDICAL INSTRUMENTATION 9**

Principle and application of Thermography-Principle and application of Nanotechnology-Endoscopy and Ophthalmic equipment's-Principles of Lithotripsy

**TOTAL PERIODS 45**

**COURSE OUTCOMES**

Upon the completion of the course, the students will be able to

- compare the concepts about electro-physiology, ECG,EEG, EMG and PCG
- apprehend the different types of measurements in Non-electrical parameter.
- analyse the functions of various machines to save human life
- examine the concept of laser, ultrasonic which is involved in medical field
- apply the recent trends in field of diagnostic and therapeutic equipment's

## TEXT BOOKS

1. Leslie Cromwell, Fred J. Weibell and Erich A. Pfeiffer, "Biomedical Instrumentation and Measurement", Prentice Hall New Delhi 2000
2. John G. Webster, "Medical Instrumentation Application and Design", Third Edition, Wiley India Edition, 2007

## REFERENCES

1. Albert M Cook and Webster J G –Therapeutic medical devices Prentice Hall New York 1982
2. Khandpur R.S Hand Book of Biomedical Instrumentation –Tata McGraw Hill publication, New Delhi 2nd edition 2003
3. Jacobson B and Webster J G Medical and Clinical Engineering –Prentice Hall of India New Delhi 1999
4. Wolbarsht . M. L, Laser Application in Medicine and Biology plenum press New York 1989.

| Mapping of Course Outcomes with Programme Outcomes:<br>(1/2/3 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak |                         |     |     |     |     |     |     |     |     |      |      |      |      |      |
|-----------------------------------------------------------------------------------------------------------------------------|-------------------------|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|
| COs                                                                                                                         | Programme Outcomes(POs) |     |     |     |     |     |     |     |     |      |      |      |      |      |
|                                                                                                                             | PO1                     | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
| CO1                                                                                                                         | 3                       | 1   | -   | 2   | 2   | -   | -   | -   | -   | -    | -    | -    | 1    | 1    |
| CO2                                                                                                                         | 3                       | 1   | -   | 2   | 2   | -   | -   | -   | -   | -    | -    | -    | 1    | 1    |
| CO3                                                                                                                         | 3                       | 1   | -   | 2   | 2   | -   | -   | -   | -   | -    | -    | -    | 1    | 1    |
| CO4                                                                                                                         | 3                       | 1   | -   | 2   | 2   | -   | -   | -   | -   | -    | -    | -    | 1    | 1    |
| CO5                                                                                                                         | 3                       | 1   | -   | 2   | 2   | -   | -   | -   | -   | -    | -    | -    | 1    | 1    |



**COURSE OBJECTIVES**

To enable the students to

- understand the fundamental cellular radio concepts
- analyse the different ways of radio propagation models
- study various modulation and equalization techniques
- learn about multiple access and speech coding techniques
- know the generation of wireless networks and wireless standards

**UNIT I CELLULAR CONCEPT AND SYSTEM DESIGN FUNDAMENTALS 9**

Introduction to wireless communication: Evolution of mobile communications-mobile radio systems Examples. Cellular Concept: Frequency reuse-channel assignment-hand off-Interference and system capacity-tracking and grade of service-Improving Coverage and capacity in Cellular systems.

**UNIT II MOBILE RADIO PROPAGATION 9**

Free space propagation model-reflection-diffraction-scattering-link budget design-Outdoor Propagation models Indoor propagation models-Small scale Multipath propagation-Impulse model- Small scale Multipath measurements-parameters of Mobile multipath channels-types of small scale fading

**UNIT III MODULATION TECHNIQUES AND EQUALIZATION 9**

Modulation Techniques: Minimum Shift Keying-Gaussian MSK-M-ary QAM-M-ary FSK Orthogonal Frequency Division Multiplexing-Performance of Digital Modulation in Slow-Flat Fading Channels and Frequency Selective Mobile Channels. Equalization: Survey of Equalization Techniques-Linear Equalization Non-linear Equalization-Algorithms for Adaptive Equalization Diversity Techniques, RAKE receiver.

**UNIT IV CODING AND MULTIPLE ACCESS TECHNIQUES 9**

Coding: Vocoder-Linear Predictive Coders-Selection of Speech Coders for Mobile Communication GSM Codec-RS codes for CDPD. Multiple Access Techniques: FDMA-TDMA-CDMA-SDMA Capacity of Cellular CDMA and SDMA

**UNIT V WIRELESS SYSTEMS AND STANDARDS 9**

Second Generation and Third Generation Wireless Networks and Standards-WLL-Bluetooth-AMPS-GSM-IS-95 and DECT

**TOTAL PERIODS 45**

**COURSE OUTCOMES**

Upon the completion of the course, the students will be able to

- examine the various cellular radio concepts used in wireless communication
- evaluate the different radio propagation models
- compare different equalization and diversity techniques
- synthesize different multiple access techniques.

- analyze different wireless standards and generations

### TEXT BOOKS

1. T.S.Rappaport, “Wireless Communications: Principles and Practice, Second Edition, Pearson Education/Prentice Hall of India, Third Indian Reprint 2003.
2. Andreas.F.Molisch, “Wireless Communication”, John Wiley- India 2006

### REFERENCES

1. R. Blake, “ Wireless Communication Technology”, Thomson Delmar, 2003
2. W.C.Y.Lee, "Mobile Communications Engineering: Theory and applications, Second Edition, McGraw- Hill International, 1998
3. Stephen G. Wilson, “ Digital Modulation and Coding”, Pearson Education, 2003
4. KavehPahlavan , Prashant Krishnamurthy, “Principles of Wireless Networks: A unified approach”, Prentice Hall – 2002

| Mapping of Course Outcomes with Programme Outcomes:<br>(1/2/3 indicates strength of correlation) 3-Strong, 2-Medium , 1-Weak |                         |     |     |     |     |     |     |     |     |      |      |      |      |      |
|------------------------------------------------------------------------------------------------------------------------------|-------------------------|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|
| COs                                                                                                                          | Programme Outcomes(POs) |     |     |     |     |     |     |     |     |      |      |      |      |      |
|                                                                                                                              | PO1                     | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
| CO1                                                                                                                          | 3                       | 1   | -   | 2   | 2   | -   | -   | -   | -   | -    | -    | 1    | 1    | 1    |
| CO2                                                                                                                          | 3                       | 1   | -   | 2   | 2   | -   | -   | -   | -   | -    | -    | 1    | 1    | 1    |
| CO3                                                                                                                          | 3                       | 1   | -   | 2   | 2   | -   | -   | -   | -   | -    | -    | 1    | 1    | 1    |
| CO4                                                                                                                          | 3                       | 1   | -   | 2   | 2   | -   | -   | -   | -   | -    | -    | 1    | 1    | 1    |
| CO5                                                                                                                          | 3                       | 1   | -   | 2   | 2   | -   | -   | -   | -   | -    | -    | 1    | 1    | 1    |



**COURSE OBJECTIVES**

To enable the students to

- know the concepts in RF design
- understand the communication concepts in microelectronics
- learn about transceiver architecture
- gain knowledge on the concepts and types of PLL
- study the power amplifiers concepts in microelectronics

**UNIT I CONCEPTS IN RF DESIGN**

9

Introduction to RF-Design challenges of RF-General consideration-Effects of Nonlinearity-Noise Sensitivity and dynamic range-Passive impedance Transformation-Scattering parameters-Analysis of Nonlinear dynamic systems-Volterra series.

**UNIT II COMMUNICATION CONCEPTS**

9

General consideration-Analog and Digital modulation-Spectral regrowth-Mobile RF communications Multiple access techniques-Wireless standards.

**UNIT III TRANSCEIVER ARCHITECTURE**

9

Receiver architecture: Basic heterodyne Receivers-Modern Heterodyne Receivers-Direct conversion receivers- Image Reject Receivers-Low IF Receivers. Transmitter architectures: Direct conversion transmitters-Modern direct conversion transmitters-Heterodyne Transmitters-Other TX architectures- OOK transceivers.

**UNIT IV PHASE LOCKED LOOPS**

9

Basic concepts-Type-I PLLs-Type-II PLLs-PFD/CP Non idealities-Phase noise in PLLs Loop Bandwidth Design procedure

**UNIT V POWER AMPLIFIERS**

9

General considerations-Classification of power amplifiers-High efficiency power amplifiers-Cascode output Stages-Large signal impedance matching-Basic Linearization Techniques-Polar modulation-Out phasing Doherty power amplifier-Design Examples

**TOTAL PERIODS 45**

**COURSE OUTCOMES**

Upon the completion of the course, the students will be able to

- apply the concepts in RF design
- analyze the communication concepts in microelectronics
- compare various transceiver architecture
- evaluate the concepts and types of PLL in microelectronics
- examine power amplifiers concepts in RF microelectronics.

### TEXT BOOKS

1. B.Razavi, "RF Microelectronics", Prentice Hall PTR, 1998.
2. Behzad Razavi, "Design of Analog CMOS Integrated Circuits", McGraw Hill, Second Edition, 2008

### REFERENCES

1. R. Jacob Baker, H.W.Li and D.E. Boyce, "CMOS Circuit Design, Layout and Simulation", Prentice-Hall of India, 1998
2. Y.P.Tsividis, "Mixed Analog and Digital VLSI Devices and Technology", McGraw Hill, 1996
3. Robert E Colin, "Foundations for Microwave Engineering", John Wiley & Sons Inc, 2005

Mapping of Course Outcomes with Programme Outcomes:  
(1/2/3 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak

| COs | Programme Outcomes(POs) |     |     |     |     |     |     |     |     |      |      |      |      |      |
|-----|-------------------------|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|
|     | PO1                     | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
| CO1 | 3                       | 1   | -   | 2   | 2   | -   | -   | -   | -   | -    | -    | -    | 1    | 1    |
| CO2 | 3                       | 1   | -   | 2   | 2   | -   | -   | -   | -   | -    | -    | -    | 1    | 1    |
| CO3 | 3                       | 1   | -   | 2   | 2   | -   | -   | -   | -   | -    | -    | -    | 1    | 1    |
| CO4 | 3                       | 1   | -   | 2   | 2   | -   | -   | -   | -   | -    | -    | -    | 1    | 1    |
| CO5 | 3                       | 1   | -   | 2   | 2   | -   | -   | -   | -   | -    | -    | -    | 1    | 1    |



**COURSE OBJECTIVES**

To enable the students to

- know about virtual versus traditional instruments and programming techniques
- learn about A/D and D/A converter and data acquisition
- study PC buses, Instrumentation buses and network protocols
- introduce the concepts of real time control
- learn about design using VI software

**UNIT I VIRTUAL INSTRUMENTATION 9**

Virtual Instrumentation-Definition and Flexibility-Block diagram and Architecture for Virtual Instruments versus Traditional Instruments-Review of software in Virtual Instrumentation-VI Programming techniques-VI sub-VI Loop and Charts-Arrays-Clusters and Graphs-Case and Sequence Structures-Formula nodes-String and File Input/Output.

**UNIT II DATA ACQUISITION IN VIRTUAL INSTRUMENTATION 9**

A/D and D/A converters-Plug-in Analog Input / Output cards-Digital Input and Output Cards Organization of the DAQ VI system-Opto-isolation-Performing analog input and analog output Scanning multiple analog channels-Issues involved in selection of Data acquisition cards-Data acquisition modules with serial communication-Design of digital voltmeter with transducer input Timers and Counters

**UNIT III COMMUNICATION NETWORKED MODULES 9**

Introduction to PC Buses-Local busses: ISA-PCI-RS232-RS422 and RS485-Interface Buses: USB PCMCIAVXI-SCXI and PXI-Instrumentation Buses: Modbus and GPIB-Networked busses-ISO/OSI Reference model-Ethernet and TCP/ IP Protocols

**UNIT IV REAL TIME CONTROL IN VIRTUAL INSTRUMENTATION 9**

Designs using VI Software -ON/OFF controller-Proportional controller-Modeling and basic control of level and reactor processes-Case studies on development of HMI-SCADA in VI

**UNIT V OPERATING SYSTEM AND HARDWARE OVERVIEW 9**

PC architecture-current trends-operating system requirements-PC based instrumentation-analog and digital interfaces- PXI and SCXI main frame-modular Instruments-Transducers-power-speed and timing considerations.

**TOTAL PERIODS 45**

**COURSE OUTCOMES**

Upon the completion of the course, the students will be able to

- examine virtual instrumentation concepts.
- analyze the various acquisition methodologies.
- evaluate traditional and virtual instrumentation.

**EC16802****PROJECT WORK (PHASE II)****0 0 12 6****COURSE OBJECTIVES**

To enable the students to

- learn to work as a member of a project team.
- understand project management tasks.
- simulate software solution for a real-time, industry relevant problem
- develop a hardware for a real-time, industry relevant problem

Every student will be required to undertake a suitable project work in the Department during VIII semester, in consultation with the Head of the Department and the guide. Every student will have to submit their project report at the end of the Semester within the stipulated time as announced by the Institute/Department.

**COURSE OUTCOMES**

Upon the completion of the course, the students will be able to

- apply knowledge of basic science and engineering to Electronics and Communication Engineering problems
- recognize the real world applications and to solve with core engineering knowledge.
- analyze and work on multidisciplinary tasks
- choose latest tools, software and equipment to solve real world problems identify, formulate, and model engineering equipment

**TOTAL PERIODS 180**

Mapping of Course Outcomes with Programme Outcomes:

(1/2/3 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak

| COs | Programme Outcomes(POs) |     |     |     |     |     |     |     |     |      |      |      |      |      |
|-----|-------------------------|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|
|     | PO1                     | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
| CO1 | 3                       | 2   | 3   | 2   | 3   | 2   | 1   | 1   | 2   | 2    | 3    | 1    | 3    | 2    |
| CO2 | 3                       | 2   | 3   | 2   | 3   | 2   | 1   | 1   | 2   | 2    | 3    | 1    | 3    | 2    |
| CO3 | 3                       | 2   | 3   | 2   | 3   | 2   | 1   | 1   | 2   | 2    | 3    | 1    | 3    | 2    |
| CO4 | 3                       | 2   | 3   | 2   | 3   | 2   | 1   | 1   | 2   | 2    | 3    | 1    | 3    | 2    |

