K.S.R.M. COLLEGE OF ENGINEERING
(UGC-AUTONOMOUS)
Kadapa, Andhra Pradesh, India– 516 003
Approved by AICTE, New Delhi & Affiliated to JNTUA, Ananthapuramu.
An ISO 14001:2004 & 9001: 2015 Certified Institution

COURSE STRUCTURE – R20 REGULATIONS
Department of ECE
Proposed Course Structure (R20) – II Year

Semester-III									
S.No	**Code**	**Course Name**	**Category**	**L**	T	**P**	**IM**	**EM**	**Credits**
1.	2021301	Special Functions and Complex Analysis	BSC	3	0	0	40	60	3
2.	2004301	Signals and Systems	PC	3	0	0	40	60	3
3.	2004302	Digital System Design	PC	3	0	0	40	60	3
4.	2004303	Analog Circuits	PC	3	0	0	40	60	3
5.	2004304	Network Theory	PC	3	0	0	40	60	3
6.	2004305	Simulation Lab	PC	0	0	3	40	60	1.5
7.	2004306	Digital System Design Lab	PC	0	0	3	40	60	1.5
8.	2004307	Analog Circuits Lab	PC	0	0	3	40	60	1.5
9.	20SC308	Python Programming (Skilled Course - I)	SC	1	0	2	40	60	2
10.	20MC309	Universal Human Values	MC	3	0	0	40		0
						Total			**21.5**

Semester-IV									
S.No	**Code**	**Course Name**	**Category**	**L**	T	**P**	**IM**	**EM**	**Credits**
1.	2021401	Probability Theory & Stochastic Processes	BSC	3	0	0	40	60	3
2.	2025402	Business Economics and Accounting for Engineers	HSC	3	0	0	40	60	3
3.	2004403	Microprocessors and Microcontrollers	PC	3	0	0	40	60	3
4.	2004404	EM Waves and Transmission Lines	PC	3	0	0	40	60	3
5.	2004405	Linear and Digital IC Applications	PC	3	0	0	40	60	3
6.	2004406	Linear and Digital IC Applications Lab	PC	0	0	3	40	60	1.5
7.	2004407	Microprocessors and Microcontrollers Lab	PC	0	0	3	40	60	1.5
8.	2004408	LabView Programming Lab	PC	0	0	3	40	60	1.5
9.	20SC409	PCB Design (Skilled Course –II)	SC	1	0	2	40	60	2
						Total			**21.5**
		Community Service Project(Mandatory) for 6 weeks duration during summer vacation							

Course Title	SIGNALS AND SYSTEMS				B. Tech. ECE III Sem		
Course Code	Category	Hours/Week		Credits	Maximum Marks		
2004301	PC	L	T	P	C	Continuous Internal Assessment	End Exams	Total
		3	--	--	3	40	60	100
Mid Exam Duration: 2Hrs					End Exam Duration: 3Hrs		

Course Objectives:

- To introduce terminology of signals and systems.
- To present Fourier tools through the analogy between vectors and signals.
- To teach concept of sampling and reconstruction of signals.
- To present linear systems in time and frequency domains.
- To teach Laplace and z-transform as mathematical tool to analyze continuous and discrete- time signals and systems.

Course Outcomes: On successful completion of this course, the students will be able to

CO 1	Identify the various signals and operations on signals.
CO 2	Describe the spectral characteristics of signals.
CO 3	Illustrate signal sampling and its reconstruction.
CO 4	Apply convolution and correlation in signal processing.
CO 5	Analyze continuous and discrete time systems.

UNIT-I

Introduction: Definition and Classification of Signals, Elementary signals, Basic operations on signals.

Fourier series representation of periodic signals: Analogy between vectors and signals, orthogonal signal space, Signal approximation using orthogonal functions, Mean square error, closed or complete set of orthogonal functions, Orthogonality in complex functions. Representation of function by a set of mutually orthogonal functions, Dirichlet‟s conditions, Trigonometric Fourier series and Exponential Fourier series, Spectrum and its significance, Amplitude and Phase spectra, bandwidth of a signal.

UNIT-II

Fourier transform: Fourier transform, Fourier transform of standard signals, properties of Fourier transforms, Fourier transforms involving impulse function, Fourier transform of periodic signals.

UNIT-III

Discrete Time Signals: Sampling of continuous time signals, Sampling theorem, Reconstruction of signal from its samples, effect of under sampling – Aliasing. Elementary sequences- Unit impulse, step, ramp, and exponential sequences, Periodicity of Discrete-time signals, Operations on Discrete-time signals.

Convolution and correlation: Graphical method of convolution, auto correlation and Cross correlation of functions, properties of correlation function, Energy density spectrum, Power density spectrum, Relation between convolution and correlation, Applications of convolution and correlation.

UNIT-IV

Response of LTI systems: Systems, Classification of Systems, Linear time invariant (LTI) system, Transmission of signals through LTI systems, Transfer function of a LTI system, Causality & Stability. Distortion less transmission through LTI system, Bandwidth of systems, relation between bandwidth and rise time.

Discrete Time Systems: Definition, classification, Linear Shift Invariant(LSI) system, Stability, Causality, Linear constant coefficient difference equation, Impulse response, Discrete time Fourier transform, Properties, Transfer function, System analysis using DTFT.

UNIT-V

Laplace Transform: Definition , ROC , Properties , Inverse Laplace transform , The S-plane and BIBO stability , Transfer functions , System response to standard signals.

Z–Transform: Definition, ROC and its properties, analysis of LTI system using Z-transform, The Inverse Z-transform using, Z-transform properties, Unilateral Z- Transform, solution of linear constant coefficient difference equations using Z-transforms.

Text Books:

1. Simon Haykin, Van Veen, and Wiley, "Signals & Systems", 2nd Edition, 2003.
2. Oppenheim AV and Willisky, "Signals and Systems", 2nd Edition, Pearson Ed, 1997.
3. B.P. Lathi, "Principles of Linear systems and signals," Oxford Univ. Press, Second Edition International version, 2009.

Reference Books:

1. Simon Haykin, "Communication Systems", 2nd Edition, Wiley-Eastern, 2003.
2. Luis F. Chaparro, "Signals and Systems using MATLAB," Academic Press, 2011.
3. P. Ramesh Babu, R. Ananda Natarajan, "Signals and Systems", 2nd edition, SciTech Publications, 2006.
4. John G. Proakis, Dimitris G. Manolakis, "Digital Signal Processing, Principles, Algorithms ,and Applications", 4 th Edition, PHI, 2007.

Course Title	DIGITAL SYSTEM DESIGN					B. Tech. ECE III Sem		
Course Code	Category	Hours/Week			Credits	Maximum Marks		
2004302	PC	L	T	P	C	Continuous Internal Assessment	End Exams	Total
		3	--	--	3	40	60	100
Mid Exam Duration: 2Hrs					End Exam Duration: 3Hrs			

Course Objectives:

- To provide fundamentals of number systems and Boolean algebra.
- To learn the design of combinational and sequential circuits.
- To teach various memories and PLDs.

Course Outcomes: On successful completion of this course, the students will be able to

CO 1	Identify various number systems and binary codes.
CO 2	Understand the postulates, theorems and properties of Boolean algebra.
CO 3	Show the correlation between the Boolean expression and their corresponding logic diagram.
CO 4	Analyze Combinational & sequential logic circuits.
CO 5	Solve Switching functions using Programmable Logic Devices

UNIT-I

Number Systems & Codes: Overview of number systems –complement representation of negative numbers- binary arithmetic, binary codes, code conversion, error detecting & error correcting codes –Hamming codes.

UNIT-II

Boolean algebra and Minimization of Switching Functions: Fundamental postulates of Boolean algebra - Basic theorems and properties –Canonical and Standard forms- Minimal SOP and POS forms, Algebraic simplification, The K- map method, tabulation method.

Realization of Logic Gates Using Diodes & Transistors: Diode AND gate, Diode OR Gate & Transistor NOT gate, Diode-Transistor Logic (DTL), Resistor-Transistor Logic (RTL), Resistor Capacitor-Transistor Logic (RCTL), Direct-Connected Transistor Logic (DCTL), Emitter-Coupled Logic (ECL) and Transistor-Transistor Logic (TTL) Families, and comparison among the logic families, digital logic gates –universal gates-Multilevel NAND/NOR realizations.

UNIT-III

Combinational Logic Design: Design using conventional logic gates, Half and Full Adders, Subtractors, Serial and Parallel Adders, Encoder, Decoder, Multiplexer, De-Multiplexer, Realization of switching functions using multiplexer, Parity bit generator, Code-converters, Hazards and hazard free realizations.

UNIT-IV

Sequential Logic Design: Synchronous and Asynchronous sequential circuits, Flip-flops-Triggering and excitation tables, Flip flop conversions, shift registers, Design of Synchronous and Asynchronous counters, Ring and Johnson counters. Finite state machines (Mealy Model, Moore Model) and their representation, Designing synchronous Sequential circuits like Serial Binary adder, Sequence detector.

UNIT-V

Semiconductor Memories and Programmable Logic Devices: ROM- Internal structure, Static RAM and Dynamic RAM. Basic PLD‟s-ROM, PROM, PLA, and PAL, Realization of Switching functions using basic PLD‟s. Concept of PLD‟s like CPLDs and FPGAs.

Text Books:

1. ZVI Kohavi, “Switching & Finite Automata theory” –, TMH, 2nd Edition.
2. Morris Mano, “Digital Design”, PHI, 3rd Edition, 2006.
3. Jacob Millman and Herbert Taub Pulse, Digital and Switching Waveforms –McGraw-Hill, 1991

Reference Books:

1. R.P. Jain, “Modern digital Electronics”, Tata McGraw Hill, 4th edition, 2009.
2. W.H. Gothmann, “Digital Electronics- An introduction to theory and practice”, PHI, 2nd edition ,2006.
3. D.V. Hall, “Digital Circuits and Systems”, Tata McGraw Hill, 1989
4. William I. Fletcher, “An Engineering Approach to Digital Design”, PHI.
5. A. Anand Kumar, “Switching Theory & Logic Design”, 2008, PHI
6. Pulse and Digital Circuits – A.Anand Kumar, PHI, 2005.

Course Title	ANALOG CIRCUITS				B. Tech. ECE III Sem		
Course Code	Category	Hours/Week		Credits	Maximum Marks		
2004303	PC	L	T	P	C	Continuous Internal Assessment	End Exams	Total
		3	--	--	3	40	60	100
Mid Exam Duration: 2Hrs					End Exam Duration: 3Hrs		

Course Objectives:

- Learn the concepts of high frequency analysis of transistors.
- To give understanding of various types of amplifier circuits such as small signal, cascaded,
  Large signal and tuned amplifiers
- To familiarize the Concept of feedback in amplifiers so as to differentiate between negative and positive feedback.
- To construct various multivibrators using transistors and sweep circuits

Course Outcomes: On successful completion of this course, the students will be able to

CO 1	Identify the multistage amplifiers.
CO 2	Understand the concepts of High Frequency Analysis ofTransistors.
CO 3	Show the improvement in stability of amplifiers using negative feedback and positive feedback to generate sustained oscillations.
CO 4	Analyze different classes of Power Amplifiers and tuned amplifiers useable for audio and Radio applications.
CO 5	Design Multivibrators and sweep circuits for various applications.

UNIT-I

Multistage and Differential Amplifiers

Introduction – Recap of Small Signal Amplifiers, Multistage Amplifiers, Cascode amplifier, Darlington pair, the MOS Differential Pair, Small-Signal Operation of the MOS Differential Pair, The BJT Differential Pair, and other Non ideal Characteristics of the Differential Amplifier.

UNIT-II

High Frequency Response of Transistors: Hybrid - model of Common Emitter transistor model, f_α, f_β and unity gain bandwidth, Gain-bandwidth product. High Frequency response of CG amplifier.

UNIT-III

Feedback Amplifiers: Concepts of feedback – Classification of feedback amplifiers – General Characteristics of Negative feedback amplifiers – Effect of Feedback on Amplifier characteristics– Voltage series, Voltage shunt, Current series and Current shunt Feedback configurations – Simple problems

Oscillators: Condition for Oscillations, RC type Oscillators-RC phase shift and Wien-bridge Oscillators, LC type Oscillators –Generalized analysis of LC Oscillators, Hartley and Colpitts Oscillators, Frequency and amplitude stability of Oscillators, Crystal Oscillator.

UNIT-IV

Large Signal Amplifiers: Class A Power Amplifier- Series fed and Transformer coupled Conversion Efficiency, Class B Power Amplifier- Push Pull and Complimentary Symmetry configurations, Conversion Efficiency, Principle of operation of Class AB and Class –C Amplifiers.

Tuned Amplifiers: Introduction, single Tuned Amplifiers – Q-factor, frequency response of tuned amplifiers, Concept of stagger tuning and synchronous tuning.

UNIT-V

Multivibrators: Analysis of Bistable, Monostable, Astable Multivibrators and Schmitt trigger using Transistors.

Time Base Generators: General features of a Time base Signal, Methods of Generating Time Base Waveform, concepts of Transistor Miller and Bootstrap Time Base Generator, Methods of Linearity improvement

Text Books:

1. Adel. S. Sedra and Kenneth C. Smith, "Micro Electronic Circuits," 6th Edition, Oxford University Press, 2011.
2. Jacob Millman, Christos C Halkias, "Integrated Electronics", McGraw Hill Education
3. Thomas L. Floyd, "Electronic Devices Conventional and current version", 2015- Pearson

Reference Books:

1. David A. Bell, "Electronic Devices and Circuits", 5th Edition, Oxford.
2. Robert L. Boylestead, Louis Nashelsky, "Electronic Devices and Circuits theory", 11th Edition,2009, Pearson

Course Title	Network Theory				B. Tech. ECE III Sem		
Course Code	Category	Hours/Week			Credits	Maximum Marks	
2004304	PC	L	T	P	C	Continuous Internal Assessment	End Exams	Total
		3	--	--	3	40	60	100
Mid Exam Duration: 2Hrs					End Exam Duration: 3Hrs		

Course Objectives:

- To learn network theorems,
- To teach application of resonance, transients applied for ac and dc circuits
- To study necessary conditions for network functions, various parameters and its relationships.

Course Outcomes: On successful completion of this course, the students will be able to

CO 1	Understand network topology.
CO 2	Compute RL, RC and RLC for DC transient response.
CO 3	Solve RL, RC and RLC circuits for AC response.
CO 4	Analyze two port networks for Z, Y, ABCD, H parameters and its relationship between them
CO5	Apply network synthesis procedure to RC, RL and LC circuits.

UNIT – I

Network topology: Introduction, definitions, formation of incidence matrix, cutest, tie set, loop current method of analysis, crammer's method, driving point and transfer impedance, dual networks, procedure to obtain dual network.

UNIT – II

DC Transient Analysis: Determination of initial conditions – transient response of R-L, R-C & R-L-C circuits for dc–solution method using differential equation and Laplace transforms.

UNIT – III

AC Analysis: Response of R-L, R-C and R-L-C series circuits for sinusoidal excitations, solution method using differential equation and Laplace transforms.

Resonance: Series, parallel circuits, concept of half power frequencies, bandwidth and Q factor. Simple problems.

UNIT – IV

Two port Networks: one port, two port and n-port networks, driving point impedance and admittance, transfer impedance and admittance, voltage and current ratios, impedance parameters, admittance parameters, transmission parameters, hybrid and inverse hybrid parameters, relationship between parameters, conditions for symmetry and reciprocity.

UNIT – V

Network Synthesis: Causality and Stability, Positive Real Function, Hurwitz Polynomial, Testing Driving Point Immittances, Elementary Synthesis Procedures, Properties of RL,RC,LC Immittances.

Text Books

1. M.E Van Valkenburg "Network Analysis" –- 3rd edition, PHI, 2015.
2. Hayt and Kimmerly "Engineering circuit analysis", 7th edition, TMH, 2010.

Reference Books

1. A. Sudhakar, Shayammohan. S. Pillai "Circuits & Networks" –, 4th Edition –. TMH, 2013.
2. Stanley "Network Analysis with applications", 4th edition, Pearson education, 2004.
3. D. Roy Chowdari "Networks and Systems" — New Age International
4. "Fundamentals of Electrical Networks" by BR Guptha and V.Singhal, S.Chand.
5. N.Sreenivasulu, "Electrical Circuits", Reem publications, 2012.
6. A.Chakrabarti, "Circuit Theory", seventh edition, Dhanapat Rai & Co publications, 2015.

Course Title	Simulation Lab				B. Tech. ECE III Sem		
Course Code	Category	Hours/Week			Credits	Maximum Marks	
2004305	PC	L	T	P	C	Continuous Internal Assessment	End Exams	Total
		-	--	3	1.5	40	60	100
					End Exam Duration: 3Hrs		

Course Objectives:

- To understand the signal properties and different transforms by using mat lab.
- To understand the simulation software

Course Outcomes: On successful completion of this course, the students will be able to

CO 1	Understand the main features and importance of the MATLAB/ SCI LAB or OCTAVE mathematical programming environment.
CO 2	Apply working knowledge of MATLAB/ SCI LAB or OCTAVE package to simulate the basic signals.
CO 3	Verify the properties of basic signals.
CO4	Analyze the Frequency characteristics of signals.

Any 12 experiments of the following

List of Experiments:

1. Basic Operations on Matrices
2. To Generate Various signals and Sequences (Periodic and Aperiodic), Such as Unit Impulse, Unit Step, Square, Saw Tooth, Triangular, Sinusoidal, Ramp, sinc function.
3. To perform various Operations such as Addition, Multiplication, Scaling, Shifting, Folding on Signals and Sequences.
4. To Compute Energy and Average Power of a signal.
5. To find the Even and Odd Components of Signal or Sequence and Real and Imaginary Parts of Signal.
6. To compute Convolution of any two Signals and Sequences.
7. Autocorrelation and Cross correlation between Signals and Sequences.
8. Verification of Linearity and Time Invariance Properties of a Given Continuous / Discrete System.
9. Computation of Unit Sample, Unit Step and Sinusoidal Responses of the Given LTI System and Verifying its Physical Reliability and Stability Properties.
10. Finding the Fourier Transform of a given Signal and plotting its Magnitude and Phase Spectrum.
11. Waveform Synthesis using Laplace Transform.
12. Locating Zeros and Poles, and plotting the Pole-Zero maps in S-Plane and Z-Plane for the given Transfer Functions.
13. Sampling Theorem Verification.
14. Removal of Noise by Auto Correlation / Cross correlation in a given signal corrupted by noise.

Note: MATLAB /SCI LAB /OCTAVE SOFTWARE is used for the above experiments.

Course Title	DIGITAL SYSTEM DESIGN LAB				B. Tech. ECE III Sem		
Course Code	Category	Hours/Week		Credits	Maximum Marks		
2004306	PC	L	T	P	C	Continuous Internal Assessment	End Exams	Total
		--	--	3	1.5	40	60	100
					End Exam Duration: 3Hrs		

Course Objectives:

- To simplify and implement different Boolean expressions.
- To design and verify the combinational circuits
- To design and verify sequential circuits.

Course Outcomes: On successful completion of this laboratory course, the students will be able to

CO 1	Simplify, design and implement Boolean expression/half and full adders using basic/universal gates.
CO 2	Design and implement the various combinational circuits
CO 3	Implement and verify the truth tables of various flip-flops
CO 4	Design and implement the registers and sequence generator.
CO 5	Design and implement the counters

List of Experiments:

1. Verification of outputs of all Logic Gates- 74XX
2. Design and verify the truth tables of Half Adder, Full Adder
3. Design and verify the 4-bit Binary Full Adder -7483 using 1 bit full adder.
4. Design and verify the 3-8 Decoder -74138.
5. Design and verify the 8-3 Encoder- 74X148
6. Design and verify the 8 x 1 Multiplexer -74X151
7. Design and verify the 4 bit Comparator-74X85
8. Design and verify the truth table of D Flip-Flop 74X74
9. Design the Decade counter-74X160 or 7490 and verify the output.
10. Design any Mod-Counters and verify the output.
11. Verify the shifting operation of 4-bit R/L shift register -7495
12. Verify the output of Ring counter
13. Verify the output of Johnson counter

Course Title	ANALOG CIRCUITS LAB				B. Tech. ECE III Sem		
Course Code	Category	Hours/Week			Credits	Maximum Marks	
2004307	PC	L	T	P	C	Continuous Internal Assessment	End Exams	Total
		--	--	3	1.5	40	60	100
					End Exam Duration: 3Hrs		

Course Objectives:

- The objective of the course is to verify theoretically and practically all the experiments, analyze the characteristics of BJT, design the oscillators, feedback amplifier circuits, power amplifier circuits and multi-vibrator circuits from the

Course Outcomes: On successful completion of this laboratory course, the students will be able to

CO 1	Verify the characteristics of amplifiers with and without feedback.
CO 2	Observe the output waveforms of different oscillators.
CO 3	Analyze the characteristics of power amplifiers.
CO 4	Design monostable Multivibrator circuit.

List of Experiments:

1. Design & Analysis of frequency Response of Common Emitter Amplifier
2. Design & Analysis of Frequency Response of Common Source Amplifier
3. Design & Analysis of Frequency Response of Common Drain Amplifier
4. Verify the Frequency Response of Two Stage RC Coupled Amplifier
5. Verify the Frequency Response of Cascode amplifier Circuit
6. Verify the Frequency Response of Darlington Pair Circuit
7. Verify the Frequency Response of Current Shunt Feedback amplifier Circuit
8. Verify the Frequency Response of Voltage Series Feedback amplifier Circuit
9. Design and verify RC Phase shift Oscillator Circuit (using MOSFET)
10. Design and verify Hartley and Colpitt‘s Oscillators Circuit
11. Verify the Frequency Response of Class A power amplifier
12. Verify the Frequency Response of Class B Complementary symmetry amplifier
13. Design and verify a Monostable Multivibrator
14. Design and verify Miller Sweep Circuit.

Course Title	PYTHON PROGRAMMING				B. Tech. ECE III Sem		
Course Code	Category	Hours/Week			Credits	Maximum Marks	
20SC308	SC	L	T	P	C	Continuous Internal Assessment	End Exams	Total
		1	--	2	2	40	60	100
					End Exam Duration: 3Hrs		

Course Objectives:

- To write, test, and debug simple Python programs.
- To implement Python programs with conditionals and loops.
- Use functions for structuring Python programs.
- Represent compound data using Python lists, tuples and dictionaries.
- Read and write data from/to files in Python

Course Outcomes: On successful completion of this course, the students will be able to

CO 1	Demonstrate the functions in Python programming.
CO 2	Illustrate Python programs with conditionals and loops.
CO 3	Test functions for structuring Python programs.
CO 4	Design functions for structuring Python programs.
CO 5	Evaluate compound data using Python lists, tuples, dictionaries.

LIST OF PROGRAMS

1. Compute the GCD of two numbers.
2. Find the square root of a number (Newton's method)
3. Find the Exponentiation (power of a number)
4. Find the maximum of a list of numbers
5. To implement Linear search and Binary search
6. To implement Selection sort, Insertion sort
7. To Merge and sort the given list
8. To obtain First n prime numbers
9. Multiplication of matrices
10. Programs that take command line arguments (word count)
11. Find the most frequent words in a text read from a file
12. To solve a given circuit diagram
13. To perform mesh analysis of electrical cicuit.

PLATFORM NEEDED

Python 3 interpreter for Windows/Linux

Course Title	PROBABILITY THEORY AND STOCHASTIC PROCESSES				B. Tech. ECE IVSem		
Course Code	Category	Hours/Week		Credits	Maximum Marks		
2021401	BSC	L	T	P	C	Continuous Internal Assessment	End Exams	Total
		3	--	--	3	30	70	100
Mid Exam Duration: 2Hrs					End Exam Duration: 3Hrs		

Course Objectives:

- The Objective of this course is to provide the students with knowledge about the random variable and random processes.
- To model the random processes in the communication system such as receiver performance, interference, thermal noise, and multipath phenomenon.

Course Outcomes: On successful completion of this course, the students will be able to

CO 1	Interpret probability by modeling sample spaces
CO 2	Understand various random processes like Gaussian, Exponential, Uniform and Poisson processes experimentally
CO 3	Compute PSD of Random process
CO 4	Analyze solutions for complex engineering problems involving random processes
CO 5	Solve the linear system challenges with random inputs

UNIT-I

Probability: Probability definition, Event, Sample space, Axioms, Joint and conditional probability, Independent events, Total probability theorem, Baye's theorem, Bernoulli trials.

Random Variable: Concept, Distribution function, Density function, Conditional distribution and density functions.

UNIT-II

Operations on Single random variables: Expectation, Conditional expected value, Moments, Chebyshev, Markov‟s and Chernoff‟s inequalities, Characteristics and moment generating functions, Transformation of continuous and discrete random variable.

UNIT-III

Multiple Random Variables: Vector random variables, Joint distribution & Density functions, Conditional density & Distribution functions, Statistical independence, pdf and cdfforsumofrandomvariables,Centrallimittheorem,Operationsonmultiplerandomvariables, Expected value of function of random variables, Joint characteristic function, Joint by Gaussian random variables, Transformations of multiple random variables.

UNIT-IV

Random Processes : Concept, Stationary, Independence, Time averages, Ergodicity, Correlation functions and its properties, Gaussian, Poisson, and Markov processes, Power spectral density and its properties, Relation between power spectral density and auto- correlation, Cross power spectral density and its properties, Power spectrum for discrete time processes and sequences, Definition of white and colored noise.

UNIT-V

Linear Systems with Random Inputs: Random signal response of linear system, System evaluation using random noise, Spectral characteristics of system response, Noise bandwidth, Band pass, Band limited, and Narrow band processes, Properties of band limited processes.

Text Books:

1. P.Z. Peebles Jr., "Probability Random Variables and Random Signal Principles", Tata McGraw-Hill, 4th Edition, 2001.
2. A. Papoulis and S. Unnikrishna Pillai, "Probability Random Variablesand Stochastic Processes", 4th Edition, PHI,2007

Reference Books:

1. S.P. Eugene Xavier, "Statistical Theory of Communication", New Age Publications, 2003.
2. B.P. Lathi, "Signals, Systems & Communications", B.S. Publications,2003.
3. G.R. Babu and K. Pushpa, "Probability Theory and Stochastic Processes", Premier Publishing House.
4. D. G. Childer, "Probability and Random Processes", McGraw Hill, 1997.
5. Hwei P. Hsu, Ph.D., "Theory and Problems of Probability, Random Variables,and Random Processes", Schaum's Outline Series, McGraw Hill, New York,1968.
6. B.P. Lathi, "Modern Digital and Analog Communication Systems," Third Edition, OXFORD University press, 1998.

Course Title	MICROPROCESSORS & MICROCONTROLLERS				B. Tech. ECE IV Sem			
Course Code	Category	Hours/Week			Credits	Maximum Marks		
2004403	PC	L	T	P	C	Continuous Internal Assessment	End Exams	Total
		3	--	--	3	40	60	100
Mid Exam Duration: 2 Hrs					End Exam Duration: 3Hrs			

Course Objectives:

- To become familiar with 8086 Microprocessor and 8051 Microcontroller Architecture, Instructions, Operating Modes and Programming.
- To use 8086 microprocessor and 8051 microcontroller for various applications.
- To study various peripherals for microprocessor based systems.

Course Outcomes: On successful completion of this course, the students will be able to

CO 1	Define various components and list out various features of microprocessor, microcontroller and peripherals.
CO 2	Describe the internal block diagram of microprocessor, microcontroller and peripherals, addressing modes, instruction set and data transfer schemes.
CO 3	Develop algorithm and assembly language programs to solve problems.
CO 4	Apply an appropriate algorithm, program and peripheral for the application.
CO 5	Design the microprocessor or microcontroller based system to solve real time problems. (Prepare a case study model to get a first prototype)

UNIT I

The 8086 Microprocessor–Introduction to microprocessors, 8086 microprocessor Architecture, Instruction set, Addressing modes, Interrupt system. Pin diagram, Minimum mode 8086 system and timings, Maximum mode 8086 system and timings.

UNIT II

Assembly Language Programming: Assembler directives, Assembly language programs (8086) with Assembler directives for addition, subtraction, multiplication, division etc., sorting and searching, bit manipulation, look-up tables, string manipulations, Macros and Delay subroutines.

Data transfer schemes and Memory Interfacing: Synchronous, Asynchronous, Interrupt driven and DMA type schemes, Address decoding techniques, Interfacing Static RAM and ROM chips.

UNIT III

Peripheral Interfacing: 8255 PPI and its interfacing, Programmable Communication Interface (8251 USART) and its interfacing, Programmable Interval Timer (8254) and its interfacing, Programmable interrupt controller (8259) and its interfacing, Programmable DMA controller (8257) and its interfacing, ADC and DAC Interfacing.

UNIT IV

The 8051 microcontroller: Architecture, pin diagram, memory organization, external memory interfacing, stack, addressing modes, instruction set, Assembler directives, Assembly Language programs and Time delay Calculations, 8051 interrupt structure, 8051 counters and Timers, programming 8051 timers.

UNIT V

Introduction to ARM: ARM Design philosophy, Registers, Program Status Register, Instruction pipeline, Interrupts and vector table, Instruction Set- Data Processing Instructions, Branch, Load-Store, Software interrupt, PSR instructions, Conditional instructions, Thumb instruction Set: Register Usage, Other Branch instructions, Data processing Instructions, Single-Register and Multi Register Load-Store Instructions, Stack, Software Interrupt Instructions.

Text Books:

1. Ramesh S. Gaonkar, "Microprocessor architecture, programming and its applications with 8085", Penram International Publications, 4th Edition.
2. A. K. Ray and K.M. Bhurchandi, "Advanced Microprocessors and Peripherals", TMH.
3. Mazidi Muhammad Ali, Mazidi Janice Gillespie &McKinlayRolin D, "The 8051Microcontroller and Embedded Systems", 2nd Edition, Pearson Education, 2008.
4. Kenneth J Ayala, "The 8051 microcontroller: Architecture, Programming & Applications", Penram publications, 2nd edition.
5. Andrew N.Sloss, Dominic Symes, Chris Wright, "ARM System Developer's Guide-Designing and Optimizing system software", Elsevier, 2008.

Reference Books:

1. Douglas V. Hall, "Microprocessors and Interfacing: Programming and Hardware", 2nd Edition, Tata McGraw-Hill.
2. Barry B. Brey, "The Intel Microprocessors-Architecture, Programming and Interfacing", 8th Edition, PHI.
3. Y. Liu and Glenn A. Gibson, "Microcomputer Systems: 8086/8088 Family Architecture, Programming and Design", 2nd Edition, PHI.
4. Raj Kamal,"Microcontrollers Architecture, Programming, Interfacing and System Design", Pearson Education, 2005.
5. Steve Furbur, "ARM System on-chip Architecture",2nd Edition, Addison Wesley, 2000.

Course Title	EM WAVES AND TRANSMISSION LINES				B. Tech. ECE IV Sem		
Course Code	**Category**	**Hours/Week**			**Credits**	**Maximum Marks**	
2004404	**PC**	**L**	**T**	**P**	**C**	**Continuous Internal Assessment**	**End Exams**	**Total**
		3	--	--	3	40	60	100
Mid Exam Duration: 2Hrs					**End Exam Duration: 3Hrs**		

Course Objectives:

- Understanding and increasing the ability to use vector algebra, and vector calculus.
- Proficiency in the use of vector identities, and various Coordinate systems & transformations
- Providing the basic education in static electromagnetic fields and time varying electromagnetic waves.
- Developing analytical skills for understanding propagation of electromagnetic waves in different media.
- Understanding the concepts of transmission lines & their applications

Course Outcomes: On successful completion of this course, the students will be able to

CO 1	Understand the basics of Electro Statics and Magneto Statics.
CO 2	Apply Maxwell's equations in the derivation of fields.
CO 3	Calculate Electric and magnetic fields due to various sources.
CO 4	Analyze the wave propagation in different media.
CO 5	Describe the transmission line equations and compute various parameters.

UNIT-I

Electrostatics: Review of Vector algebra, Co-ordinate systems & transformation, Vector calculus, 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, Convection and Conduction Currents, Dielectric Constant, Isotropic and Homogeneous Dielectrics, Continuity Equation, Relaxation Time, Poisson's and Laplace's Equations, Capacitance – Parallel Plate, Coaxial, Spherical Capacitors, Illustrative Problems.

UNIT-II

Magneto statics: Biot-savart's law, Ampere's law and applications, Magnetic flux density, Maxwell's two equations for magneto static fields, magnetic scalar and vector potentials, Forces due to Magnetic fields, Ampere's force law, inductances and magnetic energy, illustrative problems.

UNIT-III

Maxwell's Equations (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, conditions at boundary surface: Dielectric- Dielectric and Dielectric-conductor interfaces, illustrative problems.

UNIT-IV

EM wave characteristics: Wave equations for conducting and perfect dielectric media, Uniform plane waves-Definition, All relations between E&H, Sinusoidal variations, Wave propagation in loss less and conducting media, conductors& dielectrics- characterization, wave propagation in good conductors and good dielectrics, polarization.

Reflection and Refraction of plane waves: Normal and Oblique incidences for both perfect conductors and dielectrics, Brewster angle, Critical angle and total internal reflection, Surface impedance, pointing vector and pointing theorem-applications, power losses in a plane conductor, illustrative problems

UNIT-V

Transmission lines: Types, parameters, Transmission line equations, Primary & Secondary constants, Expression for characteristic impedance, Propagation constant, Phase and group velocities, Loss less and low loss characterization, Distortion- condition for Distortion less and minimum attenuation, input impedance relations, SC and OC lines, Reflection coefficient, VSWR, Smith chart & its applications, illustrative problems.

Text Books:

1. Matthew N.O. Sadiku, "Elements of Electromagnetics," Oxford Univ. Press, 4th ed.,2008.
2. William H. Hayt Jr. and John A. Buck, "Engineering Electromagnetics," TMH, 7th ed.,2006.
3. E.C. Jordan and K.G. Balmain, "Electromagnetic Waves and Radiating Systems" PHI,2nd ed., 2000.

Reference Books:

1. John D. Krauss, "Electromagnetics", McGraw- Hill publications, 3rd ed., 1988.
2. John D. Ryder, "Networks, Lines, and Fields," PHI publications, Second Edition, 2012.
3. Schaum's out – lines, "Electromagnetics", Tata McGraw-Hill publications, Second Edition, 2006

Course Title	LINEAR AND DIGITAL IC APPLICATIONS				B. Tech. ECE IV Sem		
Course Code	Category	Hours/Week		Credits	Maximum Marks		
2004405	PC	L	T	P	C	Continuous Internal Assessment	End Exams	Total
		3	--	--	3	40	60	100
Mid Exam Duration: 2Hrs					End Exam Duration: 3Hrs		

Course Objectives:

- To give introduction to Op-Amps.
- To study about Timers and PLLs.
- To learn the applications of Op-Amps.
- To introduce Verilog and its language elements to design digital systems
- Make students familiar with design of different combinational and sequential digital circuits.

Course Outcomes: On successful completion of this course, the students will be able to

CO 1	Understand the operation and characteristics of OP-AMPs, CMOS, Bipolar logic families and its interfacing.
CO 2	Applying basic equations and compute the parameters of Multivibrators.
CO 3	Analyze the circuits with OP-AMPs, 555timers.
CO 4	Apply the concepts of Verilog HDL for modeling and simulation of digital logic circuits.
CO 5	Design op-amp, 555timer circuits and logic circuits.

UNIT-I

OP-AMP AND ITS CHARACTERISTICS: Differential Amplifier- DC and AC analysis of Dual input Balanced output Configuration, Properties of other differential amplifier configuration (Dual Input Unbalanced Output, Single Ended Input Balanced/ Unbalanced Output), Integrated circuits - types, classification, package types and temperature ranges, power supplies, OP-Amp Block diagram, ideal and practical OP-Amp specifications, DC and AC characteristics, Frequency Compensation. 741 OP-Amp and its features, Inverting and non-inverting amplifier.

UNIT-II

OP-AMP APPLICATIONS: Summer, Subtractor, Integrator and differentiator, instrumentation amplifier, AC amplifier, V-I, I-V converters, comparators, Multivibrators, Triangular and square wave generators, precision rectifiers. Introduction to Analog Active Filters, Design and analysis of first order and second order LPF and HPF.

UNIT-III

TIMERS, PLL, D-A and A-D Converters: Introduction to 555 Timer, Functional diagram, Monostable and Astable operations, PLL-Introduction, Block schematic, principles and description of individual blocks, IC 565 and PLL applications. Weighted resistor DAC, parallel comparator type ADC and dual slope integration type ADC.

UNIT–IV

CMOS Logic and Interfacing: CMOS logic, CMOS NAND and NOR gates, CMOS AOI and OAI gates, CMOS steady state and dynamic electrical behavior, CMOS logic families, CMOS/TTL interfacing, low voltage CMOS logic and interfacing. CMOS transmission gates, Bi-CMOS. Familiarity with standard 74XX and CMOS 40XX series-ICs – Specifications and Applications.

UNIT–V

Verilog HDL AND DESIGN EXAMPLES: HDL based Design flow, **Verilog** Program Structure, Nets, Variables and Constants, Vectors and Operators, Arrays, Logical Operators and Expressions. **Verilog** modeling styles: Structural design elements, data flow design elements, behavioral design elements (procedural code). Design using basic gates, Decoders, Encoders, Multiplexers, Adders, Subtractors, SSI Latches and Flip-Flops, Counters and Shift Registers. **Verilog** Modules for the above ICs.

Text Books:

1. Ramakanth A. Gayakwad, "Op-Amps & Linear ICs", 4th edition, PHI, 1987.
2. John F. Wakerly, "Digital Design Principles & Practices" PHI/Pearson Education Asia, 4th Edition,2008.
3. J. Bhasker, "A Verilog HDL Primer", Star Galaxy Publishing; 3rd edition (January 31, 2005)

References:

1. D. Roy Chowdhury, "Linear Integrated Circuits", New Age International (P) Ltd, 2nd Edition, 2003.
2. James M.Fiore, "Operational Amplifiers & Linear integrated circuits & applications", Cengage 2009.
3. Fundamentals of Digital Logic with Verilog Design – Stephen Brown, Zvonko Vranesic, TMH, 3rd Edition, 2014

Course Title	LINEAR AND DIGITAL IC APPLICATIONS LAB				B. Tech. ECE IV Sem		
Course Code	Category	Hours/Week			Credits	Maximum Marks	
2004406	PC	L	T	P	C	Continuous Internal Assessment	End Exams	Total
		--	--	3	1.5	40	60	100
					End Exam Duration: 3Hrs		

Course Objectives:

- To verify various op-amp applications.
- To verify the applications of different ICs.
- To write Verilog HDL programs for different logic circuits.

Course Outcomes: On successful completion of this course, the students will be able to

CO 1	Demonstrate the circuits with analog IC's (741, 555, 78XX/79XX, 723).
CO 2	Apply IC's (741, 555, 78XX/79XX, 723) in electronic applications.
CO 3	Design a digital system with Verilog to meet required specifications.
CO 4	Test the functionality of system design with Verilog Test Benches.
CO 5	Test the results of designed digital system using FPGA.

Part A: Analog IC Application Lab:

1. Design and verify the OP AMP – Adder, Subtractor, Comparator Circuits.
2. Design and verify active filters LPF, HPF (first order).
3. Design and verify Function Generator using OP AMPs.
4. Design and verify IC 555 Timer – Monostable and Astable Operation Circuit.
5. Design and verify IC 566 – VCO Applications.
6. To verify the characteristics of Voltage Regulator using IC 723.
7. Design and verify 4 bit DAC using OP AMP.
8. To verify the characteristics of Precision Diodes.

Part B: Digital IC Applications:

(Simulate the internal structure of the following Digital IC's using Verilog HDL)

1. Logic Gates- 74XX.
2. Half Adder, Half Subtractor, Full Adder, Full Subtractor & Ripple Carry Adder.
3. 3-8 Decoder -74138 & 8-3 Encoder- 74X148.
4. 8 x 1 Multiplexer -74X151 and 2x4 Demultiplexer-74X155.
5. 4 bit Comparator-74X85.
6. D Flip-Flop 74X74.
7. JK Flip-Flop 74X109.
8. Decade counter-74X90**.**

Software Required -- Xilinx Vivado

Hardware Required -- FPGA Trainer Kits

Course Title	MICROPROCESSORS AND MICROCONTROLLERS LAB				B. Tech. ECE IV Sem		
Course Code	**Category**	**Hours/Week**			**Credits**	**Maximum Marks**	
2004407	**PC**	**L**	**T**	**P**	**C**	**Continuous Internal Assessment**	**End Exams**	**Total**
		--	--	3	1.5	40	60	100
					End Exam Duration: 3Hrs		

Course Objectives:

- To write 8086microprocessor and 8051 microcontroller programs for various operations
- Learning interfacing of processor with various Peripherals.

Course Outcomes: On successful completion of this course, the students will be able to

CO 1	Develop algorithm and assembly language programs to solve problems.
CO 2	Analyze abstract problems and apply a combination of hardware and software to address the problem.
CO 3	Choosing an appropriate algorithm, program and peripheral for the application.
CO 4	Design the microprocessor based system to solve real time problems.

General Programs

1. Addition and Subtraction of two 8- bit/16 bit numbers, Multiplication of two 8-bit & two 16-bit numbers, Division of 16-bit by 8-bit and 32-bitby 16-bit number
2. Addition and Subtraction of 6 data bytes with 6-data bytes of another location.
3. Check the given Number is even or odd, Counting of 0's and 1's in a given data, Check the given number is logical palindrome or not.
4. Finding the maximum and minimum numbers in a given string of data.
5. Sorting the given numbers in ascending and descending order.
6. Finding the Factorial and Generating Fibonacci Series.
7. Conversion of BCD to hexadecimal number, Multiplication of two 3x3 matrices.
8. Addition, Subtraction, Multiplication, Division using Microcontroller.

Interfacing

1. Dual DAC interface (waveform generation).
2. Stepper motor control.
3. Display of flags using logic controller.
4. Traffic light controller.

Course Title	LABVIEW PROGRAMMING LAB					B. Tech. ECE IVSem		
Course Code	Category	Hours/Week			Credits	Maximum Marks		
2004408	PC	L	T	P	C	Continuous Internal Assessment	End Exams	Total
		0	0	3	1.5	40	60	100
					End Exam Duration: 3Hrs			

Course Objectives:

- To write, test, and debug basic Lab View programs.
- To implement Lab View programs with conditional statements.
- To perform operations on arrays and strings.
- Use SubVi‟s for Signal Generation, spectral measurements and filtering based Lab View programs.

Course Outcomes: On successful completion of this course, the students will be able to	
CO 1	Write basic Lab View Programs
CO 2	Implement Lab View programs with conditional statements.
CO 3	Perform operations on arrays and strings
CO 4	Implement digital logic circuits using Lab view program
CO 5	Use SubVi‟s for Signal Generation, spectral measurements and filtering based Lab View programs.

List of Programs

1. Basic arithmetic operations
   (Add, mul, div, compound arithmetic, expression node, express formula and formula node)
2. Boolean operations
   (truth table verification of logic gates, Half Adder and Full Adder, convert binary to decimal value and Vice-Versa)
3. String operations
   (Length, concatenation, insert string, sub-string, replace string, reverse string, rotate string, etc)
4. Build a VI that generates a 1D array of random numbers and sort the array in descending and ascending order and find the following:
   a) Maximum and min value of array elements
   b) Size of the array
   c) Sum and product of array elements
   d) Rotate array by 1position
   e) Split the array after 2elements
5. Generate Fibonacci series for N iteration (use for ‟loop)
6. Create a VI to implement and, or & not gates(or arithmetic operations) using case structure
7. Create a VI to implement and, or & not gates(or arithmetic operations) using case structure
8. Build VI for generation of various signals and their spectral measurements
9. Build a VI to perform convolution of two given signals
10. Create a VI to perform filtering operations using Filter Express VI

PLATFORM NEEDED

LABVIEW Software for Windows/Linux

Course Title	PCB Design					B. Tech. ECE IV Sem		
Course Code	Category	Hours/Week			Credits	Maximum Marks		
20SC409	SC	L	T	P	C	Continuous Internal Assessment	End Exams	Total
		1	0	2	2	40	60	100
						End Exam Duration: 3Hrs		

Course Objectives:

- To Understand the basics of PCB
- To Create awareness on various softwares to design PCB
- To understand the design procedure of PCB.

Course Outcomes: On successful completion of this course, the students will be able to

CO 1	Understand the basics of PCB
CO 2	Apply various softwares to design PCB
CO 3	Design some electronic circuits using designing softwares.
CO 4	Design their own PCB projects up to industrial grade.

UNIT-I

Introduction to PCB: Definition and Need of PCB, Background and History of PCB, Types of PCB, Classes of PCB Design, Terminology in PCB Design, Different Electronic design automation (EDA) tools and comparison.

UNIT-II

Introduction to PCB tools: Introduction of PCB, LIVE WIRE & PCB WIZARD software installation.

Live wire software: Explanation of each and every component of PCB and some basic circuits in Live wire software, Button interfacing with LED circuit, Power circuit, LDR interfacing with LED circuit, Potentiometer interfacing with LED circuit in Livewire software. Button interfacing with motor circuit, 555 timer using LED blinking, fire alarm circuit, police siren circuit, 4026 decade counter circuit in Livewire software.

UNIT-III

PCB WIZARD: Introduction of PCB WIZARD software, Explanation of each and every components and basic PCB circuits in PCB WIZARD software. Button interfacing with LED using PCB designing, LDR interfacing with LED using PCB designing, Potentiometer interfacing with LED using PCB designing. 555 timer using LED blinking designing(Astable and Bistable), fire alarm circuit designing, traffic lights circuit designing, explanation of manual routing and auto routing designing in PCB wizard software.

UNIT-IV

EASYEDA: Introduction of EASYEDA software, Explanation of each and every components and Explanation of basic PCB circuits LED, button, LDR, panic alarm, brightness control, Ac adapter, audio amplifier, common emitter IR sensor circuit, Astable and Bistable multivibrator using 555 timer

circuit in EASYEDA software. Traffic lights circuit, motor circuit, explanation of 3D view, manual routing and auto routing designing in EASYEDA software.

UNIT-V

EAGLE: Introduction of EAGLE software, Explanation about circuit components, Basic Circuits explanation, explanation about auto routing and manual routing Astable and bistable circuit designing.