20ECT01: BASIC ELECTRONICS ENGINEERING

Credits –3	**Sessional Marks: 30**
L: T: P::2:1:0	**University Exam Marks: 70**

Course Objectives

1. To know the volt - Ampere characteristics of semiconductor devices.
2. To Gain knowledge on various Transistor Amplifiers.
3. To know the principle of operation of FET biasing schemes and Amplifiers.
4. To familiarize with negative feedback Amplifiers and oscillators.
5. To implement different op-Amp circuits.

Course Outcomes

After successful completion of the course the student should be able to

CO1. Learn PN-Diode, Transistor, FET, Amplifiers, Oscillators, IC's.

CO2. Solve problems related to Rectifiers, Transistor Amplifiers, negative feedback amplifiers, Inverting and non-inverting Op-Amp circuits.

CO3. Classify Rectifiers, BJT and FET Amplifiers, Oscillators.

CO4. Analyze the biasing schemes of Transistors, FET's, rectifiers and Amplifiers.

CO5. Apply rectifiers, BJT Amplifiers, FET amplifier, negative Feedback Amplifiers, oscillators, OP-Amps for electronic systems.

UNIT I

PN Junction Diode: Semiconductor materials, PN junction diode, Volt-ampere characteristic and applications, Half wave rectifier, Full wave rectifier, Bridge rectifier, Filters.

UNIT II

Bipolar Junction Transistor: Construction, characteristics and parameters, Transistor as amplifier, Biasing, CB, CE, CC amplifiers and their comparison.

UNIT III

Field Effect Transistor: Construction, characteristics and parameters of JFET, depletion and enhancement type MOSFETS, Biasing, JFET amplifiers, CS,CD and CG amplifiers and their comparison.

UNIT IV

Feedback Amplifiers and Oscillators: Concept of Feedback, advantages of Negative Feedback, types of feedback circuits, Bark Hausen criterion, RC phase shift and wein bridge oscillators, Hartley and Colpitts oscillators.

UNIT V

Integrated Circuit Applications: Op-Amp applications, inverting and Non-inverting amplifiers, comparator, Summer, Integrator, Astable and Monostable Multi-vibrators.

Text Books

1. J.Milliman and C.C.Halkias, Satyabratajit, "Integrated Electronics", 2nd edition, TMH, 1998.
2. Allen Mottershead, "Electronic Devices and Circuits", PHI Private Limited, 1979.

Reference Books

1. Robert L.Boylestad, Louis Nashelsky-"Electronic Devices and Circuit Theory", 9th Edition, 2008.
2. S.Salivahana, N.Suresh Kumar, A.Vallavaraj-"Electronic Devices and Circuits",2nd Edition,2008,TMH

Course Outcomes – Program Outcomes – ProgramSpecific Outcomes (CO-PO-PSO) Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	H	M	-										H		
CO2		H	M	L					L	L	L		H	M	
CO3	H	M											H		
CO4	H	M	L	L										L	H
CO5			H	M		M	L		L	L	L	L		L	H

20ECT02:ELECTRONIC DEVICES AND CIRCUITS

Credits -3	**Sessional Marks: 30**
L: T: P::2:1:0	**University Exam Marks: 70**

Course Objectives

1. To know Basic concepts of PN Diode, Rectifiers and Filters.
2. To learn different Transistor configurations, characteristics, parameters, Amplifiers and h-parameter models.
3. Familiarize with the concepts of JFET, MOSFET and biasing schemes and Amplifiers.
4. To gain knowledge on low frequency and high frequency analysis of BJT and FET Amplifiers.
5. To know the principles and operations of special purpose Electronic devices.

Course Outcomes

After successful completion of the course the student should be able to

CO1. Define the concepts of Diodes, Rectifiers, Filters, Amplifiers and FETs.

CO2. Analyze different Transistor small signal models, Low frequency and High frequency responses.

CO3. Identify the applications of Diodes, Transistors, Amplifiers, FETs and special purpose electronic devices.

CO4. Solve problems related to Transistors Hybrid models,current Gains, voltage gains, input and output resistances.

CO5. Compare different amplifiers and know their applications.

UNIT I

Semiconductors and PN Junction Diode: Review of semiconductor P&N types, Diode equation, Volt-ampere characteristic and its temperature dependence – Diode resistance and capacitance, varactor Diode, zener diode.

Diode Applications: Half wave rectifier, Full wave rectifier, Bridge rectifier, Harmonic components in a rectifier circuit, Inductor filter, Capacitor filter, L-section Filter, π filter, Multiple L-section filter.

UNITII

Bipolar Junction Transistor: Transistor construction, NPN and PNP transistors CB, CE, CC configurations and their characteristics and parameters. Transistor as an amplifier, BJT biasing schemes, Bias stability, Hybrid model, Determination of h-parameters, small signal analysis of single stage BJT amplifiers, comparison of CE,CB,CC amplifiers, approximate model analysis.

UNIT III

Field Effect Transistor: Construction, Principle of operation of JFET, Characteristics and parameters of JFET, depletion and enhancement type MOSFETS, FET biasing schemes, small signal model analysis of CS, CD and CG amplifiers and their comparison.

UNIT IV

Frequency Response: Effect of coupling and bypass capacitors on low frequency response, Hybrid π model at high frequencies, Parameters f_β and $_{T,}$ short circuit current gain, High frequency analysis of FET amplifiers.

UNIT V

Special Purpose Electronic Devices: Principle of operation and characteristics of Tunnel Diode, Schottky Barrier Diode, SCR, UJT, Photo conductors, Photo diode and transistor, Photovoltaic cells.

Text Books

1. J.Milliman and C.C.Halkias, Satyabratajit - "Integrated Electronics" , 2nd edition, 1998, TMH.
2. Allen Mottershead-" Electronic Devices and Circuits" -PHI Private Limited, 1979

References Books

1. Robert L.Boylestad, Louis Nashelsky- "Electronic Devices and Circuit Theory" 9th Edition, 2008.
2. S.Salivahana, N. Suresh Kumar, A. Vallavaraj- "Electronic Devices and Circuits", 2nd Edition, 2008, TMH.

Course Outcomes-Program Outcomes -Program Specific Outcomes(CO-PO-PSO) Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	H	M	L							L	L	L	H	M	
CO2	H	M	L	L						L	L	L	H	M	
CO3		L	H	M									L	L	H
CO4		H	M	L						L	L	L	M	H	
CO5			H			M	L	L					L	L	H

20ECT03: DIGITAL SYSTEM DESIGN

Credits -3	**Sessional Marks: 30**
L: T: P::2:1:0	**University Exam Marks: 70**

Course Objectives

1. To understand number representation and conversion between different representation in digital electronic circuits.
2. To analyze logic processes and implement logical operations using combinational logic circuits.
3. To understand concepts of sequential circuits and to analyze sequential systems in terms of state machines.
4. To understand characteristics of memory devices and their classification.
5. To understand concept of programmable devices, PLA, PAL, FPGA.
6. To understand the characteristics of logic families.

Course Outcomes

After successful completion of the course the student should be able to

CO1. Develop a digital logic and apply it to solve real life problems

CO2. Analyze, design and implement combinational logic circuits.

CO3. Classify different semiconductor memories.

CO4. Analyze, design and implement sequential logic circuits.

CO5. Design digital system design using PLD.

UNIT I

Number systems and codes: Review of Binary, octal decimal and hexadecimal number systems and their inter conversion. BCD, Grey, ASCII, Parity bit. Boolean Algebra and logic gates: NOT OR AND operations, Boolean theorems. De Morgan's theorem, symbols and truth tables of logic gates (NOT, OR, AND, NAND, NOR, XOR, XNOR), Universal gates

UNIT II

Combinational logic circuits: Standard forms of logical functions, minterm and maxterm specifications, simplification by K-maps and Tabular methods, and realization of logical functions using gates. Decoders and encoders, Multiplexers and de multiplexers, Digital Magnitude Comparator.

UNIT III

Sequential circuits : Latches, clocked flip-flops, SR, JK, D and T flip flops, timing problems and master-slave flip – flops, shift registers, Asynchronous and synchronous counters, Ring and Johnson counters, application of counters.

UNIT IV

Arithmetic circuits: Signed binary numbers, Binary arithmetic, Binary adders and subtractors, serial and parallel adders. Integrated-circuit parallel adder and its applications.

Memory Devices: Terminology, ROM, PROM, EPROM, EEPROM, CDROM, Semiconductor RAM and its architecture.

UNITV

Logic Families and Semiconductor Memories: TTL NAND gate, Specifications, Noise margin, Propagation delay, fan-in, fan-out, Tristate TTL, ECL, CMOS families and their interfacing, Memory elements, Concept of Programmable logic devices like PLA,PAL, FPGA. Logic implementation using Programmable Devices.

Text Books

1. M. MorrisMano,Digital Logic and Computer Design -3rdEdition,Pearson Education/PHI
2. Ananda Kumar -Switching Theory and Logic Design –PHI, 3rd Edition, 2008

References Books

1. Ronald J. Tocci, Neal S. Widmer." Digital Systems-Principlesand Applications".8th Edition Pearson 2001.
2. Taub and Schilling. " Digital Integrated Electronics." -Mc Graw Hill Co, 1st Edition, 2008.

Course Outcomes-Program Outcomes -Program Specific Outcomes(CO-PO-PSO) Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	M	H	L										H	M	
CO2	M	L	H	M									M	H	
CO3	M	L	H	M									M	H	
CO4	M	M		L									L	M	H
CO5			H	M					L	M	L	M		M	H

20ECT04 -SIGNALS AND SYSTEMS

Credits –4	**Sessional Marks: 30**
L: T: P::3:1:0	**University Exam Marks: 70**

Course Objectives

1. To understand the fundamental characteristics of signals and systems.
2. To understand the concepts of vector space, inner product space and orthogonal series.
3. To understand signals and systems in terms of both time and transform domains.
4. To develop the mathematical skills to solve problems involving convolution, filtering, modulation and sampling.

Course Outcomes

After successful completion of the course the student should be able to

CO1. Understand the mathematical description and representation of continuous and discrete signals and systems

CO2. Develop input output relationship for LTI system and understand the convolution operator for continuous and discrete time systems

CO3. Understand and resolve the signals in frequency domain using Fourier series and transforms.

CO4. Understand the limitations of Fourier transform and need for Laplace transform and develop mathematical models.

CO5. The ability to analyze the system in S-domain

UNIT I

Signal Analysis & Fourier Series: Exponential and Sinusoidal Signals, Continuous and Discrete Time Signals, Discrete Time Signal representation using Complex Exponential and Sinusoidal Components Periodicity of Discrete Time using Complex Exponential Signal, Concepts of Impulse Function, Unit Step Function, Signum Function. Properties of Fourier Transforms Involving Impulse Function and Signum Function. Introduction to Hilbert Transform. Representation of Fourier series.

UNIT II

Signal Transmission through Linear Systems: Discrete Time Signals and Sequences, Linear Shift Invariant Systems (LTI), Stability and Causality, Linear Constant Coefficient Difference Equations. Frequency Domain Representation of Discrete Time Signals and Systems Linear System, Impulse Response, Response of Linear System, Linear Time Variant (LTV) system, Transfer function of a LTI system. Filter Characteristics of Linear Systems. Distortion less Transmission through a system, Signal Bandwidth, System Bandwidth, Ideal LPF, HPF AND BPF Characteristics, Causality and Poly- Wiener Criterion for Physical Realization, Relationship between Bandwidth and Rise Time.

UNIT III

Convolution and Correlation of Signals: Concept of Convolution in Time Domain and Frequency Domain, Graphical Representation of Convolution, Convolution Property of Fourier Transforms. Cross Correlation and Auto Correlation of Functions, Properties of Correlation Function, Energy Density Spectrum, Parseval's Theorem, Power Density Spectrum, Relation between Auto Correlation Function and Energy/Power Spectral Density Function. Relation between Convolution and Correlation, Detection of Periodic Signals in the Presence of Noise by Correlation, Extraction of signal from Noise by Filtering.

UNIT IV

Laplace Transforms: Review of Laplace Transforms, Partial Fraction Expansion, Inverse Laplace Transform, Concept of Region of Convergence (ROC) for Laplace Transforms, Constraints on ROC for various Classes of Signals, Properties of L.T's. Laplace transform of Certain Signals using Waveform Synthesis.

State –space analysis and multi input & multi output representation: Sampling theorem – Graphical and analytical proof for Band Limited Signals, impulse sampling, Natural and Flat top Sampling, Reconstruction of signal from its samples, Effect of under sampling – Aliasing, Introduction to Band Pass sampling

UNIT V

Z-Transform: Concept of Z-Transform of a Discrete Sequence.Region of Convergence in Z- Transform, Constraints on ROC for Various Classes of Signals, Inverse Z- Transform, Properties of Z-Transforms. Transfer Function-BIBO Stability-System Response to Standard Signals-Solution of Difference Equations with Initial Conditions.

Text Books

1. B.P. Lathi–" Signals, Systems and Communications" - BS Publications, 2003.
2. A. V. Oppenheim, A.S. Willsky and S. H. Nawab – "Signals and Systems" PHI, 2nd Edition.

Reference Books

1. Simon Haykin and Van Veen, Wiley –"Signals & Systems" – 2 nd Edition.
2. Michel J. Robert – "Fundamentals of Signals and Systems", MGH International Edition, 2008.
3. C. L. Philips, J. M. Parr and Eve A. Riskin,-" Signals, Systems and Transforms " Pearson Education, 3 rd Edition, 2004.

Course Outcomes-Program Outcomes - Program Specific Outcomes (CO-PO-PSO) Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	H	H	M	L									H	L	
CO2			H	M	M				M	L	L		L	L	M
CO3		H	H	M	L				L	M			M	L	
CO4		H	H	M	L				L	M			L	M	
CO5		M	H	H									M	L	H

20ECT05: ANALOG ELECTRONICS

Credits – 4	**Sessional Marks: 30**
L: T: P::3:1:0	**University Exam Marks: 70**

Course Objectives

1. To Learn the principles, of different multistage and power amplifiers.
2. To Familiarize with the concept of Feedback amplifiers and effects of Negative Feedback.
3. To compare the characteristics of different wave shaping circuits.
4. To Study different types of oscillators and Multivibrators.
5. To learn the principle and operation of different time base generators.

Course Outcomes

After successful completion of the course the student should be able to

CO1:. Classify different multistage, power and feedback amplifiers, oscillators, Time Base generators, Waveshaping circuits.

CO2. Analyze Feedback amplifiers, Oscillators, Astable, Bistableand Monostable circuit using BJT's.

CO3. Evaluate the conversion efficiency of Class A, B, AB Amplifiers,

CO4. Calculate Rise time and Tilt of wave shaping circuits.

CO5. Compare different power amplifiers, time base generators and wave shaping circuits.

UNIT I

Multistage Amplifiers: Types of Coupling, choice of Amplifier configuration, overall voltage gain and Bandwidth of n stage amplifier, Darlington and Bootstrap circuits.

Power Amplifiers: Class-A large signal amplifier, Transformer coupled audio power amplifier, Push pull amplifier, Class B amplifier, Class AB operation Complementary symmetry power amplifier.

UNIT II

Feedback Amplifiers: Feedback concept, classification, Effects of negative feedback on gain, Stability, Noise, Distortion, Bandwidth, Input and Output resistances, Different types of feedback circuits without analysis .some practical circuits, voltage amplifiers, current amplifiers, Trans-resistance amplifier, Trans –conductance amplifier.

UNIT III

Wave shaping circuits: Types of waveforms, Characteristics of pulse waveforms. RC low pass and high pass circuits, their responses for step, pulse and square wave inputs, Rise time, Tilt, Diode as a switch, Diode clipper and clamper circuits.

UNIT IV

Sinusoidal oscillators: Bark Hausen criterion, RC Phase shift, Wein Bridge, Hartley and Colpitts oscillators, crystal oscillators.

Multivibrators : BJT switch and switching times, Inverter, Principle of operation of Bistable, Monostable, Astablemultivibrators and Schmitt trigger using BJTs.

UNITV

Time Base Generators : General features of time base signal, Methods of generating time base waveform, Exponential sweep circuit, Sweep circuit using UJT, Transistor constant current sweep, Miller and Boostrap time base generators using BJTs.

Text Books

1. Milliman and Halkias," Integrated Electronics", McGraw Hill &Co.
2. David A. Bell, "Solid State Pulse Circuits", PHI.

References Books

1. Robert L.Boylestad, Louis Nashelsky –"Electronic Devices and Circuit Theory", 9 Edition., 2008 Pearson Edition.
2. A Anand Kumar –"Pulse and Digital circuits" – 2nd edition, 2008 PHI.

Course Outcomes-Program Outcomes -Program Specific Outcomes(CO-PO-PSO) Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	H	M		M					L	L	L		H		
CO2	H	M	L	L					L	L	L		H	M	
CO3	H	M		L									L	M	H
CO4		H	M	L									H	M	
CO5		H				M	L	L					L	M	H

20ECT09: MICROPROCESSORS AND MICROCONTROLLERS

Credits –3	**Sessional Marks: 30**
L: T: P::2:1:0	**University Exam Marks: 70**

Course Objectives

1. To design and implement programs on 8085, 8086,8051 Microcontroller
2. To design I/O circuits.
3. The program prepares students to successfully analyse electronic equipment of modern usage.
4. To design Memory Interfacing circuits.
5. To design and implement 8051 microcontroller based systems.

Course Outcomes

After successful completion of the course the student should be able to

CO1. Assess and solve basic binary math operations using the microprocessor.

CO2. Apply knowledge and demonstrate programming proficiency using the various addressing modes and data transfer instructions of microprocessors and microcontrollers.

CO3. Compare accepted standards and guidelines to select appropriate Microprocessor (8085 & 8086) and Microcontroller to meet specified performance requirements.

CO4. Select appropriate assemblers of a microprocessor and microcontroller.

CO5. Design electrical circuitry to the Microprocessor I/O ports in order to interface the processor to external devices.

CO6. Evaluate assembly language programs and download the machine code that will provide solutions in real-world control problems.

UNITI

8086 Architecture: Introduction to 8085 Microprocessor, 8086 Architecture-Functional diagram. Register Organization, Memory Segmentation. Programming Mode!. Memory addresses. Physical memory organization. Architecture of 8086, signal descriptions of 8086- common function signals. Minimum and Maximum mode signals. Timing diagrams. Interrupts of 8086.

UNIT II

Instruction Set and Assembly Language Programming of 8086: Instruction formats, addressing modes, instruction set, assembler directives, macros, simple programs involving logical, branch and call instructions, sorting, evaluating arithmetic expressions, string manipulations.

UNITIII

I/O Interface: 8255 PPI various modes of operation and interfacing to 8086. Interfacing keyboard, display, stepper motor interfacing, D/A and A/D converter. Memory interfacing to 8086, Interrupt structure of 8086, Vector interrupt table, Interrupt service routine. Serial communication standards, Serial data transfer schemes. 8251 USART architecture and interfacing. RS- 232.IEEE-4-88, Prototyping and trouble shooting.

UNITIV

Introduction to Microcontrollers: Overview of 8051 microcontroller. Architecture. I/O Ports. Memory organization, addressing modes and instruction set of 8051, simple programs Interrupts, timer/ Counter and serial communication, programming Timer Interrupts, programming external hardware interrupts, programming the serial communication interrupts, programming8051timersandcounters

UNIT V

8051 Interrupts: 8051 Real Time Control Interrupts, Timer/ Counter And Serial Communication, Programming Timer Interrupts, Programming External Hardware Interrupts, Programming The Serial Communication Interrupts, Programming 8051 Timers And Counters

Text Books

1. D. V. Hall. Microprocessors and Interfacing, TMH. 2nd edition 2006.
2. Kenneth. J. Ayala. The 8051 microcontroller, 3rd edition, Cengage learning, 2010

Reference Books

1. K. Ray and K.M. Bhurchandani,-" Advanced Microprocessors and Peripherals" TMH, 2nd edition2006.
2. K. Uma Rao, Andhe Pallavi,- "The 8051 Microcontrollers, Architecture and programming and Applications " Pearson,2009.
3. Ajay. V. Deshmukh, - "Microcontrollers and application "TMH, 2005

Course Outcomes-Program Outcomes -Program Specific Outcomes (CO-PO-PSO) Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	M	H	L										H		
CO2	H	M	L	L									H	M	
CO3			L	H		M	L							L	M
CO4		L	L	M	H									L	M
CO5			H	M	M	L					M		H	L	M
CO6			H	M	M	L					M		H	L	M

20ECT06: PROBABILITY THEORY AND STOCHASTIC PROCESS

Credits –3 **Sessional Marks: 30**

L: T: P::2:1:0 **University Exam Marks: 70**

Course Objectives

To expose the students to the basics of probability theory and random processes essential for their subsequent study of analog and digital communication

Course outcomes

1. Understand the axiomatic formulation of modern probality. Theory and Think of ramdom variables as an intrinsic need for the analysis of random phenomena.
2. Characterize probability models and function of random variables based on single &multiple random variables
3. Understand the concept of in equalities and probabilistic limits.
4. Understand the concept of random processes
5. Poisson and Gaussian process and representation of low pass and band pass noise models.

UNIT – I

Probability: Probability introduced through Sets and Relative Frequency: Experiments and Sample Spaces, Discrete and Continuous Sample Spaces, Events, Probability Definitions and Axioms, Mathematical Model of Experiments, Probability as a Relative Frequency, Joint Probability, Conditional Probability, Total Probability, Bays' Theorem, and Independent Events.

The Random Variable : Definition of a Random Variable, Conditions for a Function to be a Random Variable, Discrete and Continuous, Mixed Random Variable, Distribution and Density functions, Properties, Binomial, Poisson, Uniform, Gaussian, Exponential, Raleigh, Conditional Distribution, Methods of defining Conditioning Event, Conditional Density, Properties.

UNIT – II

Multiple Random Variables : Vector Random Variables, Joint Distribution Function, Properties of Joint Distribution, Marginal Distribution Functions, Conditional Distribution and Density – Point Conditioning, Conditional Distribution and Density – Interval conditioning, Statistical Independence, Sum of Two Random Variables, Sum of Several Random Variables, Central Limit Theorem, (Proof not expected). Unequal Distribution, Equal Distributions.

Operations on Multiple Random Variables: Expected Value of a Function of Random Variables, Joint Moments about the Origin, Joint Central Moments, Joint Characteristic Functions and Joint Gaussian Random Variables: Two Random Variables case, N Random Variable case, Properties, Transformations of Multiple Random Variables, Linear Transformations of Gaussian Random Variables.

UNIT – III

Stochastic Process – Temporal Characteristics: The Random Process Concept, Classification of Processes, Deterministic and Nondeterministic Processes, Distribution and Density Functions, concept of Stationarity and Statistical Independence. First-Order Stationery Processes, Second- Order and Wide-Sense Stationarity, (N-Order) and Strict-Sense Stationarity, Time Averages and Ergodicity, Mean-Ergodic Processes, Correlation-Ergodic Processes, Autocorrelation Function & Its Properties, Cross-Correlation Function & its Properties, Covariance Functions, Gaussian Random Processes, Poisson Random Process.

UNIT – IV

Random Processes – Spectral Characteristics: The Power Spectrum: Properties, Relationship between Power Spectrum and Autocorrelation Function, The Cross-Power Density Spectrum, Properties, Relationship between Cross-Power Spectrum and Cross-Correlation Function.

UNIT – V

Linear Systems with Random Inputs: Random Signal Response of Linear Systems: System Response – Convolution, Mean and Mean-squared Value of System Response, autocorrelation Function of Response, Cross-Correlation Functions of Input and Output, Spectral Characteristics of System Response: Power Density Spectrum of Response, Cross-Power Density Spectrums of Input and Output, Band pass, Band-Limited and Narrowband Processes, Properties.

TEXT BOOKS:

1. Probability, Random Variables & Random Signal Principles - Peyton Z. Peebles, TMH, 4th Edition, 2001.

2. Probability, Random Variables and Stochastic Processes – Athanasios Papoulis and S. UnnikrishnaPillai, PHI, 4th Edition, 2002

Reference Books:

1. Communication Systems Analog& Digital – R.P. Singh and S.D. Sapre, TMH, 1995.

2. Probability and Random Processes with Application to Signal Processing – Henry Stark and John W.Woods, Pearson Education, 3rd Edition.

3. Probability Methods of Signal and System Analysis. George R. Cooper, Clave D. MC Gillem, Oxford, 3rd Edition, 1999.

4. Statistical Theory of Communication - S.P. Eugene Xavier, New Age Publications, 2003.

5. Signals, Systems & Communications - B.P. Lathi, B.S. Publications, 2003.

Course Outcomes-Program Outcomes -Program Specific Outcomes (CO-PO-PSO) Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	**M**	**H**	**L**										**H**		
CO2	**H**	**M**	**L**	**L**									**H**	**M**	
CO3			**L**	**H**		**M**	**L**							**L**	**M**
CO4		**L**	**L**	**M**	**H**									**L**	**M**
CO5			**H**	**M**	**M**	**L**					**M**		**H**	**L**	**M**
CO6			**H**	**M**	**M**	**L**					**M**		**H**	**L**	**M**

20ECT07: ELECTROMAGNETIC THEORY AND TRANSIMISSION LINES

Credits –3 **Sessional Marks: 30**

L: T: P::2:1:0 **University Exam Marks: 70**

Course Outcomes:

- Distinguish between the static and time-varying fields, establish the corresponding sets of Maxwell's Equations and Boundary Conditions and use them for solving engineering problems.
- Analyze the Wave Equations for good conductors and good dielectrics, and evaluate the UPW Characteristics for several practical media of interest.
- Establish the proof and estimate the polarization features, reflection and transmission coefficients for UPW propagation, distinguish between Brewster and Critical Angles, and acquire knowledge of their applications.
- Determine the Transmission Line parameters for different lines, characterize the distortions and estimate the characteristics for different lines.Analyze the RF Line features and configure them as SC, OC Lines, QWTs and HWTs, and design the same for effective impedance transformation.Study the Smith Chart profile and stub matching features, and gain ability to practically use the same for solving practical problems.

UNIT-I

Electrostatics: Coulomb's Law, Electric Field Intensity,-Fields due to Different charge distributions, Electric Flux Density, Gauss Law and Applications, Electric Potential, Relations Between E and V, Maxwell's two equations for Electrostatic Fields, Energy Density, Illustrative Problems. Isotropic and Homogeneous Dielectrics, Continuity equations, Relaxation time, Poisson's and Laplace's Equations. Capacitance-Parallel plate, Coaxial, Spherical Capacitors, Illustrative Problems.

UNIT-II

Magneto statics: Biot-Savart Law, Ampere's Circuital Law and Applications, Magnetic Flux Density, Maxwell's two equations for Magneto static Fields, Magnetic Scalar and Vector Potentials, Ampere's Force law, Illustrative Problems.

Maxwell's Equations (for Time Varying Fields): Faraday's Law and Transformer EMF,, Inconsistency of Ampere's Law and Displacement Current Density, Maxwell's Equations in Different Final Forms and Word Statements. Boundary Conditions of Electromagnetic fields: Dielectric-Dielectric and Dielectric-Conductor Interfaces, Illustrative Problems.

UNIT-III

EM Wave Characteristics-I: Wave Equations for Conducting and Perfect Dielectric Media, Uniform Plane Wave-Definition, All Relations between E & H, Sinusoidal Variations, Wave Propagation in Lossless and Conducting Media, Conductors and

Dielectrics-Characterization, Wave propagation in good conductors and good Dielectrics, Polarization. Illustrative Problems.

EM Wave Characteristics-I:– Reflection and Refraction of Plane Waves-Normal and Oblique Incidences, for both Perfect Conductor and Perfect Dielectrics, Brewster Angle, Critical Angle and Total Internal Reflection, Poynting Vector, and Poynting Theorem – Applications, Illustrative Problems.

UNIT-IV

Transmission Lines -I: Types, parameters, Transmission line equations, Transmission line Characteristics, Infinite line concepts and Lossless /Low loss Characterization, Distortion –Condition for Distortion less and Minimum Attenuation. Illustrative Problems.

UNIT-V

Transmission Lines -II: Input impedance Relations, SC and OC lines, Reflection coefficient, VSWR. UHF lines as Circuit elements $\lambda/4, \lambda/2$ lines –Impedance transformation significance of Zmin and Z max, Smith chart Configurations & its applications, Stub matching and Illustrative Problems.

Text books:

1. Matthew N.O. Sadiku, "Elements of Electromagnetics," Oxford Univ. Press, 4th ed., 2008
2. Electromagnetic Waves and Radiating Systems –E.C. Jorden and K.G. Balmain, PHI, 2nd ed., 2000

References:

1. R.K. Shevgoankar, Electromagnetic Waves, Tata McGraw Hill India, 2005.
2. Networks, Lines and Fields – John D. Ryder, 2nd Ed., 1999, PHI.

Engineering Electromagnetics – William H. Hayt Jr. and John A. Buck, 7th Ed., 2006, MC Graw Hill Education.

20ECT08:ANALOG COMMUNICATIONS

Credits –3 **Sessional Marks: 30**

L: T: P::2:1:0 **University Exam Marks: 70**

Course Objectives

1. The fundamentals of basic communication system, types of noise affecting communication system and noise parameters.
2. Need for modulation, amplitude, frequency modulation and demodulation techniques.
3. Various radio receivers with their parameters.
4. Need of sampling and different sampling techniques.
5. Generation and detection of pulse modulation techniques and multiplexing.

Course Outcomes

After successful completion of the course the student should be able to

CO1. Analyse and compare different analog modulation schemes for their efficiency and bandwidth.

CO2. Understand different frequency and phase modulations and comparing their efficiencies with amplitude modulations.

CO3. Evaluate various AM and FM transmitters and Receivers.

CO4. Interpret the behaviour of a communication system in presence of noise.CO5. Investigate pulse modulation techniques and analyze their system performance.

UNIT I

Review of signals and systems, Frequency domain representation of signals, Elements of Electrical communication systems – Modulation and its needs and types – Fundamental physical limitations – Electromagnetic spectrum and Areas of Applications. Amplitude modulation – Full AM, DSBSC and SSB – Generation and detection methods – VSB – Frequency translation – FDM – Nonlinear distortion and inter modulation.

UNIT II

Angle modulation – Phase and frequency modulation – NBFM – WBFM – Multitone FM – Transmission Bandwidth of FM – Direct and indirect generation of FM – Demodulation methods – Nonlinear effects – FM Versus AM.

UNIT III

Block diagram study of Radio Broadcast AM and FM transmitters Super heterodyne Receivers – Choice of IFAGC – Tracking – Characteristic of Radio Receivers – FM stereo.

UNIT IV

Noise – External and internal sources of Noise – Gaussian and white noise characteristics, Noise calculations – Noise equivalent resistance – Noise figure – Noise temperature Effects of noise in AM and FM modulation systems – FM threshold effect –pre-emphasis and de-emphasis.

UNIT V

Pulse analog modulation – TDM, types of pulse modulation-PAM, PWM, PPM, Generation and demodulation of PAM,PWM and PPM,TDM.

Text Books

1. Simon Haykin, "Communication Systems",4th Edition, Wiley & sons.
2. H.Taub & D.Schilling, Gautamsahe, "Principle of Communication Systems", 3rd Edition, TMH, 2007.

Reference Books

1. K.Sam Shanmugam,"Analog and Digital Communication" Wiley, 2005.
2. B.P. Lathi and ZhiDing, "Modern Digital and Analog Communication Systems,"4th Edition.

Course Outcomes-Program Outcomes -Program Specific Outcomes(CO-PO-PSO) Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	H	M	L	L					L	L	L		H		
CO2	H	M	L	M					L	L	L			M	H
CO3	L		M	H										M	H
CO4	M	H	L						L	L	L			M	H
CO5	H	M	L	L					L	L	L			M	H

20ECT10-IC APPLICATIONS

Credits –3 **Sessional Marks: 30**

L: T: P::2:1:0 **University Exam Marks: 70**

Course Objectives

1. To understand the concepts, working principles and key applications of Linear Integrated circuits
2. To perform analysis of circuits based on Linear Integrated circuits
3. To design circuits and systems for particular applications using Linear Integrated circuits

Course Outcomes

After successful completion of the course the student should be able to

CO1. Understand the fundamental concepts of Differential amplifiers and op-amp.
CO2. Understand the Applications of Op-Amp.
CO3. Design different types of Active filters and waveform generators.
CO4. Use the 555 Timer circuits and Phased Locked Loop for various applications.
CO5. Evaluate the performance of ADCs and DACs.

UNIT I

Operational Amplifier: Differential Amplifier and its transfer characteristic, Classification of ICs, Ideal and practical op-amp characteristics, Internal circuit, DC and AC characteristics, Inverting and non-inverting modes of operation, DC and AC amplifiers, Voltage follower.

UNIT II

Op-Amp Linear applications: Difference Amplifier, Summer, Integrator, Differentiator, Analog computations, Instrumentation amplifier, V to I and I to V converters, Precision rectifiers, Log and Antilog amplifiers.

Op-AmpNon Linear applications Comparator, Regenerative comparator, Astable and mono stable multi vibrators using op-amp, Traingular wave generator, RC Oscillators using Op-Amp.

UNIT III

Timer and Phase Locked Loop: Introduction to 555 timer, Functional diagram, Monostable and Astable operations and Applications, Schmitt Trigger, Basic Principles of PLL, Lock and capture range, IC PLL (565), PLL applications. VCO 566.

UNIT IV

a) Active Filters: First and second order Low pass, High pass filters and Band pass filter, Band Reject filter, all pass filter.

b) Voltage Regulators: Series op-amp regulator, IC Voltage regulators, 723 regulator, Fixed voltage regulators.

UNITV

D-A &A-D Converters: Introduction, basic DAC Techniques: Weighted resistor DAC,R-2R ladder DAC , Inverted R-2R DAC, Different Types of ADCs: Parallel comparator type, Counter type, successive Approximation , and Dual slope ADCs, DAC and ADC specifications.

Text Books

1. D. Roy Choudary, Shail B. Jain, "linear Integrated circuits", New Age International Publishers, 2003
2. David A. Bell, " Operational Amplifiers and Linear ICs", PHI.

Reference Books

1. J. Michael Jacob, "Applications and Design with Analog integrated circuits", PHI, EEE, 1993.
2. Ramakant A. Gayakwad, "Op-amps and Linear Integrated Circuits", LPE 4th edition, Pearson Education.

Course Outcomes-Program Outcomes -Program Specific Outcomes(CO-PO-PSO) Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	H	M	L						L	L	L		H		
CO2	H	M	L						L	L	L		H		
CO3		H	M		M				L	L	L		H	M	
CO4		L	H	M									L	M	H
CO5	H	M	M	L									L	M	H

20ECT11: DIGITAL COMMUNICATION

Credits –3 **Sessional Marks: 30**

L: T: P::2:1:0 **University Exam Marks: 70**

Course Objectives

1. To design digital communication systems.
2. To analyze the performance of a digital communication link when additive noise is present in terms of the signal-to- noise ratio and bit error rate.
3. To compute and compare power, power spectral density and bandwidth requirements of modern communication systems.
4. To compute the probability of errors for various digital modulation techniques.
5. To evaluate the performance of spread spectrum modulation techniques.

Course Outcomes:

After successful completion of the course the student should be able to

CO1. Interpret the fundamentals of digital communications and demonstrate generation and reconstruction of different Pulse Code Modulation schemes like PCM, DPCM etc.

CO2. Demonstrate the generation and reconstruction of various pass band techniques.

CO3. Calculate different parameters like power spectrum density, probability of erroretc of base band signal for optimum transmission.

CO4. Understandthe basic concepts of Information theory and coding techniques like Huffman and Shannon- fanocoding to increase average information per bit.

CO5. Evaluate the Performance of spread spectrum communication system

UNIT I

Pulse Digital Modulation: Elements of digital communication systems, advantages of digital communication systems, Elements of PCM: Sampling, Quantization and coding, Quantization error, companding in PCM systems. Differential PCM Systems (DPCM).

Delta Modulation: Delta Modulation, its drawbacks, adaptive delta modulation, comparison of PCM and delta and adaptive delta modulation, noise in PCM and DM systems.

UNIT II

Digital Modulation Techniques: Introduction, BPSK, DPSK, DEPSK, QPSK, M-ary PSK, ASK, QASK, BFSK, M-ary FSK, MSK, Duobinary Encoding, Comparison of digital modulation techniques, Partial response signalling.

UNIT III

Data Transmission: Base band signal receiver, Inter symbol Interference and Nyquist criterion, probability of error, the optimum filter, matched filter, probability of errorusing matched filter, coherent reception, non- coherent detection of FSK, calculation of error probability of ASK BPSK, BFSK, QPSK, Time Division Multiplexing, Digital Multiplexers.

UNIT IV

Information Theory: Discrete messages, concept of amount of information and its properties. Average information, Entropy and its properties. Information rate, Mutual information and its properties. Source Coding: Introductions, Advantages, Shannon's theorem, Shannon-Fano coding, Huffman coding, efficiency calculations, channel capacity of discrete and analog Channels, capacity of a Gaussian channel, bandwidth –S/N trade off.

UNIT V

Spread Spectrum Modulation: Pseudo-noise Sequences, Generation and characteristics, Direct Sequence Spread Spectrum Modulation, Frequency Hopping Spread Spectrum Modulation, Comparison of Spread Spectrum Modulation, Applications.

Text Books

1. Digital communications- Simon Haykin, John Wiley,2005
2. "Principles of Communication Systems", Herbert Taub & Donald L Schilling Tata McGraw-Hill, 3rd Edition, 2009.

Reference Books

1. "Digital Communications", John G. Proakis, Masoud Salehi – 5th Edition, Mc Graw Hill, 2008.
2. "Modern Digital & Analog Communication Systems", B.P. Lathi, & Zhi Ding," Oxford University Press, International 4th edition, 2010.

Course Outcomes-Program Outcomes -Program Specific Outcomes (CO-PO-PSO) Mapping

	PO 1	PO 2	PO 3	PO 4	PO5	PO6	PO7	PO8	PO 9	PO1 0	PO1 1	PO12	PSO 1	PSO 2	PSO 3
CO 1	H	M	M						L	L	L				M
CO 2	L	H	M	L					L	L	L			H	M
CO 3		H	M	L					L	L	L		H	M	
CO 4		M	L						L	L	L		H	M	
CO 5			H	M									L	M	H

20ECT12: ANTENNAS & WAVEPROPOGATION

Credits –3 **Sessional Marks: 30**

L: T: P::3:0:0 **University Exam Marks: 70**

Course Objectives

1. To learn Antenna parameters and radiation patterns of different types of Antennas
2. To know different types of Broadband Antennas
3. To study about different types of Antenna arrays
4. To distinguish between modes of propagation and theirapplications

Course Outcomes

After successful completion of this course the student will be able to

CO1: Understand Antenna parameters

CO2: Calculate the radiation resistance for Quarter wave monopole and Half wave dipole and the principle of Pattern multiplication

CO3: Know the applications of Folded dipole and its use in design of Yagi-uda array

CO4: Analyze and compare different propagation techniques

CO5: Derive formulas for Critical frequency, MUF, Skip distance

UNIT I

Radiation Fundamentals: Definition of an antenna, Retarded potential, relation between potentials and time varying fields. Far-field approximation. Radiation from a current element. Antenna parameters – Radiation pattern, Radiation intensity, Directivity, Gain, HPBW, Effective aperture, relation between Directivity and maximum Effective aperture

UNIT II

Linear wire Antennas and Arrays: Current distribution on thin linear wire antennas. Half-wave dipole and Quarter-wave monopole. Array of two point sources. Principle of pattern multiplication. Uniform linear arrays – Broad side and End fire cases.

UNIT III

Broadband antennas – Long wire, V and Rhombic antennas, folded dipole, Yagi-Uda array. Log-periodic dipole array and Helical antenna.

UNITIV

Surface wave and Space wave propagation: Friis transmission formula. Salient features of Sommerfeld's theory. Ground wave field strength calculation. Antennas located over a flat earth. Effect of curvature of earth. Refraction of radio waves in troposphere. Effective radius of earth. Radio horizon and maximum radio range.

UNIT V

Sky wave propagation: Structure of ionosphere, Mechanism of wave reflection in ionosphere. Critical frequency, MUF, Virtual height, Skip distance. Effect of earth's magnetic field, Faraday rotation

Textbooks:

1. C. A. Balanis, "Antenna Theory- Analysis and design", John Wiley,3rd Edition.,1982
2. J. D. Krauss, "Antennas", McGraw -Hill,2nd Edition.,1988.

Reference books:

1. R.E Collin," Antennas and Radio Wave Propagation", McGraw Hill,1985.
2. J. Griffiths, "Radio wave propagation and Antennas", Prentice Hall International.

Course Outcomes-Program Outcomes -Program Specific Outcomes(CO-PO-PSO) Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	H	M			M							L	L		
CO2	M	H	L						M	L		L	H	L	L
CO3	L	L	H	M		H					L		H	L	L
CO4		M	M				L					M	L	M	M
CO5	M	L	H	M									H		L

20ECT13: DIGITAL SIGNAL PROCESSING

Credits –3 **Sessional Marks: 30**

L: T: P::2:1:0 **University Exam Marks: 70**

Course Objectives

1. To make students familiar with the most important methods in DSP, including digital filter design, transform-domain processing and importance of Signal Processors.
2. To make students aware about the meaning and implications of the properties of systems and signals.

Course Outcomes

After successful completion of the course the student should be able to

CO1. Use concepts of trigonometry, complex algebra, Fourier transform, z-transform to analyze the operations on signals and acquire knowledge about Systems

CO2. Select proper tools for analog-to-digital and digital-to-analog conversion. Also select proper tools for time domain and frequency domain implementation.

CO3. Design, implement, analyse and compare of digital filters for processing of discrete time signals

CO4. Integrate computer-based tools for engineering applications

CO5. Employ signal processing strategies at multidisciplinary team activities

UNIT I

Discrete-Time Signals And Systems: Discrete time signals and systems: Sequences; representation of signals on orthogonal basis; Representation of discrete systems using difference equations, Sampling and reconstruction of signals - aliasing; Sampling theorem and Nyquist rate.

UNIT II

Z-Transform And Discrete Fourier Transform: Z-Transform, Region of Convergence, Analysis of Linear Shift Invariant systems using z-transform, Properties of z-transform for causal signals, Interpretation of stability in z-domain, Inverse z-transforms.

Frequency Domain Analysis, Discrete Fourier Transform (DFT), Properties of DFT, Connvolution of signals, Fast Fourier Transform Algorithm, Parseval's Identity, Implementation of Discrete Time Systems.

UNIT III

Design Of Digital Filters: FIR Digital filters: Windowing method, strurctures of FIR filters Effect of finite register length in FIR filter design. Parametric and non-parametric spectral estimation.

IIR Digital Filters: Butterworth, Chebyshev and Elliptic Approximations; Low-pass, Band-pass, Band-stop and High-pass filters. Strurctures of IIR filters.intorduction to multi rate digital signal processing.

UNIT IV

Applications Of Digital Signal Processing : Correlation Functions and Power Spectra, Stationary Processes, Optimal filtering using ARMA Model, Linear Mean-Square Estimation, Wiener Filter.

UNIT V

Digital Signal Processors: Introduction to Programmable DSP's, Multiplier and Multiplier accumulator (MAC), Modified bus structures and Memory Acess Schemes in P-DSP's Multiplier Access Memory, Multi ported Memory, VLIW Architecture, Pipelining, Special addressing modes in PDSPs, On-chip Peripherals.

Features Of TMS3210C5X Processors: Internal Architecture, External Memory accessories, Pipeline operations, Peripherals.

Text Books

1. J. G. Proakis and D.G. Manolakis, "Digital Signal Processing: Principles, Algorithms and Applications", Prentice Hall, 1997.
2. S. K. Mitra, "Digital Signal Processing: A computer based approach", McGraw Hill, 2011.

Reference Books

1. L. R. Rabiner and B. Gold, "Theory and Application of Digital Signal Processing", Prentice Hall, 1992.
2. J. R. Johnson, "Introduction to Digital Signal Processing", Prentice Hall, 1992.
3. 3.A.V. Oppenheim and R. W. Schafer, "Discrete Time Signal Processing", Prentice Hall, 1989.

Course Outcomes - Program Outcomes - Program Specific Outcomes (CO-PO-PSO) Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	H	H	M	L	M				L	H	H	L	H	M	
CO2		M	M		H					L	M		M	H	L
CO3		M	M		H					L	M		H	M	L
CO4					H	M		L	M	M			M	L	H
CO5		L	L						H		L	M		M	H

20ECT14: MICROWAVE THEORY

Credits –3 **Sessional Marks: 30**

L: T: P::2:1:0 **University Exam Marks: 70**

Course Objectives

1. To study characteristics of Microwave tube Generators and Amplifiers
2. ToUnderstand different semiconductor Microwave devices andapplications
3. To study different types of microwave components and their applications
4. To measure various microwave parameters using a microwave test bench
5. To study about Microwave Integrated circuits and antennas used at MW frequencies

Course Outcomes

After successful completion of the course the student should be able to

CO1. Know the knowledge of Microwave frequency bands, amplifiers, oscillators and efficiency expression for signal generators.

CO2. Study about different types of Microwave Semi conductor Diodes and Transistors CO3.Derive scattering parameters for Microwave Tees, couplers and networks.

CO4. Measure various Microwave parameters

CO5. Know Fabrication techniques of IC's in Microwave frequencies.

UNITI

Introduction to Microwaves: Microwave frequency bands, Mathematical model of Microwave transmission –concept of mode, features of TE and TM modes.

Microwave Tubes: Klystron amplifier, Reflex klystron oscillator, Traveling wave tube amplifier and magnetron oscillator.

UNITII

Semiconductor devices: Tunnel diode, GUNN diode, IMPATTdiode, PIN diode, Crystal diode, Schottky Barrier diode, Varactordiode and parametric amplifier, MASER, microwave transistors and FET's.

UNITIII

Components: Cavity resonators, attenuators, Tees, bends, corners, windows. Coupling probes and loops, phase shifters, Rotary joints, Directional couplers, matching elements, Isolators and circulators, S-parameters of networks.

UNITIV

Measurements: Measurement of frequency, power, VSWR, Impedance, Reflection coefficient, Attenuation constant and dielectric constant, S-parameters and Q of a cavity..

UNITV

MIC's and Antennas: Advantages of MIC's, Hybrid MIC's, Strip lines and microstrip lines, Monolithic MIC's. Parabolic reflector antennas, passive reflector, Horn and lens antennas.

Text Books

1. GottapuSasiBhushanaRao ,"Microwave and Radar Engineering", ISBN – 978813179944 Pearson Education Chennai 2013.
2. Samuel Y Liao," Microwave Devices and Circuits", Pearson, 3rd Edition, 2003.

Reference Books

1. David M. Pozar ,"Microwave Engineering", Wiley ,4th Edition,Nov.2011.
2. R.E. Collins, Microwave Circuits, McGraw Hill 2nd Edition, June 1992.

Course Outcomes-Program Outcomes -Program Specific Outcomes(CO-PO-PSO) Mapping

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO7	PO8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2	PSO 3
CO 1	H	M	M	L									H	M	M
CO 2	L	M	L	L						M			H	L	H
CO 3	M	H	H	M	H				M		L	M	M	H	
CO 4	H	M	L	M	M				H	L	L	H		M	
CO 5			L	H		M						M			

20ECT15: VLSI DESIGN

Credits –3 **Sessional Marks: 30**

L: T: P::2:1:0 **University Exam Marks: 70**

Course Objectives

1. Be able to use mathematical methods and analysis ofCMOS digital electronics circuits, including logic components and their interconnect.
2. Be able to create models of moderately sized CMOS circuits that realize specifieddigital functions.
3. Have exposure to the design rules to be followed to draw the layout of any logic circuit.
4. Provide design concepts to design building blocks of data path of any system usinglogic gates.
5. Understand basic programmable logic devices and testing of CMOScircuits.

Course Outcomes

After successful completion of the course the student should be able to

CO1. Acquire qualitative knowledge about different types of MOS IC technologies.

CO2. Illustrate stick diagrams and layouts for NMOS, CMOS and BiCMOS circuits. CO3.Describe Circuit Concepts of various Gate Level Designs.

CO4. Understand Basic architectures of Data path subsystems and design simple memories using MOS transistors.

CO5. Design simple logic circuits using PLA, PAL, FPGA and CPLD.

UNITI

Introduction to IC Technology – MOS, PMOS, NMOS, CMOS & BiCMOS,Basic Electrical Properties of MOS and BiCMOS Circuits: I_{ds}-V_{ds} relationships, MOS transistor threshold Voltage, g_m, g_{ds}, Figure of merit ω_o; Pass transistor, NMOS Inverter, Variouspull ups, CMOS Inverter analysis and design, Bi-CMOS Inverters.

UNIT II

VLSI Circuit Design Processes: VLSI Design Flow, MOS Layers, Stick Diagrams, Design Rules and Layout, 2 μm CMOS Design rules for wires, Contacts and Transistors Layout Diagrams for NMOS and CMOS Inverters and Gates, Scaling of MOS circuits.

UNIT III

Gate Level Design: Logic Gates and Other complex gates, Switch logic, Alternate gate circuits, Time delays, Driving large capacitive loads, Wiring capacitance, Fan – in, Fan – out, Choice of layers.

UNIT IV

Data Path Subsystems: Subsystem Design, Shifters, Adders, ALUs, Multipliers, Parity generators, Comparators, Counters.

Synthesis: VHDL Synthesis, Circuit Design Flow, Circuit Synthesis, Simulation, Layout, Design capture tools, Design Verification Tools, Test Principles.

UNIT V

Programmable Logic Devices: PLAs, FPGAs, CPLDs, Standard Cells, Programmable Array Logic, Design Approach, Parameters influencing low power design.

CMOS Testing: CMOS Testing, Need for testing, Test Principles, Design Strategies for test, Chip level Test Techniques.

Text Books

1. Kamran Eshraghian, Eshraghian Dougles and A. Pucknell,"Essentials of VLSI circuits and systems", 2005 Edition , PHI.
2. Neil H. E Weste, David Harris, Ayan Banerjee,"CMOS VLSI Design – A Circuits and Systems Perspective", 3rdEd, Pearson, 2009.

Reference Books

1. John .P. Uyemura, "CMOS logic circuit Design", 1st Edition., Springer.
2. Wayne Wolf, "Modern VLSI Design", 3rd Edition, Pearson Education.

Course Outcomes-Program Outcomes -Program Specific Outcomes (CO-PO-PSO) Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	H	L											H		
CO2		H	H	M	M								M	H	
CO3	H	L		L										M	L
CO4		L	H	M										L	M
CO5		M	H	L										M	H

20ECT16: DETECTION AND ESTIMATION THEORY

Credits –3 **Sessional Marks: 30**

L: T: P:: 2:1:0 **University Exam Marks: 70**

Course Objectives

1. To enable the students to acquire the fundamental concepts of Signal Detection and Estimation
2. To get familiarize with different Hypotheses in detection and estimation problems
3. To introduce the methods of Detection and estimation of signals in white and non-white Gaussian noise.
4. To familiarize with the detection of random signals.

Course Outcomes

1. Acquire basics of detection theory used for signal detection and estimation.
2. Understand different hypotheses in detection and estimation problems
3. Analyse the conceptual basics of detection and estimation of signals in white and non-white Gaussian noise.
4. Compare different estimation models of random signals.
5. Analyse cost minimization technique for different estimators.

UNIT I

Review of Vector Spaces Vectors and matrices: notation and properties, orthogonality and linear independence, bases, distance properties, matrix operations, Eigen values and eigenvectors.

UNIT II

Properties of Symmetric Matrices Diagonalization of symmetric matrices, symmetric positive definite and semi definite matrices, principal component analysis (PCA), singular value decomposition.

UNIT III

Stochastic Processes: Time average and moments, ergodicity, power spectral density, covariance matrices, response of LTI system to random process, cyclostationary process, and spectral factorization.

UNIT IV

Detection Theory: Detection in white Gaussian noise, correlator and matched filter interpretation, Bayes‘ criterion of signal detection, MAP, LMS, entropy detectors, detection in colored Gaussian noise, Karhunen-Loeve expansions and whitening filters.

UNIT V

Estimation Theory Minimum variance estimators, Cramer-Rao lower bound, examples of linear models, system identification, Markov classification, clustering algorithms. Topics in Kalman and Weiner Filtering: Discrete time Wiener-Hopf equation, error variance computation, causal discrete time Wiener filter, discrete Kalman filter, extended Kalman filter, examples. Specialized Topics in Estimation: Spectral estimation methods like MUSIC, ESPIRIT, DOA Estimation.

Text Books

1. Steven M. Kay, "Fundamentals of Statistical Signal Processing, Volume I: Estimation Theory",Prentice Hall, 1993
2. Steven M. Kay, "Fundamentals of Statistical Signal Processing, Volume II: Detection Theory", 1st Edition, Prentice Hall, 1998

Reference Books

1. Thomas Kailath, BabakHassibi, Ali H. Sayed, "Linear Estimation", Prentice Hall, 2000.
2. H. Vincent Poor, "An Introduction to Signal Detection and Estimation", 2nd Edition, Springer, 1998.

Course Outcomes-Program Outcomes -Program Specific Outcomes-(CO-PO-PSO) Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3
CO1	H	M					H		
CO2	H	M					H		
CO3	H	M					H		
CO4	H	M					H	M	
CO5		M	H						H
CO6									

20ECT17 -EMBEDDED SYSTEMS

Credits –3 **Sessional Marks: 30**

L: T: P::2:1:0 **University Exam Marks: 70**

Course objectives:

1. To familiarize about the basic functions of embedded systems.
2. To inculcate the basic architecture of general purpose processors and its applications.
3. To Gain interface between analog and digital systems, also Software aspects of embedded systems.
4. To develop different State Machine and Concurrent Process Models.
5. To Learn Evolution of complication and synthesis, Verification and reuse of intellectual property cores.

Course Outcomes:

After successful completion of the course the student should be able to

CO1: Understand the embedded system concepts and technologies of embedded systems. CO2: Analyze the general process of embedded system development.

CO3: Construct interfacing between analog and digital systems and apply Software aspects of embedded systems.

CO4: Create finite state machines and analyze Communication and Synchronization among processes.

CO5: Design and develop automation.

UNIT I

Introduction: The concept of embedded systems design, Examples of embedded systems Design challenge, Processor technology, IC technology, Design technology. RT-Level combinational logic, Sequential logic (RT-Level), Custom single purpose processor design (RT-Level), Optimizing custom single purpose processors.

UNIT II

General Purpose Processors: Basic architecture, Development environment, Application specific system depth, Set processors (ASIPs), embedded Memories.

UNIT III

Technological aspects of embedded systems: Interfacing between analog and digital blocks, signal conditioning, digital signal processing. System interfacing, interfacing with external systems, user interfacing. Design tradeoffs due to process compatibility, thermal considerations, etc., Software aspects of embedded systems: real time programming languages and operating systems for embedded systems.

UNIT IV

State Machine and Concurrent Process Models: Introduction, Models Vs languages, Finite State Machine with Data path model (FSMD), Using State Machines, Program State Machine (PSM),Concurrent Process Model, Concurrent Processes, Communication among processors, Synchronization among processes, Implementation, Data flow model.

UNIT V

Introduction Automation: The parallel evolution of complication and synthesis, Logic, RT, Behavioral synthesis, System synthesis and hardware/software code sign, Verification of hardware/software co-simulation, Reuse of intellectual property cores, Embedded microcontroller cores.

Text Books

1. Frank Vahid, Tony D. Givargis, John Wiley & Sons," Embedded Systems Design – A unified Hardware/Software introduction" by Inc.2nd edition 2002.
2. J.W. Valvano, "Embedded Microcomputer System: Real Time Interfacing", Brooks/Cole, 3rd edition 2000.

Reference Books

1. Jack Ganssle, "The Art of Designing Embedded Systems", 3rd edition Newness, 1999.
2. David Simon, "An Embedded Software Primer", Addison Wesley, 2nd edition,2000.

Course Outcomes-Program Outcomes -Program Specific Outcomes(CO-PO-PSO) Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	H		L				M						H		
CO2	L	M	H	M	L					L				M	H
CO3				M	H		L		L	M	L		L	M	H
CO4		L	M	H				L	M		M	L		L	H

20ECT18: BIO-MEDICAL ELECTRONICS

Credits –3 **Sessional Marks: 30**

L: T: P:: 2:1:0 **University Exam Marks: 70**

Course Objectives

1. To acquire knowledge on basics of human physiology and cardiovascular systems.
2. To study different bio electrodes, biomedical transducers and measurements of physiological parameters.
3. To deal with ECG, EEG &EMG machines, recordings and their interpretations.
4. To learn how electronic instruments works in various departments and laboratories of a hospital and solve engineering problems related to medical field.

Course Outcomes

After successful completion of the course the student should be able to

CO1. Describe the functioning of human physiological systems.

CO2. Understand the origin of Bioelectric Potential and their measurements using electrodes and transducers.

CO3. Explore the applications of the electronic systems in biological measurements using namely the ECG, EMG and EEG machines.

CO4. Analyse the biological processes by using electronic systems.

CO5. Examine the various medical imaging techniques and discuss about therapeutic and assist Doctors about conditions of patients.

UNIT 1

Human physiological Systems: Brief introduction to human physiology, cells and their structure, transport of ions through the cell membrane, Resting and action potentials, Bioelectric potentials, Nerve tissues and organs, Different systems of human body.

UNIT II

Biomedical Transducers: The transducer and transduction principles, active transducers, passive transducers, transducers for biomedical applications. Bio-electrodes: Electrode theory, Biopotential Electrodes, Biochemical transducers.

UNIT III

Bioelectric potentials and Measurements: Resting and action potentials, propagation of action potentials, Bioelectric potentials for ECG, EMG and EEG machines.

UNIT IV

Cardiovascular System and Measurements: The heart and Cardiovascular System, measurement of blood pressure, measurement of blood flow, Impedance plethysmography, temperature measurements, ultrasonic measurement, X-ray and nuclear imaging.

UNIT V

Prosthetic Devices: Block diagram approach of Pacemakers, Defibrillators, heart-lung machine and kidney machine. Safety aids: Introduction, radiation safety instrumentation, Microshock and macroshock hazards, aids for the handicapped, devices to protect against electric hazards.

Text Books

1. Leslie Cromwell, F.J.Weibell, E.A.Pfeiffer, Biomedical Instrumentation and Measurements, 2nd Edition, PHI, 2004.
2. John G. Webster, Medical Instrumentation, Application and Design, 3rd Edition, John Wiley, 2001.

Reference Books

1. L.A. Geoddes and L.E. Baker, Principles of Applied Biomedical Instrumentation, 3rd Edition, John Wiley and Sons, 1991.
2. R.S. Khandpur, Hand-book of Biomedical Instrumentation, 2nd Edition, McGraw-Hill, 2003.
3. M. Cook and J.G. Webster(eds.), Therapeutic Medical Devices: Application and Design, Prentice-Hall, 1982.
4. Arun Ghosh, Introduction to measurements and instrumentation, 3rd Edition, PHI learning, 2010.
5. W. F. Ganong, Review of Medical Physiology, 8th Asian Ed, Medical, Publishers, 1977.

Course outcomes-Program outcomes -Program Specific Outcomes-(CO-PO-PSO) Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	H	M											H		
CO2	H			M									H	M	
CO3	L	L	M	H									H	M	
CO4	H	M													H
CO5	L	M	M	H										M	H

20ECT19: CODING THEORY AND TECHNIQUES

Credits –3 **Sessional Marks: 30**

L: T: P:: 2:1:0 **University Exam Marks: 70**

Course Objectives

1. To introduce the principles and applications of information theory.
2. To study how information is measured in terms of probability and entropy, and the relationships among conditional and joint entropies.
3. To learn coding schemes, including error correcting codes.
4. To explain how this quantitative measure of information may be used in order to build efficient solutions to multitudinous engineering problems.

Course Outcomes:

After successful completion of the course the student should be able to

CO1: Apply linear block codes with error correction and error detection.

CO2: Develop the concepts of cyclic codes.

CO3: Apply convolutional codes for performance analysis. CO4: Acquire the basics of turbo codes.

CO5: Design space codes for the channel performance.

UNIT I

Linear Block Codes: Introduction to Linear Block Codes, Syndrome and Error Detection, Minimum Distance of a Block code, Error-Detecting and Error-correcting Capabilities of a Block code, Standard array and Syndrome Decoding, Probability of an undetected error for Linear Codes over a BSC, Hamming Codes. Applications of Block codes for Error control in data storage system.

UNIT II

Codes : Description, Generator and Parity-check Matrices, Encoding, Syndrome Computation and Error Detection, Decoding ,Cyclic Hamming Codes, Shortened cyclic codes, Error-trapping decoding for cyclic codes, Majority logic decoding for cyclic codes.

UNIT III

Convolutional Codes: Encoding of Convolutional Codes, Structural and Distance Properties, maximum likelihood decoding, Sequential decoding, Majority- logic decoding of Convolution codes. Application of Viterbi Decoding and Sequential Decoding, Applications of Convolutional codes in ARQ system.

U

UNIT IV

Turbo Codes: LDPC Codes- Codes based on sparse graphs, Decoding for binary erasure channel, Log-likelihood algebra, Brief propagation, Product codes, Iterative decoding of product codes, Concatenated convolutional codes- Parallel concatenation, The UMTS Turbo code, Serial concatenation, Parallel concatenation, Turbo decoding

UNIT V

Space-Time Codes: Introduction, Digital modulation schemes, Diversity, Orthogonal space- Time Block codes, Alamouti's schemes, Extension to more than Two Transmit Antennas, Simulation Results, Spatial Multiplexing : General Concept, Iterative APP Preprocessing and Per-layer Decoding, Linear Multilayer Detection, Original BLAST Detection, QL Decomposition and Interface Cancellation, Performance of Multi – Layer Detection Schemes, Unified Description by Linear Dispersion Codes.

Text Books

1. Ranjan Bose, "Information Theory, Coding and Cryptography", 2nd Edition, TMH,2009,.
2. Man YoungRhee, "Error Correcting Coding Theory", McGraw-Hill, 1989.

Reference Books

1. Bernard Sklar, "Digital Communications-Fundamental and Application", PE,2000.
2. John G. Proakis, "Digital Communications", 5th Edition, 2008, TMH.
3. K.Moon, "Error Correction Coding – Mathematical Methods and Algorithms", WileyIndia, 2006.

Course Outcomes- Program Outcomes -Program Specific Outcomes (CO- PO-PSO) Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	H	M	M	L					L	L	L		H	M	
CO2	H	M	M	L					L	L	L		H	H	
CO3	H	M	M	L					L	L	L		H		
CO4	H	M	L	L					L	L	L		H	M	
CO5	L	L	H	M					L	L	L	L	L	M	H

20ECT20-NANO ELECTRONICS

Credits –3 **Sessional Marks: 30**

L: T: P:: 2:1:0 **University Exam Marks: 70**

Course Objectives

1. To study the concept of Nano electronics.
2. To understand the Mesostructure, Schrodinger equation, Kronig penny model.
3. To construct the shrink down approaches.
4. To discuss Nano particles, Nano shells and Nano tubes electronics.

Course Outcomes

After successful completion of the course the student should be able to

CO1: Apply knowledge on Nano technology and its applications.

CO2: Analyse the concept of Quantum Mechanics, solid band theory, Kronig penny model.

CO3: Demonstrate the Shrink- down approaches, CMOS scaling.

CO4: Recognize Nano crystals, Nano particles and apply their knowledge on practical applications. CO5: Compare the performance of different nano electronic devices.

UNIT I

Introduction to Nano Technology: Nano – The Beginning – Electron microscope – Scanning probe microscope Optical microscope for Nano science and Technology otherkindsofmicroscope.

Carbon Nanotubes: Synthesis and purification – Filling of Nanotubes Mechanism of growth – Electronic structure – Transport, Mechanical and physical properties – Applications.

UNIT II

Basics of Quantum Mechanics: Meso structure, Schrodinger equation, Density of States. Particle in a box Concepts, Degeneracy, Band Theory of Solid, Kronig-Penny Model, Brillouin Zones.

UNIT III

Shrink-downapproaches: Introduction, CMOS Scaling, The Nano scale MOSFET, Finfets, Vertical MOSFETs, limits to scaling, system integration limits (interconnect issues etc.).

UNIT IV

Nano Particles and Nanoshells: Electronic structure of Nanocrystals Correlation of properties with size uses. Monolayer -protected metal, Nanoparticles method of preparation characterization Functionalized Metal, Nanoparticles Applications super lattices. Core-shell Nanoparticles Types of systems characterization properties Applications.Types of Nano shells and its properties characterization applications.

UNITV

Nano Electronic Devices: Synthesis of Quantum dots, ResonantTunnelling Diode, Coulomb dots, Quantum blockade, Single electron transistors, Carbon nanotube electronics, Band structure and transport, devices, applications, 2D semiconductors and electronic devices, Graphene, atomistic simulation.

Text Books

1. Rainer waser, "Nanoelectronics and Information Technology (Advanced Electronic Materialand Novel Devices)", 3rd edition,Wiley-VCH, 2012.
2. G.W. Hanson,"Fundamentals of Nanoelectronics", Pearson,2009.

Reference Books

1. K.Goser, P.Glosekotter,J.Dienstuhl, "Nanoelectronics and Nanosystems", Springer Edition, 2004
2. .P. Poole, F. J. Owens,"Introduction to Nanotechnology", Wiley, 2003.
3. T.Pradeep, "Nano: The Essentials", TMH Edition, 2008.

Course Outcomes-Program Outcomes -Program Specific Outcomes(CO-PO-PSO) Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	H	M											H		
CO2	H	M											H		
CO3			H	M									H	M	
CO4	H		L	M									L	M	H
CO5	H												L	M	H

20ECT21 : CELLULAR MOBILE COMMUNICATIONS

Credits –3 **Sessional Marks: 30**

L: T: P:: 2:1:0 **University Exam Marks: 70**

Course Objectives

1. To understand the basic cellular concepts like frequency reuse, cell splitting, cell sectoring etc., and various cellular systems.
2. To learn different types of interferences influencing cellular and mobile communications.
3. To study the frequency management, channel assignment and various propagation effects in cellular environment.
4. To understand different types of antennas used at cell site and in mobile.
5. To analyse the concepts of handoff and types of handoffs and understand the architectures of GSM and 3G cellular systems.

Course Outcomes

After successful completion of the course the student should be able to

CO1. Identify the limitations of conventional mobile telephone systems; understand the concepts of cellular systems.

CO2. Understand the frequency management, channel assignment strategies and antennas in cellular systems.

CO3. Understand the concepts of handoff and architectures of various cellular systems. CO4. Understand the relation between the user features and underlying technology.

CO5: Analyze mobile communication systems for improved performance.

UNIT I

Cellular Mobile Radio Systems: Introduction to Cellular Mobile System, uniqueness of mobile radio environment, operation of cellular systems, consideration of the components of Cellular system, Hexagonal shaped cells, Analog and Digital Cellular systems.

Cellular Concepts: Evolution of Cellular systems, Concept of frequency reuse, frequency reuse ratio, Number of channels in a cellular system, Cellular traffic: trunking and blocking, Grade of Service; Cellular structures: macro, micro, pico and femto cells; Cell splitting, Cell sectoring.

UNIT II

Interference: Types of interferences, Introduction to Co-Channel Interference, real time Co- Channel interference, Co-Channel measurement, Co-channel Interference Reduction Factor, desired C/I from a normal case in a omni directional Antenna system, design of Antenna system, antenna parameters and their effects, diversity receiver, non-cochannel interference- different types.

UNIT III

Frequency Management and Channel Assignment: Numbering and grouping, setup access and paging channels, channel assignments to cell sites and mobile units: fixed channel and non-fixed channel assignment, channel sharing and borrowing, overlaid cells.

Cell Coverage for Signal and Traffic: Signal reflections in flat and hilly terrain, effect of manmade structures, phase difference between direct and reflected paths, straight line path loss slope, general formula for mobile propagation over water and flat open area, near and long-distance propagation, antenna height gain, form of a point to point model.

UNIT IV

Cell Site and Mobile Antennas: Sum and difference patterns and their synthesis, omnidirectional antennas, directional antennas for interference reduction, space diversity antennas, umbrella pattern antennas, minimum separation of cell site antennas, high gain antennas.

UNIT V

Handoff Strategies: Concept of Handoff, types of handoff, handoff initiation, delaying handoff, forced handoff, mobile assigned handoff, intersystem handoff, vehicle locating methods, dropped call rates and their evaluation.

Digital Cellular Networks: GSM architecture, GSM channels, multiple access schemes; TDMA, CDMA, OFDMA; architecture of 3G cellular systems.

Text Books

1. W.C.Y.Lee, “Mobile Cellular Telecommunications “, Tata McGraw Hill, 2rd Edition, 2006.
2. Gordon L. Stuber , “Principles of Mobile Communications “, Springer International 2nd Edition, 2007.

References Books

1. Theodore. S. Rapport , "Wireless Communications", Pearson education, 2nd Edition, 2002.

2. Lee , "Wireless and Mobile Communications" , McGraw Hills, 3rd Edition, 2006.

3. R. Blake, "Wireless Communication Technology " , Thompson Asia Privatet. Ltd., 2004.

Course Outcomes - Program Outcomes - Program Specific Outcomes (CO-PO-PSO) Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	**H**			**L**									**H**		**M**
CO2		**H**	**M**	**L**		**M**			**L**	**L**	**L**			**M**	**H**
CO3	**H**					**M**							**M**		**H**
CO4	**H**		**M**	**L**											**H**
CO5				**H**		**M**	**L**	**M**					**H**		

20ECT22: WIRELESS SENSOR NETWORKS

Credits –3 **Sessional Marks: 30**

L: T: P:: 2:1:0 **University Exam Marks: 70**

Course Objectives

1. To understand the basic WSN technology and supporting protocols.
2. To learn standardization basic sensor systems and provide a survey of sensor technology.
3. To understand the medium access control protocols and address physical layer issues.
4. To learn key routing protocols for sensor networks and main design issues.
5. To learn transport layer protocols for sensor networks, and design requirements.
6. To understand the Sensor management, sensor network middleware, operating system.

Course Outcomes

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

CO1. Understand and explain common wireless sensor node architectures.

CO2. Be able to carry out simple analysis and planning of WSNs.

CO3. Demonstrate knowledge of MAC protocols developed for WSN.

CO4. Understand and explain mobile data-centric networking principles.

CO5. Be familiar with WSN standards.

UNIT I

Introduction: Introduction to Sensor Networks, unique constraints and challenges, Advantage of Sensor Networks, Applications of Sensor Networks, Types of wireless sensor networks, Mobile Ad- hocNetworks (MANETs) and Wireless Sensor Networks, Enabling technologies for Wireless Sensor Networks.

UNIT II

Sensor Node Hardware and Network Architecture: Single-node architecture, Hardware components & design constraints, Operating systems and execution environments, introduction to TinyOS and nesC, Network architecture, Optimization goals and figures of merit, Design principles for WSNs, Service interfaces of WSNs,

Gateway concepts, Need for gateway, WSN to Internet Communication, and Internet to WSN Communication.

UNIT III

Deployment and Configuration: Localization and positioning, Coverage and connectivity, Single-hop and multi-hop localization, self configuring localization systems, sensormanagement.

UNIT IV

Network Protocols: Issues in designing MAC protocol for WSNs, Classification of MAC Protocols, S- MAC Protocol, B-MAC protocol, IEEE 802.15.4 standard and Zig Bee, Dissemination protocol for large sensor network.Data dissemination, data gathering, and datafusion; Quality of a sensor network; Real-time traffic support and security protocols.

Routing protocols: Issues in designing routing protocols, Classification of routing protocols, Energy-efficient routing, Unicast, Broadcast and multicast, Geographic routing.

UNIT V

Data Storage and Manipulation: Data centric and content based routing, storage and retrieval in network, compression technologies for WSN, Data aggregation technique.

Applications: Detecting unauthorized activity using a sensor network, WSN for Habitat Monitoring.

Text Books

1. HolgerKerl, Andreas Willig, "Protocols and Architectures for Wireless Sensor Network", Student Edition, John Wiley and Sons, 2005 (ISBN: 978-0-470-09511-9).
2. Raghavendra, Cauligi S, Sivalingam, Krishna M., ZantiTaieb, "Wireless Sensor Network", 1st Edition,Springer, 2004 (ISBN: 978-4020-7883-5).

Reference Books

1. Kazem, Sohraby, Daniel Minoli, TaiebZanti, "Wireless Sensor Network: Technology, Protocols and Application", 1st Edition,John Wiley and Sons, 2007 (ISBN:978-0-471-74300-2).
2. B. Krishnamachari, "Networking Wireless Sensors", 1st Edition, Cambridge University Press, 2005.
3. N. P. Mahalik, "Sensor Networks and Configuration: Fundamentals, Standards, Platforms, and Applications", 1st Edition, Springer Verlag, 2007.

Course Outcomes-Program Outcomes -Program Specific Outcomes-(CO-PO-PSO) Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	**H**	**M**			**L**								**H**	**H**	
CO2		**H**	**M**	**L**	**L**								**M**	**M**	
CO3		**L**	**M**	**H**									**L**	**H**	**H**
CO4		**M**	**H**	**L**									**M**	**M**	
CO5	**H**		**M**				**L**			**L**	**L**		**H**		

20ECT23: DIGITAL IMAGE AND VIDEO PROCESSING

Credits –3 **Sessional Marks: 30**

L: T: P:: 2:1:0 **University Exam Marks: 70**

Course Objectives

The objective of this course is to make the students:

1. To learn basic concepts of image processing, fundamentals and mathematical models in digital image and video processing.
2. Ability to study different types of image transforms for image and video processing
3. To develop time and frequency domain techniques for image enhancement.
4. To understand Image segmentation, restoration, and morphological signal processing with applications.
5. To expose the students to current applications, techniques and issues in image and video processing.

Course Outcomes

At the end of the course, students will demonstrate the ability to

CO1. Understand theory and models in Image and Video Processing.

CO2. Interpret and analyze 2D signals in frequency domain through image transforms.

CO3. Apply quantitative models of image and video processing for various engineering applications.

CO4. Develop innovative design for practical applications in various fields.

CO5. Understand different methods, models for video processing and motion estimation.

UNIT I

Fundamentals of Image Processing and Image Transforms: Introduction, Image sampling, Quantization, Resolution, Image file formats, Elements of image processing system, Applications of Digital image processing, Need for transform, image transforms, Fourier transform, 2 D Discrete Fourier transform and its properties, Importance of phase, Walsh transform, Hadamard transform, Discrete cosine transform, KL transform, comparison of different image transforms.

UNIT II

Image Enhancement: Spatial domain methods: Histogram processing, Fundamentals of Spatial filtering, Smoothing spatial filters, Sharpening spatial filters. Frequency domain methods: Basics of filtering in frequency domain, image smoothing, image sharpening, Selective filtering.

Image Restoration: Introduction to Image restoration, Image degradation, Types of image blur, Classification of image restoration techniques, Image restoration model, Inverse filtering and Wiener filtering.

UNIT III

Image Segmentation: Introduction to image segmentation, Point, Line and Edge Detection, Region based segmentation. Classification of segmentation techniques, Region approach to image segmentation, clustering techniques, Image segmentation based on thresholding, Edge based segmentation.

UNIT IV

Image Compression: Introduction, Need for image compression, Redundancy in images, Classification of redundancy in images, image compression scheme, Classification of image compression schemes, Fundamentals of information theory, Run length coding, Shannon – Fano coding, Huffman coding, Discrete cosine transform, JPEG coding, Transformed based compression, Image compression standard, JPEG Standards.

Basic Steps of Video Processing: Analog Video, Digital Video. Time-Varying Image Formation models: Three-Dimensional Motion Models, Geometric Image Formation, Photometric Image Formation.

UNIT V

2-DMotionEstimation: Optical flow, General Methodologies, Pixel Based Motion Estimation, Block-Matching Algorithm, Mesh based Motion Estimation, Global Motion Estimation, Region based Motion Estimation, Multi resolution motion estimation, Waveform based coding, Block based transform coding, Predictive coding, Application of motion estimation in Videocoding.

Text Books

1. 1.R.C. Gonzalez and Woods,"Digital Image Processing"- 3rd Ed., Pearson.- 2002

2. Yao Wang, Joern Ostermann and Ya–quin z hang, "Video Processing and Communications" – Zhang. 1st Ed., PH Int.- 2002.

Reference Books

1. ScotteUmbaugh, "Digital Image Processing and Analysis-Human and Computer Vision Application with CVIP Tools" – 2nd Ed, CRC Press, 2011.
2. M. Tekalp, "Digital Video Processing", –Prentice Hall International.
3. S.Jayaraman, S.Esakkirajan, T.Veera Kumar –"Digital Image Processing", TMH, 2009

Course outcomes-Program outcomes -Program Specific Outcomes-(CO-PO-PSO) Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	H	L	L	M	M					M		M	H		
CO2	L	M	M	H	L	L				L			H	M	
CO3	L	M	M	M	M	H		M		L				H	L
CO4			H	M	L	M	L	L	L	M	L	L	H	L	M
CO5	H	M	L		H	L			M	L		L	M	H	

20ECT26: DIGITAL LOGIC DESIGN

Credits –3 **Sessional Marks: 30**

L: T: P::3:0:0 **University Exam Marks: 70**

Course objectives

1. To introduce the basic rules for design with combinational and sequential digital logic and state machines.
2. To learn simple digital circuits in preparation for computer engineering.

Course Outcomes

After successful completion of the course the student should be able to

CO1. Define different Number systems, binary addition and subtraction, two's compliment representation & operations, different switching algebra theorems and apply them for logic functions

CO2. Define K-map for a few variables and perform an algorithmicreduction of logic functions and known about different combinational circuits

CO3. Learn about different sequential logic circuits

CO4. Learn HDL for combinational logic circuits.

CO5. Learn HDL for Sequential logic circuits.

UNIT I

Binary Systems: Digital Systems, Binary Numbers, Number base conversions, Octal and Hexadecimal Numbers, Complements, Signed binary numbers, Binary codes, Binary Storage and Registers, Binary Definitions, Axiomatic definition of Boolean Algebra, Basic theorems and properties of Boolean algebra, Boolean functions canonical and standard forms, Other logic operations, Digital logic gates, Integrated circuits.

UNIT II

Gate Level Minimization: The map method, Four-variable map, five variable map, Product of sums simplification, Don't care conditions, NAND and NOR implementation, Other Two level implementations, Exclusive-OR function,

Combinational Logic: Combinational Circuits, Analysis procedure, Design procedure, Binary Adder-Subtractor Decimal Adder, Binary multiplier, Magnitude Comparator, Decoders, Encoders, Multiplexer.

UNIT III

Synchronous Sequential Logic: Sequential circuits, latches, Flip-flops, Analysis of clocked sequential, Hardware Description Language (HDL), HDL for Sequential

circuits, HDL for logic circuits, State reduction and Assignment: Design procedure, Registers, Shift Registers,

UNIT IV

Ripple counters, Synchronous counters, Other Counters, HDL for Registers and Counters. Introduction, Random-Access Memory Decoding, Error Detection and Correction, Read-Only Memory, Programmable Logic Array, Programmable Array Logic, Sequential Programmable Devices.

UNIT V

Asynchronous Sequential Logic: Introduction, Analysis, procedure, Circuits with Latches, Design procedure, Reduction of state and flow tables, Race free state assignment Hazards, Design Example.

Text Books

1. M.MorrisMano, "Digital Logic and Computer Design"- 3rd Edition, Pearson Education / PHI Thomson, "Fundamentals of Logic Design", Roth, 5th Edition.

References

1. Zvi.Kohavi, "Switching and finite automata Theory", Tata Mc Graw Hill Donlad D.Givone,"Digital Principles and Design", Tata Mc Graw Hill, Edition.
2. M. Rafiquzzaman Hohn Wiley, "Fundamentals of Digital Logic & Micro Computer Design". 5th Edition.

Course Outcomes-Program Outcomes - Program Specific Outcomes-(CO-PO-PSO) Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	M	H	H	L					L	M	L		H		
CO2	L	L	H	M					L	L	M			H	M
CO3	M	H											H	M	
CO4	H	L												H	M
CO5		L	L	M	H									M	H

20ECT35: ELECTRONIC CIRCUITS

Credits –3 **Sessional Marks: 30**

L: T: P::3:0:0 **University Exam Marks: 70**

Course Objectives

1. To analyse the diode clipper and clamper circuits.
2. To explain biasing schemes of BJT and FET amplifiers.
3. To Analyse Small signal performance of amplifiers.
4. To classify different types of coupling and feedback Amplifiers

Course Outcomes

After successful completion of the course the student should be able to

CO1. Understand the characteristics of diodes and transistors.

CO2. Design and analyze various rectifier and amplifier circuits.

CO3. Design and analyse various FET biasing circuits.

CO4. Design and analyse the methods of Multistage Amplifiers.

CO5. Design sinusoidal RC and LC oscillators.

UNIT I

Diode Circuits: Diode equivalent circuits, Analysis of diode circuits, Diode clippers, Diode clampers.

General Amplifiers: Concept of Amplifier, Voltage gain, Current gain, Power gain, Input and Output resistances, conversion efficiency, Frequency response, Bandwidth, distortion, Classification of amplifiers.

UNIT II

BJT Amplifiers: BJT biasing schemes, Bias stability, Hybrid model, Small signal analysis of single stage BJT amplifiers, Comparison of CE,CB and CC amplifiers, approximate model analysis, Effect of coupling and bypass capacitors on low frequency response, Hybrid π model at high frequencies, Parameters f_B and f_T**.**

UNIT III

FET Amplifiers: FET biasing schemes, Small signal model, Analysis of CS, CD and CG amplifiers. High frequency analysis of FET Amplifier.

UNIT IV

Multistage Amplifiers: Types of Coupling, choice of Amplifier configuration, overall voltage gain and Bandwidth of n stage amplifier.

Power Amplifiers: Class-A large signal amplifiers, Transformer coupled audio power amplifiers, Push pull amplifiers, Class B amplifiers, Class AB operation Complementary symmetry power amplifier.

UNIT V

Feedback Amplifiers: Feedback concept, classification, Effects of negative feedback on gain, Stability, Noise, Distortion, Bandwidth, Input and Output resistances, Different types of feedback circuits without analysis, voltage amplifiers, current amplifiers, Trans-resistance amplifier, Trans –conductance amplifier.

Sinusoidal oscillators: Barkhausen criterion, RC Phase shift, Wein Bridge, Hartley and Colpittsoscillators , crystal oscillator.

Text Books

1. Milliman and Halkias," Integrated Electronics", Mc Graw Hill &Co.
2. Moottershed," Electronic Devices and Circuits", PHI.

References

1. R.L. Boylestad&LouisNashelay " Electronic Devices and Circuits", pearson edition.
2. Salivahana ," Electronic Devices and circuits, "2nd Edition ,2008,TMH.

Course Outcomes-Program Outcomes -Program Specific Outcomes(CO-PO-PSO) Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	H	M	L						L	L	L		H		
CO2	L	M	H	L					L	L	L		H	M	
CO3	L	M	H	L					L	L	L		H	M	
CO4	L	M	H	L					L	L	L		H	M	
CO5	L	M	H	L					L	L	L		H	M	L

20ECT36: ELECTRO MAGNETIC WAVES

Credits –3 **Sessional Marks: 30**

L: T: P::3:0:0 **University Exam Marks: 70**

Course Objectives

1. To introduce the basic mathematical concepts related to electromagnetic vector fields.
2. To impart knowledge on the concepts of electrostatics, electric potential, energy density and their applications.
3. To impart knowledge on the concepts of magneto statics, magnetic flux density, scalar and vector potential and its applications.
4. To impart knowledge on the concepts of Faraday‘s law, induced emf and Maxwell‘s equations.

Course Outcomes

After successful completion of the course the student should be able to

CO1. Solve Maxwell’s equations using vectorcalculus in three standard coordinate systems

CO2. Study EM wave propagation in free space in dielectric medium

CO3. Analyze electromagnetic wave propagation in guiding structures under variousmatching conditions

CO4. Understand the power flow mechanism in guiding structures and in unbounded medium

UNIT I

Static Electric Field: Introduction, Coulomb's law of forces, Principle of Superposition of fields, Electric scalar potential, Relation of Electric field lines and equi-potential contours,The electric dipole and dipole moment, Gauss's law, Characteristics of dielectrics. Boundary relations, Capacitance, Divergence of flux density, Divergence Theorem, Poisson's and Laplace Equations, Joule's law, Ohm's law at a point, Kirchoff's laws, Current and field at boundaries.

UNIT II

Static Magnetic Field: Magnetic field of current carrying element - BiotSavart law, Force between two parallel linear conductors, Magnetic flux and flux density, Magnetic field relations, Torque of a loop, Energy stored in a magnetic field, Inductance, Ampere's law, Maxwell's First curl equation, Comparison of divergence and curl, The vector potential, permeability, Analogies between electric and magnetic fields.

Maxwell's Equations: The equation of continuity for time varying fields, Maxwell's equations, Conditions at a boundary surface, Applications of circuit and field theory, Comparison of field and circuit theory, Maxwell's equations as generalization of circuit equations.

UNIT III

Electromagnetic Waves: Plane waves: Wave equations, plane waves in dielectric media, Plane waves in conducting media, polarization, skin effect and surface impedance, direction cosines, reflection of plane waves: Reflection of normally and oblique plane waves from conductors and dielectrics, total reflection.

UNIT IV

Poynting Vector And The Flow Of Power: Poynting theorem, power flow for a plane wave and power loss in a plane conductor, GUIDED WAVES: Waves between parallel planes, TE and TM waves, Characteristics of TE and TM waves, TEM waves, Velocities of propagation, Attenuation in parallel plane guides, Wave impedance, Electric field and current flow within the conductor.

UNIT V

Wave Guides: Rectangular wave-guides, TE and TM modes in wave-guides, Velocity, wavelength, impedance and attenuation in rectangular waveguides.

Text Books

1. E.C.Jordan and K.G.Balmain, Electromagnetic waves and Radiating Systems, Prentice Hall, Inc., Englewood Cliffs, New Jersey, 1968.
2. John D.Kraus, Electromagnetics, McGraw Hill Book Co., 1973.

Reference Books

1. Matthew N.O. Sadiku, "Elements of Electromagnetics," Oxford Univ. Press, 4th ed.,2008
2. E.C. Jorden and K.G. Balmain, "Electromagnetic Waves and Radiating Systems " PHI, 2nd ed., 2000

Course Outcomes-Program Outcomes -Program Specific Outcomes-(CO-PO-PSO) Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	H	M	L	L	L				L			H	H	M	
CO2	H	H	M	H	L							L	L	H	
CO3	L	H	M									L	H		
CO4	H	L		M	M		L			M		M	H		

20ECT37:ANALOG AND DIGITAL IC APPLICATIONS

Credits –3 **Sessional Marks: 30**

L: T: P::3:0:0 **University Exam Marks: 70**

Course Objectives

1. To make the student understand the basic concepts in the design of electronic circuits using linear integrated circuits and their applications.
2. To introduce some special function ICs.
3. To be able to use computer-aided design tools for development of complex digital logic circuits
4. To be able to design tests for digital logic circuits, and design for testability

Course Outcomes

After successful completion of the course the student should be able to

CO1. Understand the basic building blocks of linear integrated circuitsand its characteristics.

CO2. Analyze the linear, non-linear and specialized applications of operational amplifiers.

CO3. Understand the theory of ADC and DAC.

CO4. Able to use computer-aided design tools for development of complex digital logic circuits.

CO5. Able to design tests for digital logic circuits, and design for testability.

UNIT I

OP-AMP Characteristics: Ideal and practical Op-amp, DC and AC characteristics, 741 Op-amp and its features, inverting, non-inverting, differential. Basic applications of Op-amp, instrumentation amplifier, AC amplifier, V to I and I to V converters, Differentiator and Integrator, Comparators and Schmitt trigger.

UNIT II

Timers& D-A AND A-D Converters : Introduction to 555 timer, functional diagram, Monostable and Astable operations and applications.Basic DAC techniques, Weighted resistor DAC, R-2R ladder DAC, inverted R-2R DAC, Different types of ADCs –parallel comparator type ADC, Counter type ADC, successive approximation ADC and dual slope ADC.

UNIT III

Active Filters: Introduction, 1storder LPF, HPF filters, Band pass, Band reject and all pass filters.

Voltgae Regulators: Series Op-amp regulator, IC voltage regulators, Fixed voltage regulators.

UNIT IV

Digital Integrated Circuits: Classification of Integrated Circuits, CMOS Transmission Gate, IC interfacing.

Combinational Logic ICs- Specifications and Applications of TTL-74XX & CMOS 40XX Series ICs - Code Converters, LED & LCD Decoders with Drivers, Priority Generators/Checkers.

UNIT V

Sequential Logic ICS: Familiarity with commonly available 74XX & CMOS 40XX Series ICs - Synchronous Counters, Decade Counters, Shift Registers.

Memories - ROM Architecture, Types of ROMS & Applications, RAM Architecture, Static & Dynamic RAMs.

Text Books

1. D.RoyChowdhury, Linear Integrated Circuits, 2nd Ed., New Age International (p) Ltd, 2003.
2. John F. Wakerly, Digital Design Principles & Practices, 3rd Ed.,PHI/ Pearson Education Asia, 2005.

Reference Books

1. Ramakanth A.Gayakwad, Op-amps & Linear ICs, PHI, 1987.
2. Sergio Franco, Design with Operational amplifiers & Analog Integrated circuits3rd Ed., Mc Graw Hill, 2002.

Course Outcomes-Program Outcomes -Program Specific Outcomes-(CO-PO-PSO) Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	H	L											H		
CO2	L	H	M											L	H
CO3	M	H	L											H	L
CO4	M	L	L	M	H									M	H
CO5		L	H	M										M	H

20ECT27 -PULSE AND DIGITAL CIRCUITS

Credits –3 **Sessional Marks: 30**

L: T: P::3:0:0 **University Exam Marks: 70**

Course Objectives

1. To explain the complete response of R-C circuits.
2. To explain clippers, clampers,switching characteristics of transistors.
3. To construct various multivibrators using transistors, design of sweep circuits.
4. To discuss about different digital IC's, families and characteristics.

Course Outcomes

After successful completion of the course the student should be able to

CO1. Compare the applications of diode as integrator, differentiator, clipper, clamper circuits.

CO2. Design multivibrators for various applications, sweep circuit using a Transistor switch.

CO3. Compare time base generators and wave shaping circuits.

CO4. Understand 555 timer and multivibrator models.

CO5. Illustrate Digital IC's, characteristics and different IC families.

UNIT I

Wave shaping circuits: Types of waveforms, Characteristics of pulse waveforms. RC low pass and high pass circuits, their responses for step, pulse and square wave inputs, Rise time, Tilt, Square wave testing of amplifiers, Diode as a switch, Diode clipper and clamper circuits.

UNIT II

Multivibrators: BJT switch and switching times, Inverter, JFET switch, MOSFET and CMOS switches, Principle and operation of Bistable, Monostable, Astablemultivibrators and Schmitt trigger using BJTs.

UNIT III

Time Base Generators: General features of time base signal, Methods of generating time base waveform, Exponential sweep circuit, sweep circuit using UJT. Sweep circuit using a Transistor switch, Transistor constant current sweep, Miller and Boostrap time base generators using BJTs.

UNIT IV

IC Timer &Multivibrators: CMOS monostable and astablemultivibrators, 555 timer, Monostable and astable models, Dual timer and its applications.

UNIT V

Digital integrated circuits: Evaluation of ICs, Advantages and classification of ICs, Digital IC characteristic, Digital IC families, TTL, ECL, MOS, CMOS and their comparison, Totem pole, Open collector, and Tristate outputs, IC Packaging.

Text Books

1. David A. Bell, "Solid State Pulse Circuits", PHI.
2. Taub and Schilling, "Digital Integrated Circuits" Mc Graw – Hill.

References

1. A Anand Kumar -"Pulse and Digital circuits" PHI
2. J Millman and H.Taub ,"Pulse, Digital and switching waveforms", Mc Graw – Hill.

Course Outcomes-Program Outcomes -Program Specific Outcomes-(CO-PO-PSO) Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	H	L	L										M	H	
CO2			H	M					L	L	L		H	L	
CO3	M	H											H		
CO4	H	L	M						L					H	
CO5	M	M		L									H		

20ECT28: ELECTRONIC MEASUREMENTS

Credits –3 **Sessional Marks: 30**

L: T: P::3:0:0 **University Exam Marks: 70**

Course Objectives

1. To explain basic concepts and definitions in measurement.
2. To describe the bridge configurations and their applications.
3. To elaborate discussion about the importance of signal generators and analyzers in measurement.
4. To understand the concept of Transducer Technology and construct the equipment for measurement of physical parameters.

Course Outcomes

After successful completion of the course the student should be able to

CO1. Measure various electrical parameters with accuracy, precision, resolution.

CO2. Use AC and DC bridges for relevant parameter measurement.

CO3. Select appropriate passive or active transducers for measurement of physical parameters.

CO4. Use Signal Generator, frequency counter, CRO and digital IC tester for appropriate measurement effectively.

CO5. Test and troubleshoot electronic circuits using various measuring instruments.

CO6: Maintain various types of test and measuring instruments.

UNIT I

Electronic Instruments: Performance characteristics of instruments, Static characteristics, Accuracy, Resolution, Precision, expected value, Error, Sensitivity. Errors in Measurement, Dynamic Characteristics-speed of response, Fidelity, Lag and Dynamic error. DC Voltmeters- Multi-range, Range extension/Solid state and differential voltmeters, AC voltmeters- multi range, range extension, shunt. Thermocouple type RF ammeter, Ohmmeters series type, shunt type, Multi- meter for Voltage, Current and resistance measurements.

UNIT II

Oscilloscope: Oscilloscopes CRT features, vertical amplifiers, horizontal deflection system, sweep, trigger pulse, delay line, sync selector circuits, simple CRO, triggered sweep CRO, Dual beam CRO, Dual trace oscilloscope, sampling oscilloscope, storage oscilloscope, digital readout oscilloscope, digital storage oscilloscope, Lissajous method of frequency and phase measurement, standard specifications of CRO, probes for CRO- Active & Passive, attenuator type.

UNIT III

Signal Generators, Wave & Hormonic Distortion Analyzer: Signal Generator-fixed and variable, AF oscillators, Standard and AF sine and square wave signal generators, Function Generators, Random noise generator, Arbitrary waveform generator. Wave Analyzers, Harmonic Distortion Analyzers, Spectrum Analyzers.

UNIT IV

BRIDGES: DC Bridges-Wheat stone bridge, Kelvins bridge and Kelvins double bridge. AC Bridges Measurement of inductance- Maxwell's bridge, Anderson bridge. Measurement of capacitance -Schearing Bridge. Wien Bridge, Errors and precautions in using bridges. Q-meter.

UNIT -V

Transducers: Active & passive transducers- Resistance, Capacitance, inductance; Strain gauges, LVDT, Piezo Electric transducers, Resistance Thermometers, Thermocouples, Thermistors, Sensistors.

Text Books

1. HS. Kalsi –"Electronic Instrumentation". Albert D. Helfrick & William D. Copper- Modern Electronic Instrumentation & Measurement Techniques"

References

1. David A. Bell –"Electronic Instrumentation & Measurements ", PHI, 2nd Edition, 2003.
2. Robert A.Witte -"Electronic Test Instruments, Analog and Digital Measurements ", Pearson Education, 2nd Ed., 2004.
3. K. Lal Kishore -"Electronic Measurements & Instrumentations ", Pearson Education – 2005.

Course Outcomes-Program Outcomes-Program Specific Outcomes-(CO-PO-PSO) Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	H	L											H		
CO2	H	L											H		
CO3		L	M	L		M	L						H		
CO4	H	L											H	L	
CO5		M	H	M									H	M	L
CO6			L	M		H								M	H

20ECT29:COMMUNICATION SYSTEMS

Credits –3 **Sessional Marks: 30**

L: T: P::3:0:0 **University Exam Marks: 70**

Course Objectives

The objective of this course is to make the students:

1. To introduce the concepts of various analog modulations and their spectral characteristics.
2. To understand the digital modulation techniques.
3. To study the limits set by Information Theory
4. To study the satellite and radar communications.

Course Outcomes

At the end of the course, students will demonstrate the ability to:

CO1. Understand and analyse the amplitude modulation

CO2. Analyse different frequency modulation techniques regarding angle modulation.

CO3. Analyse the different types of information techniques and their different codes.

CO4. Understand different digital modulation techniques.

CO5. Understand the systems and applications of Radar and satellite communications.

UNIT I

Amplitude Modulation: Generation and detection of AM wave-spectra-DSBSC, Hilbert Transform, Pre-envelope & complex envelope – SSB and VSB –comparison – Super heterodyne Receiver.

UNIT II

Angle Modulation: Phase and frequency modulation-Narrow Band and Wind band FM – Spectrum – FM modulation and demodulation – FM Discriminator- PLL as FM Demodulator – Transmission bandwidth.

UNIT III

Information Theory: Entropy – Discrete Memoryless channels – Channel Capacity - Hartley – Shannon law – Source coding theorem – Huffman & Shannon – Fano codes.

UNIT IV

Digital Modulation: Sampling, Quantization and coding, Quantization error, companding in PCM systems. Differential PCM Systems (DPCM),Delta Modulation, its drawbacks.

Digital Modulation Techniques: Introduction, BPSK, DPSK, DEPSK, QPSK, M-ary PSK, ASK, QASK, BFSK, M-ary FSK, MSK, Duo binary Encoding, Comparison of digital modulation techniques, Partial response signalling.

UNIT V

SYSTEMS: Nature of Radar and Radar equation, simple from radar equation, radar block diagram and operation, Radar frequencies, application of Radar.

Principles and architecture of satellite Communication, Brief history of Satellite systems, advantages, disadvantages, applications and frequency bands used for satellite communication

Text Books

1. J.G.Proakis, M.Salehi, "Fundamentals of Communication Systems", Pearson Education 2006.
2. Simon Haykin, "Digital Communications", John Wiley, 2005.
3. Dennis Roddy, Satellite Communication: 4th Edition, McGraw Hill,2009
4. Introduction to radar systems – "M.I. Skolmik", 2nd edition TMH 2017.

References

1. B.P.Lathi, "Modern Digital and Analog Communication Systems", 3rd Edition, Oxford University Press, 2007.
2. H P Hsu, Schaum Outline Series –"Analog and Digital Communications" TMH 2006.
3. Electronic Communication Systems – "Kennedy & Davis" 4th edition TMH 2011. Tri T. Ha: Digital Satellite Communications: Tata McGraw Hill, 2009

Course outcomes-Program Outcomes- Program Specific Outcomes (CO-PO-PSO) Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	H	M	L	L					L	L	L		H		
CO2		H	M	L					L	L	L	L	H	M	
CO3	H	M	L	L					L	L	L		M		H
CO4	H								L	L	L		H	M	
CO5	H	M	L											M	H

20ECT30- MICROPROCESSORS AND INTERFACING

Credits –3 **Sessional Marks: 30**

L: T: P::3:0:0 **University Exam Marks: 70**

Course Objectives

1. To provide insight into architectural details of microprocessors.
2. To master the assembly language programming using concepts like assembler directives, procedures, macros, software interrupts etc.
3. To understand well the organization of 8085 and 8086 memory, addressing, address decoding concepts.
4. To provide the knowledge of interfacing 8086 with memory, I/O devices, 8255, keyboard etc
5. To understand the concept of Interrupts and their significance in 8086.
6. To study various hardware, software interrupts, Programmable Interrupt Controller etc
7. To provide the knowledge about aspects which differentiates the versions of microprocessors.

Course Outcomes

At the end of this course, students will demonstrate the ability to

CO1. Understand the architecture, memory organization of microprocessor 8086.

CO2. Apply the programming using assembly level language in microprocessors for simple arithmetic, logical, string and real time applications.

CO3. Identify the different ways of interfacing memory and I/O with microprocessors.

CO4. Apply and Analyse the interfacing concept of different programmable interfacing modules with microprocessors for real time applications.

CO5. Develop a report to generate a code for applications using microprocessors to meet the societal requirements.

UNIT I

Microprocessors: Introduction to Microprocessor, development of microprocessors, 8086 microprocessor, - Architecture, Instruction set, Addressing modes, interrupt systems. System timing of 8086 – clock cycle, machine cycle and instruction cycle, timing diagram for simple instructions, generation of delays.

UNIT II

Programming: Assembler, Assembler directives, Assembly language programs, (8086) with assembler directives for addition, subtraction, multiplication, division etc., sorting and searching, bit multiplication program using look-up tables, stages of software development, modular programming, debugging and documentation.

UNIT III

Data Transfer Schemes: Synchronous, Asynchronous, Interrupt driven and DMA type schemes, USART (8251) and its interfacing, Programmable Interrupt controller (8259) and its interfacing, Programmable DMA controller and its interfacing, Data Communication standards RS – 232 Serial Interface standards, IEEE – 488 GPIB standard

UNIT IV

Memory Interface To 8086: Interfacing various types of RAM and ROM chips, Address decoding techniques, Interfacing ADC and DAC to 8086 systems, Data acquisition, Waveform generation, Traffic light controller, stepper motor control, temperature measurement and control.

UNIT V

Advance Microprocessor: Introduction to 80386 and 80486 microprocessor, different modes of operation, protected mode, virtual mode.

Introduction to Pentium processor – special Pentium register, Pentium Memory management, Introduction to Pro-Microprocessor.

Text Books

1. Barry B. Brey –"The Intel microprocessors", Prentice Hall, 2006.
2. Douglas V. Hall –"Microprocessors and interfacing", Tata Mc Graw-Hill,1986

Reference Books

1. A.K.Ray and K.M.Bhurchandi –"Advanced Microprocessor and Peripherals",2nd edition,TMH-2000
2. Douglas V.Hall –"Micoprocessors Interfacing" 2nd edition,2007
3. Rajkamal,"Microprocessors Architecture, programming, interfacing and system Design"- Pearson Education,2005

Course Outcomes-Program Outcomes-Program Specific Outcomes (CO-PO-PSO) Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	H		M										H	M	
CO2		L	H	M									M	H	L
CO3	M	H		L									H	L	
CO4		L	H	H	L								L	M	H
CO5		L	L	M					L	H	H			L	H

20ECT31: DIGITAL DESIGN USING VHDL

Credits –3 **Sessional Marks: 30**

L: T: P::3:0:0 **University Exam Marks: 70**

Course Objectives

1. To understand the design of ADC and DAC characteristic parameters and conversion errors.
2. To analyze different models in hardware description language.
3. To design VHDL models for different combinational logic circuits.
4. To design VHDL models for different sequential logic circuits.
5. To understand characteristics of memory and their classification.

Course Outcomes

After successful completion of the course the student should be able to

CO1. Develop an ADC and DAC and apply it to solve real life problems

CO2. Analyze, design and implement combinational logic circuits.

CO3. Classify different semiconductor memories.

CO4. Analyze, design and implement sequential logic circuits.

CO5. Simulate and implement combinational and sequential circuits using VHDL systems

UNIT I

Electronic data converters: D/A converters, characteristic parameters – DAC designs, DAC ICs – Conversion errors – performance measurements. A/D converters – characteristic parameters – ADC design ADC ICs – conversion errors – ADC testing.

UNIT II

The VHDL Hardware Description Language: Design flow, program structure, types and constants, functions and procedures, libraries and packages.

The VHDL design elements: Structural design elements, behavioral design elements, time dimension and simulation synthesis.

UNIT III

Combinational Logic Design: Decoders, encoders, three state devices, multiplexers and demultiplexers, Code Converters, EX-OR gates and parity circuits, comparators, adders & subtractors, ALUs, Combinational multipliers, VHDL models for the above ICs.

UNIT IV

Design Examples (using VHDL): Barrel shifter, comparators, floating-point encoder, and dual parity encoder.

Sequential logic Design: Latches & flip flops, PLDs, counters, shift register and their VHDL models, Synchronous design methodology.

UNIT V

ROMs: Internal Structure, 2D – decoding commercial types, timing and applications.

Static RAMs: Internal Structure, timing and standard SRAMs, Synchronous SRAMs.

Dynamic RAMs: Internal Structure, timing and standard DRAMs, Synchronous DRAMs.

Text Books

1. John F.Wakerly -"Digital Design Principles & Practices", Pearson Education, 3rdEdition, 2005.
2. - J.Bhaskar –"VHDL Primer", Pearson education, 3rdEdition.

Reference Books

1. K.C.Chang –"Digital design and Modelling with VHDL & Synthesis",1st edition.
2. Peter J.A Shenden –"The designers guide to VHDL", JIM LEWIS 3rd edition

Course outcomes-Program outcomes- Program Specific Outcomes (CO-PO-PSO) Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1		M	L	M									H	M	
CO2	M	H	L	L									H	M	
CO3	M	L	L										H		
CO4	L	H	M										H	M	L
CO5		M	L	H									L	L	H

20ECT32: MICROCONTROLLERS AND INTERFACING

Credits –3 **Sessional Marks: 30**

L: T: P::3:0:0 **University Exam Marks: 70**

Course Objectives

1. The course aims to highlight the architecture of 8051 microcontroller and to provide the students with a basic understanding of instruction sets & assembly language programming.
2. Programming the microcontroller in 8051 C is also emphasized in syllabus.
3. The main purpose of this subject is to develop the student abilities to apply the general knowledge of the microcontroller architecture in specific projects.

Course Outcomes

At the end of this course, students will demonstrate the ability to

CO1. Identify features of various microcontroller

CO2. Select appropriate microcontroller for different application

CO3. Interface microcontroller with hardware for given application

CO4. Write and execute assembly language programs(software) for given application CO5.Develop small microcontroller based applications.

UNIT I

8051 microcontroller: Overview of Architecture of microcontroller and advanced architecture and resources in advance,8051 microcontroller, internal and external memories, Counters and timers, synchronous serial-cum-asynchronous serial communication, Interrupt, instruction set-basic assembly language programming, Data transfer instructions, data and bit manipulation instructions, arithmetic instructions, Instructions for Logical operations on the test among the registers, internal RAM and SFR's, Program flow control instructions, Interrupt control flow.

UNIT II

Real –Time Control: Interrupt handling structures of a MCU, Interrupt latency and interrupt deadline, multiple source of interrupts, Enabling or disabling of interrupts, polling, priorities of interrupt, interrupt structure in Intel 8051.Timers-Programmable timers in MCU's.

UNIT III

Interface Methods: Key board interfacings, LED and array of LED's, Keyboard-cum-display controller (8279), Alphanumeric devices, Printer interfaces, Programmable instruction interface using IEEE 488 Bus, Interface with the flash

memory, interfacing to high power devices specify one/two devices, Analog inputs and output interfaces, optical motor shaft encoder, industrial control, industrial process control system, prototype MCU based measuring instruments, Robotics and embedded control.

UNIT IV

Real- Time Operating system: RTOS of keil (RTX51), use of RTOS in design, software development tools for microcontrollers.

UNIT V

16-Bit Microcontrollers: Memory map in Intel 80196 family MCU system, I/O ports, Programmable timers and high-speed outputs and inputs, Captures, interrupt, instruction. **ARM 32 Bit MCU's**: Introduction to 16/32-bit processors, Architecture and organization, ARM/THUMB programming method, ARM/THUMB instruction set and development tools.

Text books

1. Raj Kamal –"Microcontrollers architecture, programming, interfacing and organization", Pearson Education, 2005
2. Mazidi and Mazidi –"The 8051 Micro controller and embedded systems"-, PHI, 2000.

References

1. A.V.Deshmuk –"Microcontrollers (Theory and applications) ", WTMH, 2005.
2. Mohammad Ali Mazdi –"The 8051 micro Controller and Embedded systems", Vol1, PHI, 2000.

Course Outcomes – Program Outcomes- Program Specific Outcomes (CO-PO-PSO) Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	H	L											H		
CO2	H	L		M									L	M	H
CO3		M	H	L		L							L	M	H
CO4		M	H	L		L							L	M	H
CO5			M	H	L	L			L	L	L	L		M	H

20ECT33: BASICS OF EMBEDDED SYSTEMS

Credits –3 **Sessional Marks: 30**

L: T: P::3:0:0 **University Exam Marks: 70**

Course Objectives

Students completing this course will be well positioned to:

1. Familiarize about the basic functions of embedded systems.
2. Inculcate the basic architecture of general-purpose processors and its applications.
3. Gain interface between analog and digital blocks, also Software aspects of embedded systems.
4. Develop different State Machine and Concurrent Process Models.
5. Learn Evolution of complication and synthesis, Verification and reuse of intellectual property cores.

Course Outcomes

After successful completion of the course the student should be able to

CO1. Understand the embedded system concepts and technologies of embedded systems.

CO2. Analyze the general process of embedded system development.

CO3. Apply Interfacing between analog and digital blocks and apply Software aspects of embedded systems.

CO4. Create finite state machines and analyze Communication and Synchronization among processes.

CO5. Remember evolution and verification of hardware/software co-simulation.

UNIT I

Introduction: The concept of embedded systems design, Examples of embedded systems Design challenge, Processor technology, IC technology, Design technology. RT-Level combinational logic, Sequential logic (RT-Level), Custom single purpose processor design (RT-Level), Optimizing custom single purpose processors.

UNIT II

General Purpose Processors: Basic architecture, Development environment, Application specific system depth, Set processors (ASIPs). Embedded Memories,

UNIT III

Technological aspects of embedded systems: Interfacing between analog and digital blocks, signal conditioning, digital signal processing. System interfacing, interfacing with external systems, user interfacing. Design tradeoffs due to process compatibility, thermal considerations, etc., Software aspects of embedded systems: real time programming languages and operating systems for embedded systems.

UNIT IV

State Machine and Concurrent Process Models: Introduction, Models Vs languages, Finite State Machine with Data path model (FSMD), Using State Machines, Program State Machine (PSM),Concurrent Process Model, Concurrent Processes, Communication among processors, Synchronization among processes, Implementation, Data flow model.

UNIT V

Introduction Automation: The parallel evolution of complication and synthesis, Logic, RT, Behavioral synthesis, System synthesis and hardware/software code sign, Verification of hardware/software co-simulation, Reuse of intellectual property cores, Embedded microcontroller cores.

Text Books

1. Frank Vahid, Tony D. Givargis –"Embedded Systems Design – A unified Hardware/Software introduction ", John Wiley & Sons. Inc. 2002.
2. J.W. Valvano, "Embedded Microcomputer System: Real Time Interfacing", Brooks/Cole, 2000.

Reference books

1. Jack Ganssle, "The Art of Designing Embedded Systems", Newness, 1999.
2. V.K. Madisetti, "VLSI Digital Signal Processing", IEEE Press (NY, USA), 1995.
3. David Simon, "An Embedded Software Primer", Addison Wesley, 2000.

Course Outcomes-Program Outcomes- Programming Specific Outcomes (CO-PO-PSO) Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	H		L				M						H		
CO2	L	M	H	M	L					L				M	H
CO3				M	H		L		L	M	L		L	M	H
CO4		L	M	H				L	M		M	L		L	H
CO5			M	L		H	L	M	L	L	M	M	L	H	M

20ECT34 – DIGITAL IMAGE PROCESSING

Credits –3 **Sessional Marks: 30**

L: T: P::3:0:0 **University Exam Marks: 70**

Course Objectives

1. To learn basic concepts of signals, fundamentals and mathematical models in digital image processing.
2. To study different types of image transforms for image processing
3. To develop time and frequency domain techniques for image enhancement.
4. To understand Image segmentation, restoration, and filters with applications.
5. To expose the students to current applications, techniques and issues in image processing.

Course Outcomes

After successful completion of the course the student should be able to

CO1. Understand theory and models in Digital Image Processing.

CO2. Interpret and analyze 2D signals in frequency domain through image transforms.

CO3. Apply quantitative models of Digital image processing for various engineering applications.

CO4. Develop innovative design for practical applications in various fields.

CO5. Understand different methods for transmission and reception of Digital image.

UNIT I

Signals & Systems: Exponential and sinusoidal signals, continuous and Discrete time signals, sampling and reconstruction of signals- aliasing; sampling theorem and Nyquist rate.

Digital Image Fundamentals: Digital Image representation, Digital image processing systems, Visual perception, 2-D Sampling and Quantization, Basic relationships between pixels and imaging geometry.

UNIT II

Image Transforms: Discrete Fourier Transform, 1-D Discrete Fourier Transform, Fast Fourier Transform, Properities of 2 – D Fourier transform, Walsh, Hadmard, and Discrete cosine transform.

UNIT III

Image Enhancement: Background enhancement by point processing Histogram processing, Spatial filtering, Enhancement in frequency domain, Image smoothing, Image sharpering, Fundamentals of Colour image, Pseudo and False colour image.

UNIT IV

Image Restoration: Degradation model, Algebraic approach to restoration, Inverse filtering and Wiener filtering, Least mean Square filters, constrained least square restoration.

UNIT V

Image Coding: Fidelity criteria, Encoding process, Error free coding, Image coding relative to fidelity criterion, Image compression and decompression techniques.

Text Books

1. R.C. Gonzalez and R.E. Woods, ‘’Digital Image Processing” Prentice Hall 2002 **.**
2. A.V.Oppenheim, A.S.Willsky with S.Hamid Nawab, “Signals and Systems “,-PHI, 2nd Edition

Reference books

1. A.K. Jain, Prentice Hall, Fundamentals of “Digital Image Process”, India, New Delhi 1983.
2. William K Pratt, John Wilely, - “Digital Image Processing”,-3rd edition Wiley - 2004.
3. S.Jayaraman, S.Esakkirajan, T. Veera Kumar,”Digital Image Processing”, TMH-2009.

Course outcomes-Program outcomes- Control Specific Outcomes (CO-PO-PSO) Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	H	L		M	M		L			M		M	H		
CO2	L	M	M	H	L	L				L			H	M	
CO3	L	M	M	M	M	H		M		L				H	L
CO4			H	M	L	M	L	L	L	M	L	L	H	L	M
CO5		H	M	L	H	L			M	L		L	M	H	L

20ECP01: BASIC ELECTRONICS ENGINEERING LAB

Credits –1 **Sessional Marks: 40**

L: T: P::0:0:2 **University Exam Marks: 60**

CourseObjectives

1. To provide Engineering skills by way of breadboard circuits with electronic devicesand components.
2. To test and experimentally determine characteristics of electronic devices such as FET, PN diode, BJT & JFET.
3. To construct and measure different parameters of Rectifiers, Amplifiers and OP Amps.

Course Outcomes

After successful completion of the course the student should be able to

CO1. Plot the characteristics of electronic devices and determine their parameters.

CO2. Construct and test amplifiers, Rectifiers and oscillators.

CO3. Operate electronic test equipment.

CO4. Verify experimentally determined values with theoretical values.

CO5. Identify the applications of different Electronic Devices.

LIST OF EXPERIMENTS

1. Study of CRO.
2. PN Junction DiodeCharacteristics
3. Half Wave Rectifier with and without C filter
4. Full Wave Rectifier with and without LC filter
5. Bridge Rectifier with and without π filter
6. Input and output Characteristics of BJT in CE configuration
7. CE amplifier
8. FET characteristics
9. Feedback Amplifiers
10. RC phase shift Oscillator
11. OP-Amp applications
12. OP Amp Comparator and AstableMultivibrator.

Note: A Minimum of 10 experiments have to be conducted.

Course Outcomes – Program Outcomes – ProgramSpecific Outcomes(CO-PO-PSO) Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	M	H	-	-	-	-	-		L	L	L		H		
CO2			H	M					L	L	L			H	L
CO3		L	H	M					L	L	L		H	M	L
CO4		M	H						L	L	L		H		M
CO5		H	M	M					L	L	L	L	L		H

20ECP02: ELECTRONIC DEVICES AND CIRCUITS LAB

Credits –1 **Sessional Marks: 40**

L: T: P::0:0:2 **University Exam Marks: 60**

Course Objectives

1. To provide Engineering skills by the way of breadboard circuits with electronic devices
2. To construct and measure different parameters of Rectifiers, Amplifiers and Photo devices
3. To design and analyze BJT & FET Amplifiers.

Course Outcomes

After successful completion of the course the student should be able to

CO1. Plot the characteristics of Electronic devices and determine their parameters

CO2. Construct & test Rectifiers, Amplifiers & Oscillators.

CO3. Use different Electronic equipment.

CO4. To verify experimentally determined values with theoretical values.

CO5. Identify the applications of different Electronic circuits.

LIST OF EXPERIMENTS

1. Study of Electronic Equipment and components.
2. (a) PN Junction Diode and ZENER Diode Characteristics

(b) Zener application as Voltage regulator.

3. Half Wave Rectifier with and without C filter.
4. Full Wave Rectifier with and without LC filter.
5. Bridge Rectifier with and without π filter.
6. CE input and output Characteristics and determination of h parameters.
7. CE amplifier
8. Emitter follower
9. JFET characteristics and determination of its parameters
10. UJT Characteristics
11. JFET CS amplifier
12. Photosensitive Devices

Note: A Minimum of 10 experiments have to be conducted.

Course Outcomes-Program Outcomes -Program Specific Outcomes(CO-PO-PSO) Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1		**M**	**H**						**L**	**L**	**L**		**H**		
CO2			**H**	**M**					**L**	**L**	**L**			**H**	**L**
CO3		**L**	**H**	**M**					**L**	**L**	**L**		**H**	**M**	**L**
CO4		**M**	**H**						**L**	**L**	**L**		**H**		**M**
CO5		**H**	**M**	**M**					**L**	**L**	**L**	**L**	**L**		**H**

20ECP03:DIGITAL SYSTEM DESIGN LAB

Credits –1 **Sessional Marks: 40**

L: T: P::0:0:2 **University Exam Marks: 60**

Course Objectives

1. To Know about the behavior of digital logic.
2. To Understand combinational logic circuits and sequential logic circuits.

Course Outcomes

After successful completion of the course the student should be able to

CO1. Construct and experiment different logic gates .

CO2. Measure Test combinational logic circuits.

CO3. Usage different adders and subtractor.

CO4. Verify experimentally sequential logic circuits.

CO5. Identify the applications of decoders and display.

LIST OF EXPERIMENTS

1. Testing of Logic gates and simulation of gates using universal gates
2. Decoders
3. Encoders
4. Multiplexers
5. Demultiplexers
6. Flip –Flops
7. MOD-10 Counter
8. Shift register
9. Johnson counter
10. Half adder, Full adder and 4-bit parallel adder
11. Half subtractor & Full subtractor
12. Seven Segment Decoder and display

Note: A minimum of 10 experiments have to be conducted.

Course Outcomes-Program Outcomes -Program Specific Outcomes(CO-PO-PSO) Mapping

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	M	H	H	L					L	M	L		H		
CO2	L	L	H	M					L	L	M			H	M
CO3	M	H											H	M	
CO4	H	L												H	M
CO5		L	L	M	**H**									M	H

20ECP04: ANALOG ELECTRONICS LAB

Credits –1 **Sessional Marks: 40**

L: T: P::0:0:2 **University Exam Marks: 60**

Course Objectives

1. To test different amplifier circuits.
2. To generate sinusoidal and non-sinusoidal signals.
3. To design and test various multi-vibrator circuits and oscillators experimentally.
4. To Design and construct UJT relaxation oscillator

Course Outcomes

After successful completion of the course the student should be able to

CO1. Construct and experiment amplifiers, oscillators and multi-vibrator circuits

CO2. Measure different parameters and waveforms.

CO3. Use different electronic equipment.

CO4. Verify experimentally determined parameters with theoretical values.

CO5. Identify the applications of different Electronic circuits.

LIST OF EXPERIMENTS

1. Two stage RC coupled amplifier.
2. Darlington Amplifier with Bootstrapping.
3. Power amplifier.
4. Feedback amplifiers.
5. RC Phase shift oscillator.
6. Colpitts or Hartley oscillator.
7. RC Low pass and High pass circuits.
8. Diode clipper circuits
9. Schmitt Trigger.
10. Monostable Multivibrator.
11. Astable Multivibrator.
12. Sweep circuit using UJT.

Note: A minimum of 10 experiments have to be conducted.

Course Outcomes-Program Outcomes -Program Specific Outcomes(CO-PO-PSO) Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1		M	H						L	L	L		H		
CO2			H	M					L	L	L			H	L
CO3		L	H	M					L	L	L		H	M	L
CO4		M	H						L	L	L		H		M
CO5		H	M	M					L	L	L	L	L		H

20ECP05: MICROPROCESSORS AND MICROCONTROLLERS LAB

Credits –1 **Sessional Marks: 40**

L: T: P::0:0:2 **University Exam Marks: 60**

Course Objectives

1. Study the Architecture of 8086 microprocessor.
2. Learn the design aspects of I/O and Memory Interfacing circuits.
3. Study the Architecture of 8051 microcontroller

Course Outcomes

After successful completion of the course the student should be able to

CO1. Design and implement programs on 8086 microprocessor.

CO2. Design interfacing circuits with 8086.

CO3. Design and implement 8051 microcontroller-based systems

CO4**.** To understand the concepts related to I/O and memory interfacing

CO5. Design interfacing circuits with 8051 microcontroller

LIST OF EXPERIMENTS

8086 Microprocessor:

1. Arithmetic operations (Addition, subtraction, multiplication, division) using 8086 microprocessor
2. Sorting the n numbers in ascending & descending order.
3. Moving the block of string from one segment to another segment.
4. Sorting of string in ascending order
5. Sorting of string in descending order
6. Length of string
7. Reverse of string
8. Interface of ADC converter.
9. Interfacing of DAC converterStepper motor control using microprocessor.
10. Interfacing Keyboard/Display controller.
11. Microprocessor based traffic controller

8051 Microcontroller:

12. Programming using arithmetic, logical and bit manipulation instructions of 8051
13. Counter Design Display digits starting from 00 up to 99, incremented every second
14. Lamp Controller Switch ON a lamp through a relay and switch it OFF after say 2 minutes under p program control
15. Water Level Indicator Sense the presence or absence of water and switch ON or OFF an LED
16. DAC Interface Interface DAC to the microcontroller to generate a saw-tooth, square and triangular waveform
17. ADC Interface Interface to ADC and display the input analogue voltage to digital display of 8 LEDs
18. STEPPER MOTOR Interface to a Stepper motor to rotate
19. LCD Interface Interfacean 16 x 2 LCD display Serial Communication Establish

Course Outcomes-Program Outcomes -Program Specific Outcomes(CO-PO-PSO) Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1		**L**	**H**	**M**					**M**	**M**	**M**		**H**	**L**		
CO2		**L**	**H**	**M**					**M**	**M**	**M**		**H**	**L**		
CO3		**L**	**H**	**M**					**M**	**M**	**L**	**L**	**H**	**M**		
CO4	**H**	**L**	**M**						**M**	**L**	**M**	**L**	**M**	**H**		
CO5		**L**	**H**	**M**					**L**	**M**	**M**	**M**	**H**	**L**		

20ECP06: IC APPLICATIONS LAB

Credits –1 **Sessional Marks: 40**

L: T: P::0:0:2 **University Exam Marks: 60**

Course Objectives

1. To generate and measure sinusoidal and non-sinusoidal signals.
2. To design and construct different circuits with 555 timer and 566 VCO.
3. To acquire the basic Knowledge on special function ICs.

Course Outcomes

After successful completion of the course the student should be able to

CO1. Construct and experimentally verify different OP-Amp circuits.

CO2. Measure different parameters and waveforms.

CO3. Design different circuits using ICs.

CO4. Verify the experimentally determined parameters with theoretical values.

CO5. Identify the applications of different ICs.

LIST OF EXPERIMENTS

1. Measurement of OP Amp characteristics.
2. Design and construct the following using OP-Amp

a) Inverting amplifiers

b) Non-Inverting amplifiers

c) Adder

d) Subtractor

3. Integrator & Differentiator
4. Op-Amp Comparator and zero crossing detector
5. Astable and Monostable Multivibrators using Op-Amp
6. Design and construct Astable and Monostable Multivibrators using 555 timer
7. Schmitt trigger using 555 timer & 741 Op-Amp
8. VCO Application using 566 IC
9. IC Voltage Regulators.

10. Design and test Low pass and High pass filters using Op-Amp
11. 4-bit R-2R DAC using OPAMP
12. Design and test Wein bridge Oscillators.

Note: A minimum of 10 experiments have to be conducted.

Course outcomes - Program outcomes -Program Specific Outcomes (CO-PO-PSO) Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1		**M**	**H**						**L**	**L**	**L**		**H**		
CO2			**H**	**M**					**L**	**L**	**L**			**H**	**L**
CO3		**L**	**H**	**M**					**L**	**L**	**L**		**H**	**M**	**L**
CO4		**M**	**H**						**L**	**L**	**L**		**H**		**M**
CO5		**H**	**M**	**M**					**L**	**L**	**L**	**L**	**L**		**H**

20ECP07: ANALOG AND DIGITAL COMMUNICATION LAB

Credits –1 **Sessional Marks: 40**

L: T: P::0:0:2 **University Exam Marks: 60**

Course Objectives

1. To analyze and specify fundamental parameters of communication systems.
2. To evaluate the advantages and disadvantages of communication systems from the point of view practical considerations.
3. To study various pulse modulation and demodulation techniques practically.
4. To interpret various digital modulation and demodulation techniques.

Course Outcomes

After successful completion of the course the student should be able to

CO1. Design, construct and evaluateamplitude, frequency modulation and demodulation techniques.]

CO2. Understand and analyse various pulse modulation and demodulation techniques.

CO3. Analyse the generation and detection of various digital modulation techniques.

CO4. Verify sampling theorem and applications.

CO5. Evaluate the characteristics of Mixer.

LIST OF EXPERIMENTS

1. Amplitude modulation and demodulation and its spectral analysis
2. Frequency modulation and demodulation and its spectral analysis
3. Balanced modulator.
4. Characteristics of Mixer.
5. Synchronous detector.
6. SSB system.
7. Pulse Amplitude Modulation and Demodulation.
8. Pulse Width and Pulse Position Modulation and Demodulation.
9. Pulse Code Modulation.
10. Delta Modulation
11. Frequency Shift Keying
12. Phase Shift Keying.
13. Verification of sampling theorem.

Course Outcomes-Program Outcomes -Program Specific Outcomes(CO-PO-PSO) Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1		L	H	M					L	L	L		H	M	
CO2	H	M	L	L					L	L	L				H
CO3		L	M	H					L	L	L			H	M
CO4	H	M	L						L	L	L		L	H	M
CO5	H	M							L	L	L		H	L	

20ECP08 -DIGITAL SIGNAL PROCESSING LAB

Credits –1 **Sessional Marks: 40**

L: T: P::0:0:2 **University Exam Marks: 60**

Course Objectives

1. To develop simple algorithms for signal processing and test them using MATLAB
2. To write programs to perform computation in DSP processor using CCS.
3. To design and test digital filters for signal processing

Course Outcomes

After successful completion of the course the student should be able to

CO1. Analyze and process signals in the discrete domain

CO2. Design filters to suit specific requirements for specific applications

CO3. Perform statistical analysis and inferences on various types of signals

CO4. Design multi rate signal processing of signals through systems.

CO5. Analyze binary fixed point and floating-point representation of numbers and arithmetic Operations

LIST OF EXPERIMENTS USING MATLAB

1. To verify linear convolution
2. To verify the circular convolution.
3. To design FIR filter (LP/HP) using Windowing Techniques.

a. Using Rectangular Window.

b. Using triangular Window.

c. Using Kaiser Window.

4. To implement IIR filter (LP/HP) on DSP Processors.
5. N-point FFT algorithm.
6. MATLAB program to find frequency response of analog LP/HP Filters.
7. To compute power density spectrum of sequence.
8. To find the FFT of given 1-D signal and plot.

LIST OF EXPERIMENTS USING TMS320C5X

9. To verify linear convolution
10. To verify the circular convolution.
11. N-point FFT algorithm.
12. To compute power density spectrum of sequence.
13. To find the FFT of given I-D signal and plot.

Course Outcomes-Program Outcomes -Program Specific Outcomes(CO-PO-PSO) Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1		**H**	**L**		**H**				**H**	**H**	**L**	**L**	**H**	**M**	
CO2			**H**	**M**	**L**				**M**	**L**	**M**	**M**	**M**	**H**	**L**
CO3	**H**	**M**	**H**	**M**	**M**								**H**	**M**	
CO4			**M**	**H**	**M**				**L**	**M**	**H**	**L**	**M**	**H**	**L**
CO5	**H**	**M**	**L**	**L**									**H**	**M**	

20ECP09: MICROWAVE Lab

Credits –1 **Sessional Marks: 40**

L: T: P::0:0:2 **University Exam Marks: 60**

Course Objectives

1. To Know about the behaviour of microwave components.
2. To Know about the behaviour of microwave Devices.
3. To Understand the radiation pattern of different types of antennas.
4. To measure the impedance,attenuation and other parameters at microwave frequencies.
5. To analyse loss estimation of different components.

Course Outcomes

After successful completion of the course the student should be able to

CO1. Design, construct and test the various microwave devices and components.

CO2 .Compare the characteristics of the microwave devices and compare with the oretical values.

CO3. Analyze the variations of theoretical and practical values of different components.

CO4. Practice microwave measurement procedures.

CO5. Evaluate the frequency, wave length, VSWR, impedance and scattering parameters of various microwave devices practically.

LIST OF EXPERIMENTS

1. Reflex Klystron Characteristics.
2. Gunn Diode Characteristics.
3. Measurement of dielectric constant.
4. Measurement of Waveguide Parameters.
5. Low and High VSWR measurements.
6. Attenuation Measurements.
7. Impedance Measurements by using smith chart.
8. Directional Coupler Characteristics.
9. Antenna Measurements.
10. Scattering Parameters of Circulator, isolator.
11. S-matrix of T junctions.

Note: Aminimum of 10 experiments has to be conducted.

Course Outcomes-Program Outcomes -Program Specific Outcomes(CO-PO-PSO) Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1		**L**	**H**	**M**		**L**			**L**	**L**	**M**	**L**	**H**	**M**	
CO2	**M**	**H**	**L**	**L**					**L**	**L**	**M**		**H**	**M**	
CO3	**H**	**M**	**L**	**L**					**L**	**L**	**M**		**H**	**M**	
CO4	**H**	**M**	**L**	**L**					**L**	**L**	**M**		**H**		**L**
CO5	**H**	**M**	**L**	**L**	**L**				**L**	**L**	**M**		**H**		**L**

20ECP10: VLSI LAB

Credits –1 **Sessional Marks: 40**

L: T: P::0:0:2 **University Exam Marks: 60**

Course Objectives

1. The objective of this laboratory is to design and analyze digital circuits using EDA tools.
2. To educate students with the knowledge of HDL and test becnch, to write verilog code for all logic gates, flip-flops, counters and adders etc.
3. Students will be able to compile, simulate and synthesize the HDL.

Course Outcomes

After successful completion of the course the student should be able to

CO1. Design Entry & simulation of basic logic gates, encoders, decoders and multiplexer circuit with test bench & functional verification.

CO2. Ability to design & simulation of comparator, adders and flip-flop circuits with EDA tool.

CO3. Synthesis, P&R and Post P&R simulation, Concepts of FPGA floor plan, critical path, design gate count, I/O configuration and pin assignments.

LIST OF EXPERIMENTS

1. HDL Code to realize all the logic gates.
2. Design of 2-to-4 decoder
3. Design of 8-to-3 encoder (without and with priority)
4. Design of 8-to-1 multiplexer
5. Design of 4 bit Binary to Gray code converter
6. Design of Demultiplexer and comparator
7. Design of Full Adder using 3 modeling styles
8. Design of Flip Flops: SR, D, JK,T(Asynchronous Reset and Synchronous Reset)
9. Design of 4-bit binary, BCD Counters(Asyn Reset and Syn Reset) or any Sequence Counter
10. Finite State Machine Design

Course Outcomes-Program Outcomes – Program Specific Outcomes (CO-PO-PSO) Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1		M	H						M	L	L		H	M	
CO2		L	L	M	H				M	L	L			L	H
CO3			H	M	M	L			L	M	L	L		L	H

20ECP11: DIGITAL LOGIC DESIGN LAB

Credits –1 **Sessional Marks: 40**

L: T: P::0:0:2 **University Exam Marks: 60**

Course Objectives

1. To Know about the behavior of digital logic.
2. To Understand combinational logic circuits and sequential logic circuits.

Course Outcomes

At the end of the course, students will demonstrate the ability to:

CO1. Construct and experiment different logic gates .

CO2. Measure Test combinational logic circuits.

CO3. Usage different adders and subtractor.

CO4. Verify experimentallysequential logic circuits.

CO5. Identify the applications of decoders and display.

LIST OF EXPERIMENTS

1. Testing of Logic gates
2. Decoders
3. Encoders
4. Multiplexers
5. Demultiplexers
6. Half subtractor & Full subtractor
7. Half adder & Full adder
8. Flip –Flops
9. MOD-10 Counter
10. Shift register
11. Johnson counter
12. Seven Segment Decoder.

Note: A minimum of 10 experiments have to be conducted.

Course outcomes-Program outcomes -Program Specific Outcomes (CO-PO-PSO) Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	M	H	H	L					L	M	L		H		
CO2	L	L	H	M					L	L	M			H	M
CO3	M	H											H	M	
CO4	H	L												H	M
CO5		L	L	M	H									M	H