GAYATRI VIDYA PARISHAD COLLEGE FOR DEGREE & P.G. COURSES (A)

RUSHIKONDA, VISAKHAPATANAM 530045 | website: www.gvpcdpgc.edu.in

(Approved by A.I.C.T.E | Affiliated to Andhra University | Reaccredited by NAAC | ISO 9001:2015

ENGINEERING & TECHNOLOGY PROGRAM

DEPARTMENT OF ELECTRONICS & COMMUNICATION ENGINEERING

(Program Accredited by NBA)

4 Years B.TECH

Proposed Scheme of Instruction and Examination with effect from 2022-2023 admitted batches onwards

SCHEME FOR I/IV B. TECH I SEM (I-Semester) (R-22)

(With effect from 2022-23 admitted batches onwards)

CATEGORY	COURSE CODE	COURSE	HOURS PER WEEK			MAXIMUM MARKS			CREDITS
			THEORY	TUTORIAL	LAB	EXAM	SESSIONALS	TOTAL	
BSC		Engineering Mathematics-I	3	0	0	70	30	100	3
BSC		Engineering Physics	3	0	0	70	30	100	3
ESC		Engineering Graphics	3	0	0	70	30	100	3
ESC		Electronic Devices and Circuits	3	0	0	70	30	100	3
ESC		Network Theory and Machines	3	0	0	70	30	100	3
BSC		Engineering Physics Lab	0	0	3	50	50	100	1.5
ESC		Electronic Devices and Circuits Lab	0	0	3	50	50	100	1.5
ESC		Network Theory and Machines Lab	0	0	3	50	50	100	1.5
		Total	**18**	0	**11**	**500**	300	**800**	19.5

SCHEME FOR I/IV B. TECH II SEM (II- Semester) (R-22)

(With effect from 2022-23 admitted batches onwards)

CATEGORY	COURSE CODE	COURSE	HOURS PER WEEK			MAXIMUM MARKS			CREDITS
			THEORY	TUTORIAL	LAB	EXAM	SESSIONALS	TOTAL	
BSC		Engineering Mathematics-II	3	0	0	70	30	100	3
BSC		Engineering Chemistry	3	0	0	70	30	100	3
HSC		English	3	0	0	70	30	100	3
ESC		Computer Programming with C and Numerical Methods	3	0	0	70	30	100	3
PCC		Digital Logic Design	3	0	0	70	30	100	3
HSC		English Language Lab	0	0	3	50	50	100	1.5
ESC		Computer Programming with C and Numerical Methods Lab	0	0	3	50	50	100	1.5
PCC		Digital Logic Design Lab	0	0	3	50	50	100	1.5
		Total	**21**	0	**6**	**500**	300	**800**	19.5

ELECTRONIC DEVICES AND CIRCUITS

Credits	Periods			Exam Hrs.	Sessional Marks	Exam Marks	Total Marks
	Theory	Tutorial	Lab				
3	3	-	-	3	30	70	100

COURSE OBJECTIVES:

- To give a comprehensive exposure to Semiconductors and understand the V-I characteristics of semiconductor diodes.
- To give a comprehensive exposure to Rectifiers.
- To give a comprehensive exposure to Fundamentals of BJT.
- To give a comprehensive exposure to Fundamentals of FET and MOSFET.
- To give a comprehensive exposure to low frequency analysis of transistor amplifier.

COURSE OUTCOMES

By the end of the course the student would be able to

CO1: **Familiarize with the** properties of conductors, insulators and semiconductor materials well as characteristics and applications of different types of semiconductor diodes. **(L1).**

CO2: **Understand** the current, voltage components, efficiency and ripple factor of different rectifier circuits. **(L2).**

CO3: **Understand** the construction, operation and characteristics of BJT. **(L2).**

CO4: **Understand** the construction, operation and characteristics of JFET and MOSFET. **(L2).**

CO5: **Analyze** the different parameters in transistor amplifier. **(L4)**

SYLLABUS

UNIT-I: Energy band theory of Solids and Transport phenomenon in Semiconductors and Junction Diode Characteristics

Energy Band Theory of Solids, Intrinsic and Extrinsic Semiconductors, Doping, Doping Materials, Carrier Mobility, Conductivity, Diffusion and continuity equation, Hall–Effect and its Application. Semiconductor Diodes, Forward Bias and Reverse Bias Operation of PN Diode, Volt -Amp. Characteristics, Temperature Dependence, Transition and Diffusion Capacitance of PN Junction, Zener and Avalanche Breakdowns, Tunnel Diode, LED, Schottky Barrier Diode, Varactor Diode, Photo Diode, PIN Diode.

UNIT-II: Rectifier Circuits

Diode Rectifiers Half-wave, Full-wave and Bridge Rectifiers with and without Filters, Ripple Factor and Regulation Characteristics.

UNIT-III: Transistor Characteristics and Transistor Biasing

Bipolar Junction Transistor NPN and PNP junction Transistor, Characteristics of Current Flow across the Base Regions, Minority and Majority Carrier Profiles, CB, CE and CC Configurations and their Input and Output Characteristics. Comparison of CE, CB and CC Configurations. Junction Biasing for Saturation, Cutoff and Active Region, α and β Parameters and the relation between them, Photo Transistor, various Biasing circuits, stabilizations, thermal runaway, thermal stability.

UNIT-IV: Field Effect Transistors

JFET and its characteristics, Pinch off Voltage, Drain Saturation Current, JFET biasing, MOSFET –Enhancement and Depletion Modes, Small signal models of FET.

UNIT-V: Transistor at Low Frequencies

Small Signal – Low Frequency Transistor Amplifier Circuits Transistor as an Amplifier, h – parameter model, Analysis of Transistor Amplifier Circuits using h–parameters. CB, CE and CC Amplifier configurations and performance factors. Analysis of Single Stage Amplifier, RC Coupled Amplifiers. Effects of Bypass and Coupling Capacitors. Frequency Response of CE Amplifier.

TEXT BOOKS:

1. Integrated Electronics, Analog Digital Circuits and systems, Jacob Millman and D. Halkias McGraw Hill,July 2017.
2. Electronic Devices and Circuits Theory, Boylsted and Nashelsky, PrenticeHall Publications, January 2009.
3. Electronic Devices and Circuits by Sanjeev Gupta, DhanpatRai Publications, January 2010.

REFERENCE BOOKS:

1. Electronic Devices and Circuits 2ndEdition, B.V. Rao and K.Raja Rajeswari, Pearson Education, October 2006.
2. Electronic Devices and Circuits, G.S.N.Raju, I.K.International Publications, NewDelhi, 2006.

WEB RESOURCES:

1.https://nptel.ac.in/courses/108/108/108108122/
2.https://nptel.ac.in/courses/117/103/117103063/

NETWORK THEORY AND MACHINES

Credits	Periods			Exam Hrs.	Sessional Marks	Exam Marks	Total Marks
	Theory	Tutorial	Lab				
3	3	-	-	3	30	70	100

COURSE OBJECTIVES:

To make the students capable of

1. Explain any given linear DC electrical network.
2. Understanding the concepts of AC and DC machines

COURSE OUTCOMES:

By the end of the course a student would be able to

CO1: Discuss any linear DC network by using Kirchhoff's laws and also by Two-Port Parameters (L2).

CO2: Explain any linear DC network by using Network Theorems. (L2)

CO3: Describe a linear series RL and RC network with/without DC excitation by computing it's transient, steady-state and complete response. (L2)

CO4: Understand the concepts of Direct current machines and its operation under no load and loaded conditions. (L2)

CO5: Describe the concepts of A.C Machines (Transformers, 3-phase Induction motors, Synchronous Generators). (L2)

SYLLABUS

UNIT-I: Analysis of DC Circuits

Active Elements, Passive Elements, Reference Directions for Current and Voltage, Kirchhoff's Laws, Voltage and Current Division, Nodal Analysis, The Super node, Mesh Analysis, The Super mesh, Delta-Wye Conversion. Two-Port Parameters: Z, Y and h.

UNIT-II: DC Network Theorems

Concept of Linearity, Superposition Theorem, Thevenin's Theorem, Norton's Theorem, Maximum Power Transfer Theorem and Reciprocity Theorem.

UNIT-III: DC transients

Inductor, Capacitor, source free series RL and RC response, Evaluation of Initial conditions, Application of unit-step function to series RL, RC concepts of Natural, Forced and Complete response.

UNIT IV DC MACHINES

Constructional Features, Function of Commutator, Induced EMF and Torque Expressions, Relationship Between Terminal Voltage and Induced EMF for Generator and Motoring Action, Different Types of Excitation and Performance Characteristics of Different Types of DC Machines, Starting and Speed Control of DC Motors, Losses and Efficiency, Efficiency by Direct Loading, Swinburne's Test, Applications of DC Machines. (Concepts are limited to these topics only & consider all concepts are elementary level and simple problems are included)

UNIT V A.C MACHINES

EMF Equation of single phase transformer, Equivalent Circuit, Voltage Regulation, Losses and Efficiency, Open/Short – Circuit Tests of transformer and Determination of Efficiency and Regulation, Construction of 3ph Induction Motor, Rotating Magnetic Field and 3ph Induction Motor, Torque-slip Characteristics, Condition for Max. Torque and its Value, No – Load and Rotor – Blocked Tests and Efficiency and Torque – Speed Characteristics, Synchronous Impedance and Voltage Regulation of 3-phase synchronous generator, stepper motor construction and operation. (Concepts are limited to these topics only & consider all concepts are elementary level and problems are not included in the syllabus)

TEXT BOOKS:

1. Engineering Circuit Analysis, William H.Hayt Jr., Jack E. Kemmerley and Steven M Durbin, 8thEdition, McGraw Hill, 2013.
2. Network Analysis, M. E. Van Valkenburg, 3rd Edition, PHI, 2015
3. Electrical Machines, S. K. Bhattacharya, TMH Publications N. Delhi, 2017.
4. A Text book of Electrical Technology by B.L Thereja, A.K Thereja, Volume-II, 3rd Edition, S.Chand Publishers, 2002.
5. A First Course in Electrical Engineering, S. M. Tiwari, A. S. Binsaroor, Wheeler Publications, 1993.

REFERENCES:

1. Circuit Theory Analysis and Synthesis, Abhijit Chakrabarti, Dhanpat Rai & Co., 2018

Web Resources:

1. https://archive.nptel.ac.in/courses/108/105/108105159/
2. https://www.youtube.com/watch?v=NEhH6C7Fzw4&list=PLBlnK6fEyqRgLR-hMp7wem-bdVN1iEhsh

ELECTRONIC DEVICES AND CIRCUITS LAB

Credits	Periods			Exam Hrs.	Sessional Marks	Exam Marks	Total Marks
	Theory	Tutorial	Lab				
1.5	-	-	3	3	50	50	100

Course Objectives:

1. Generate sine, square and triangular waveforms with required frequency and amplitude using function generator and Measure voltage, frequency and phase of any waveform using CRO.
2. Measure the V-I characteristics of various semiconductor diodes, verify their characteristics and applications of diodes as regulators, rectifiers.
3. Verify functionality through V-I characteristics of active devices like BJT and JFET their applications.

Course Outcomes:

CO1: **Measure** voltage, frequency and phase of any waveform using CRO. **(L2)**
CO2: **Analyze** the characteristics of different diodes. **(L3)**
CO3: **Analyze** the characteristics of transistor and JFET **(L3)**
CO4: **Analyze** the frequency response of CE amplifier **(L3)**

LIST OF EXPERIMENTS

1. Study of CRO and Applications
2. V-I Characteristics of PN Junction Diode
3. V-I Characteristics of Zener Diode and Zener regulator characteristics.
4. V-I Characteristics of LED
5. V-I characteristics of Photo diode
6. Half-wave and full-wave rectifiers
7. Half-wave and full-wave rectifiers with capacitor filter
8. CE characteristics of BJT, h-parameters
9. CB characteristics of BJT, h-parameters
10. Voltage gain, input impedance and output impedance of emitter follower
11. Drain and transfer characteristics of JFET
12. Frequency response of CE amplifier

NETWORK THEORY AND MACHINES LAB

Credits	Periods			Exam Hrs.	Sessional Marks	Exam Marks	Total Marks
	Theory	Tutorial	Lab				
1.5	-	-	3	3	50	50	100

COURSE OBJECTIVES:

This course enables the students to:

1. Design and verify various electrical circuits by applying theorems.
2. Verify various electrical circuits by applying basic laws (Ohm's law & Kirchoff's laws)
3. Evaluate the performance of DC machines by conducting no-load and on-load tests.
4. Learn how to regulate the speed control of DC machine using various methods.
5. Understand the performance of various types of Transformers, induction motors, alternators.

COURSE OUTCOMES:

After successful completion of this course, the students will be able to

CO1: Understand various basic laws (Ohm's law, Kirchoff's laws) & theorems for linear electrical circuits. **(L1)**

CO2: Describe the practical methods to find the performance of various types of DC machines(**L2)**

CO3: Explain the speed control techniques of DC motors. **(L2)**

CO4: Understand the efficiencies of single phase transformer and induction motors through various tests **(L1)**

LIST OF EXPERIMENTS:

1. Verification of Superposition Theorem.
2. Verification of Reciprocity Theorem.
3. Verification of Thevenin's Theorem
4. Verification of Two-port network parameters.
5. Verification of Ohm's law.
6. Verification of Kirchhoff's law.
7. No load and blocked rotor tests on 3-phase squirrel cage Induction motor
8. Regulation of alternator by synchronous Impedance method
9. Open circuit test and short circuit test on 1-phase transformer
10. Swinburne's test on a D.C Shunt machine.
11. Speed control of a D.C shunt motor.

DIGITAL LOGIC DESIGN

Credits	Periods			Exam Hrs.	Sessional Marks	Exam Marks	Total Marks
	Theory	Tutorial	Lab				
3	3	-	-	3	30	70	100

COURSE OBJECTIVES:

- Different number systems, digital logic, simplification and minimization of Boolean functions.
- How to analyze logic processes and implement logical operations using combinational logic circuits.
- The characteristics of memory and their classification.
- How to design combinational & sequential digital circuits and state machines.
- About programmable logic devices.

COURSE OUTCOMES:

After successful completion of this course, the students will be able to

CO1: Convert a number from one number system to other Number system and Implement logic circuits using basic Logic gates or universal Logic gates. (**L2)**
CO2: Simplify logic expressions using basic theorems, K-map and Tabular method**. (L1)**
CO3: Design Combinational logic circuits and also realize logic expressions using Multiplexers, Decoders and PLDs. **(L4)**
CO4: Design Sequential logic circuits using flip-flops. **(L4)**
CO5: Design Finite State machines. **(L4)**

SYLLABUS

UNIT-I: NUMBER SYSTEMS AND CODES

Number systems, Base conversion methods, Complement of numbers, Codes: Binary, Non binary, Decimal, Alphanumeric, Gray, Error detecting and error correcting codes.

UNIT- II: MINIMIZATION OF BOOLEAN FUNCTIONS

Logic Gates: AND, OR, NOT, NAND, NOR, XOR, EX-NOR and Universal Gates, Fundamental postulates of Boolean algebra, Basic theorems, Simplification of Boolean equations, Min terms, Max terms, Standard form of Boolean functions. Simplification of functions: Karnaugh map method and Multiple Output functions, incomplete specified functions.

UNIT-III: COMBINATIONAL CIRCUITS

Logic design of combinational circuits: Adders and Subtractors: Binary, BCD, Excess -3 and Look –ahead-carry adder, Code converters, Multiplexers, De multiplexers, Encoders, Decoders and priority encoders, Realization of Boolean functions using multiplexers, De multiplexers and Decoders.Design of 4-bit comparator, Parity checker/Generator, Seven segment decoders, Hazards in combinational circuits, Hazard free realizations. Basics of PLDs: Basic structure of PROM, PAL, PLA, CPLD, FPGAs, Realization of Boolean functions with PLDs and their merits and demerits.

UNIT-IV: SEQUENTIAL CIRCUITS

Classification of sequential circuits, SR-latch, Gated latches, Flip flops: RS, JK, D, T and Master slave flip flops, Excitation tables, flip flop conversion from one type to another. Design of counters: Ripple counters, Synchronous counters, asynchronous counters, up-down counters, Johnson counter, ring counter. Design of registers: Buffer registers, Shift registers, Bi directional shift registers, Universal shift register

UNIT-V: ANALYSIS AND DESIGN OF FINITE STATE MACHINES

State assignment, State tables, Equivalent states, Elimination of Redundant states, Determination of state equivalence, Reduction using implication table, reducing incompletely specified state tables.

TEXT BOOKS:

1. Digital Logic and Computer Design, Morris mano, Pearson Education,2004
2. Switching and finite Automatic theory, Zui Kohari, TMH, October 2009.
2. Switching theory and logic design by Frederick.J.Hill and Gerald. R.Peterson, January 2009.
3. Switching theory and logic design, Anand kumar, PHI, 2016.

REFERENCE BOOKS:

1. Fundamentals of Logic Design, Charles.R.Roth, Thomson Publications, February 2013
2. Digital Design by Morris Mono, PHI, August 2001.

PROPOSED SCHEME FOR II/IV B. TECH I SEMESTER (3rd SEMESTER) (R-22)

Category	Course Code	Course	Hours Per Week			Maximum Marks			Credits
			Theory	Tutorial	Lab	Exam	Sessionals	Total	
BSC		Engineering Mathematics-III	3	0	0	70	30	100	3
PCC		Analog Electronic Circuits	3	0	0	70	30	100	3
PCC		Pulse and Digital Circuits	3	0	0	70	30	100	3
HSS		Professional Ethics& Universal Human values	3	0	0	70	30	100	3
PCC		Signals and Systems	3	0	0	70	30	100	3
PCC		Analog Electronic Circuits Lab	0	0	3	50	50	100	1.5
PCC		Digital Design Through Verilog Lab	0	0	3	50	50	100	1.5
PCC		Signals and Systems Simulation Lab	0	0	3	50	50	100	1.5
SC		Problem Solving Using Python	0	1	2	50	50	100	2
MC		NCC/NSS	2	0	0	100	0	100	0
		Total	**17**	**1**	**11**	**650**	**350**	**1000**	**21.5**

ANALOG ELECTRONIC CIRCUITS

Credits	Periods			Exam Hrs.	Sessional Marks	Exam Marks	Total Marks
	Theory	Tutorial	Lab				
3	3	-	-	3	30	70	100

COURSE OBJECTIVES:

1. To prepare students to perform the analysis of semiconductors at high frequencies.
2. To empower students to understand the design and working of Multistage Amplifiers.
3. To aware students to understand the analysis of feedback amplifiers.
4. To empower students to understand the working of oscillators
5. To build students to understand power amplifiers and tuned amplifiers.

COURSEOUTCOMES:

CO1: Acquire basic knowledge of physical and electrical conducting properties of Semiconductors at high frequencies. **(L3)**

CO2: Develop the Ability to understand the design and working of multistage amplifiers **(L6)**

CO3: Develop the Ability to understand the design and working of BJT Feedback Amplifiers (**L6)**

CO4: Develop the Ability to understand the design and working of BJT oscillators **(L6)**

CO5: Develop the Ability to understand the design and working of Power amplifiers and Tuned Amplifier **(L6)**

SYLLABUS

UNIT-I: SMALL SIGNAL HIGH FREQUENCY TRANSISTOR AMPLIFIER MODELS:

BJT: Transistor at high frequencies, Hybrid-π common emitter transistor model, Hybrid-π conductance's, Hybrid-π capacitances, validity of Hybrid-π model, determination of high frequency parameters in terms of low frequency parameters, CE short circuit current gain, current gain with resistive load, cut-off frequencies, frequency response and gain bandwidth product. **FET:** common source and common drain amplifier circuits at high frequencies (*Elementary concepts*).

UNIT-II: MULTISTAGE AMPLIFIERS

High frequency transistor models, Miller's Theorem, Concept of Multi Stage Amplifiers: Methods of Inter Stage Coupling, n–Stage Cascaded Amplifiers, Cascode Configurations, Darlington pair, Frequency response of RC Coupled Amplifiers using BJT, Gain Bandwidth Product.

UNIT-III: FEEDBACK AMPLIFIERS

Concept of Feedback Amplifiers – Effect of Negative feedback on the amplifier Characteristics. Four Feedback Amplifier Topologies. Method of Analysis of Voltage Series, Current Series, Voltage Shunt and Current Shunt Feedback Amplifiers (*BJT version only*).

UNIT-IV: SINUSOIDAL OSCILLATORS

Condition for oscillations – LC Oscillators – Hartley, Colpitts, Frequency and amplitude Stability of Oscillators – Crystal Oscillators – RC Oscillators --RC Phase Shift and Wein bridge Oscillators (*BJT version only*).

UNIT-V: POWER AMPLIFIERS AND TUNED VOLTAGE AMPLIFIERS

Classification of Power Amplifiers – Class A, Class B and Class AB power Amplifiers. Series Fed, Single Ended Transformer Coupled and Push Pull Class A and Class B Power Amplifiers. Cross-over Distortion in Pure Class B Power Amplifier, Class AB Power Amplifier – Complementary Push Pull Amplifier.

Tuned Amplifier: Capacitive, Inductive and Transformer coupling; Analysis of Capacitive coupled single stage tuned amplifier.

TEXT BOOKS:

1. Integrated Electronics, Analog Digital Circuits and systems, **Jacob Millman**and **D. Halkias**, McGraw Hill, 1972
2. Electronic Devices and Circuits – **G.K.Mithal**, Khanna Publishers, 23rd Edition, 2004.

REFERENCES:

1. Electronic Devices and Circuits, G.S.N. Raju, IK International Publications, New Delhi, 2006.
2. Electronic Devices and Circuits by **Salivahanan, N.Suresh Kumar** and **A.Vallava Raj** TMH, 2nd Edition, 1998.
3. Electronic Circuit Analysis, **B.V.Rao**, **K. Raja Rajeswari et.al**, Pearson Publishers

WEB RESOURCES:

1. https://onlinecourses.nptel.ac.in/noc20_ee45/preview

PULSE AND DIGITAL CIRCUITS

Credits	Periods			Exam Hrs.	Sessional Marks	Exam Marks	Total Marks
	Theory	Tutorial	Lab				
3	3	-	-	3	30	70	100

COURSE OBJECTIVES:

1. To impart basic knowledge on linear wave shaping circuits.
2. To enable the students to know non-linear wave shaping circuits.
3. To make the students to design different types of Multivibrators using transistors
4. To make the students to acquire knowledge on basic concept of time base generators.
5. To make the students to know the working of logic families and sampling gates.

COURSE OUTCOMES:

After successful completion of this course, the students will be able to

CO 1: Demonstrate the linear wave shaping circuits **(L2)**.

CO 2: Analyze the non-linear wave shaping circuits **(L4)**.

CO 3: Build Bistable Multivibrator using transistors **(L3).**

CO 4: Explain Multivibrator using Monostable and Astable circuits **(L5).**

CO 5: Examine the sampling gates and logic families **(L4)**.

SYLLABUS

UNIT-I: LINEAR WAVE SHAPING

High pass, low pass RC circuits, their response for sinusoidal, step, pulse, square, ramp and exponential inputs. RC network as differentiator and integrator, Attenuators, its application in CRO probe, RL and RLC circuits and their response for step input, Ringing circuit.

UNIT-II: NON-LINEAR WAVE SHAPING

Diode clippers, Shunt Clippers, Series Clippers clipping at two independent levels, Clamping operation, Negative clamper ,Positive Clamper, Biased Clamping , Clamping circuit theorem, practical clamping circuits, effect of diode characteristics on clamping voltage. Designing of Clamping Circuit.

UNIT-III: BISTABLE MULTIVIBRATOR

Analysis And Design of Fixed Bias, Self-Bias Bistable Multi Vibrator, Collector Catching Diodes, Commutating Capacitors, Triggering of Binary Circuits, Emitter Coupled Bistable Multivibrator (Schmitt Trigger).

UNIT-IV: MONOSTABLE AND ASTABLE MULTIVIBRATORS

Analysis and Design of Collector Coupled Monostable Multi vibrator, Triggering of Monostable Multivibrator, Applications of Monostable Multivibrator. Astable Multivibrator: Analysis and Design of Collector Coupled Astable Multivibrator, Application of Astable Multivibrator as a Voltage to Frequency Converter.

UNIT-V: LOGIC FAMILIES AND SAMPLING GATES

LOGIC FAMILIES: Diode Logic, Transistor Logic, Diode-Transistor Logic, Transistor-Transistor Logic, Emitter Coupled Logic, CMOS Logic, Comparison of Logic Families.

SAMPLING GATES: Basic Operating Principles of Sampling Gates, Diode Unidirectional Sampling Gate and Two-Diode Bi-Directional Sampling Gate, Four-Diode gates, Six- Diode Gates, Applications of Sampling Gates.

TEXT BOOKS:

1. Pulse, Digital and Switching Waveforms, J. Millman and H. Taub, Mothiki, S. Prakash Rao, Mc Graw Hill, 2nd Edition, 2008.
2. Pulse and Digital Circuits, A. Anand Kumar, PHI, 2nd Edition, 2008.
3. Pulse & Digital Circuits, Venkata Rao.K, Ramasudha.K, Manmadha Rao G, Pearson, 1st Edition, 2010.

REFERENCES:

1. Solid State Pulse circuits, David A. Bell, PHI, 4th Edition, 2002.
2. Wave generation and shaping, L. Strauss, International Student Edition.
3. Digital Principles and Applications, Leach & Malvino, SIE, 5th Edition, 1994.

WEB RESOURCES:

1 https://www.smartzworld.com/notes/pdc-pulse-and-digital-circuits/
2 http://nptel.ac.in/courses/117103064/22
3 http://www.electronics-tutorials.ws/filter/filter_1.html
4 https://electronicspost.com/v-i-characteristics-of-pn-junction-diode/

SIGNALS AND SYSTEMS

Credits	Periods			Exam Hrs.	Sessional Marks	Exam Marks	Total Marks
	Theory	Tutorial	Lab				
3	3	-	-	3	30	70	100

COURSE OBJECTIVES:

1. To understand the properties of CT and DT signals and systems
2. To understand spectral characteristics of signals using Fourier analysis.
3. To analyze Convolution.
4. To understand Laplace transforms for analyzing CT systems
5. To analyze DT Signals Using Z Transform.

COURSE OUTCOMES:

After successful completion of this course, the students will be able to

CO1	**Classify** the signals as Continuous time and Discrete time**.(L2)**
CO2	**Analyze** the spectral characteristics of signals using Fourier analysis.**(L4)**
CO3	**Illustrate** linear systems in time domain. **(L4)**
CO4	**Apply** Laplace transform techniques to analyze continuous-time signals and systems**(L4)**
CO5	**Interpret** Sampling theorem and to apply Z transform techniques to analyze discrete-time signals and systems**.(L2)**

SYLLABUS

UNIT- I: INTRODUCTION TO SIGNALS AND SYSTEMS

Introduction, Elementary signals: The Impulse function, step function, ramp function, complex Exponential and Sinusoidal Signals, Classification of Signals, Basic operations on Signals, Classification of Systems.

UNIT-II: FOURIER SERIES AND FOURIER TRANSFORM

Fourier series representation of continuous time periodic signals, properties of Fourier series, Dirichlet's conditions, Trigonometric and Exponential Fourier series, Complex Fourier spectrum, Deriving Fourier transform from Fourier series, Fourier transform of standard signals, properties of Fourier transforms, System analysis with Fourier Transform Introduction to Hilbert Transform.

UNIT-III: ANALYSIS OF LINEAR SYSTEMS

System analysis by Convolution, Convolution Theorems, Graphical interpretation of Convolution, Signal comparison, Correlation, Transfer function of a LTI system, Distortion less transmission through a system, Signal bandwidth, system bandwidth, Causality and Poly-Wiener criterion for physical realization, Relationship between bandwidth and rise time.

UNIT-IV: LAPLACE TRANSFORM

Introduction, relationship of the Fourier transform to the Laplace transform, The Laplace transform, the region of convergence for Laplace transforms, Laplace transforms of standard signals, properties of Laplace transform, the initial value theorem and final value theorem, Inverse Laplace transform, Analysis and characterization of LTI systems using the Laplace Transforms.

UNIT-V: SAMPLING THEOREM AND Z-TRANSFORM

Sampling, Sampling theorem, Sampling Techniques, Z-Transform, relationship of the Fourier transform to the Z- transform, Z- transforms of standard signals, Properties of Z-Transform, the initial value theorem and final value theorem, Inverse Z-Transform by contour integral, power series, partial fraction expansion. decomposing of rational Z-transform, causality and stability, Analysis and characterization of LTI systems using the Z-Transforms.

TEXTBOOKS:

1. Alan V. Oppenheim, Alan S. Willsky and Ian T. Young, "Signals and Systems", 5th Edition,PHI.
2. B. P. Lathi "Signals Systems and Communication", 4th Edition, BS Publication

REFERENCES:

1. Simon Haykin and Van Veen "Signals and Systems", 2nd Edition, Wiley
2. Rodger E Ziemer,D Ronald Fannin, "Signals and Systems Continuous and Discrete" Pearson Publication.

WEB RESOURCES:

1. https://www.cdeep.iitb.ac.in/search_result.php
2. https://onlinecourses.nptel.ac.in/noc21_ee28/preview
3. http://www.stanford.edu/~boyd.ee102
4. http://www.ece.gatech.edu/users/bonnie/book
5. https://ocw.mit.edu/courses/res-6-007-signals-and-systems-spring-2011

ANALOG ELECTRONIC CIRCUITS LAB

Credits	Periods			Exam Hrs.	Sessional Marks	Exam Marks	Total Marks
	Theory	Tutorial	Lab				
1.5	-	-	3	3	50	50	100

COURSE OBJECTIVES:

1. To study the characteristics of various single stage, multi stage and feedback Amplifiers practically
2. To study the characteristics of various feedback Amplifiers practically
3. To study responses of oscillators
4. To study responses of power amplifiers and tuned amplifiers practically.

COURSE OUTCOMES:

After successful completion of this course, the students will be able to

CO1: Design and verify Frequency response characteristics of single stage and Multistage Amplifiers. **(L6)**

CO2: Design and verify Frequency response characteristics of Feedback Amplifiers. **(L6)**

CO3: Design and test various types of oscillators. **(L6)**

CO4: Determine the efficiency of power amplifiers and resonant frequency of tuned amplifier.**(L4)**

LIST OF EXPERIMENTS

1. Common emitter Amplifier
2. Common Drain Amplifier
3. Common source FET Amplifier
4. Two stage RC coupled Amplifier
5. Current Series feedback Amplifier
6. Voltage Series feedback Amplifier
7. Colpitt's oscillator
8. Heartly Oscillator
9. RC Phase shift oscillator using transistors
10. Class-A Power Amplifier (transformer less)
11. Class-B complementary symmetry Amplifier
12. Tuned Voltage Amplifier.

DIGITAL DESIGN THROUGH VERILOG LAB

Credits	Periods			Exam Hrs.	Sessional Marks	Exam Marks	Total Marks
	Theory	Tutorial	Lab				
1.5	-	-	3	3	50	50	100

COURSE OBJECTIVES:

1. Students able to understand the design and verification of logic gate.
2. Students able to understand the design and verification of combinational circuits.
3. Students able to understand the design and verification of flip-flops and registers.
4. Students able to understand the design and verification of counters and FSM.

COURSEOUTCOMES:

CO1: Design and verify the functionality of logic gates and its applications **(L6)**

CO2: Design and verify the functionality of medium complexity standard combinational circuits **(L6)**

CO3: Design and verify the functionality of a flip-flops and registers **(L6)**

CO4: Design and verify the functionality of counters and FSM **(L6)**

HARDWARE EXPERIMENTS:

1. Verilog description for Logic Gates
2. Verilog description for half adder and full adder
3. Verilog description for Ripple carry adder
4. Verilog description for Decoder
5. Verilog description for Encoder
6. Verilog description for Multiplexer
7. Verilog description for Demultiplexer
8. Verilog description for ALU
9. Verilog description for Flip – flops
10. Verilog description for Universal shift register
11. Verilog description for Counter
12. Verilog description for Finite state machine

SIGNALS AND SYSTEMS SIMULATION LAB

Credits	Periods			Exam Hrs.	Sessional Marks	Exam Marks	Total Marks
	Theory	Tutorial	Lab				
1.5	-	-	3	3	50	50	100

COURSE OBJECTIVES:

1. To provide background and fundamentals of MATLAB tool for the analysis and processing of signals and to generate various continuous and discrete time signals.
2. To understand discrete signal design and analysis.
3. To provide an overview of signal transmission through linear systems, convolution and correlation of signals and sampling.
4. To understand the concept and importance of Fourier and Z-Transforms

COURSE OUTCOMES:

Upon completion of this course, students will able to:

CO1: Build Various Signals and Sequences in MATLAB, including the Operations on signals and sequences **(L4)**.

CO2: Test For Linearity and Time Invariance Properties of a given Signals/ Systems **(L4)**.

CO3: Verify the Sampling Theorem **(L6).**

CO4: Analyze the Fourier Transform of a given signal and plotting its magnitude and phase Spectrum and also plot Pole-Zero Maps in Z-Plane **(L4).**

LIST OF EXPERIMENTS

1. Basic Operations on Matrices.
2. Write a program for Generation of Various Signals and Sequences (Periodic and Aperiodic) such as Unit impulse, unit step, square, saw tooth, triangular, sinusoidal, ramp and sinc functions.
3. Write a program to perform operations like addition, multiplication, scaling, shifting, and folding on signals and sequences and computation of energy and average power.
4. Write a program for finding the even and odd parts of the signal / sequence and real and Imaginary parts of the signal.
5. Write a program to perform convolution between signals and sequences.
6. Write a program to perform autocorrelation and cross correlation between signals and Sequences.
7. Write a program for verification of linearity and time invariance properties of a given continuous/discrete system.
8. Write a program for computation of unit samples, unit step and sinusoidal response of the Given LTI system and verifying its physical reliability and stability properties.

9. Write a program to find trigonometric and exponential Fourier series coefficients of a Rectangular periodic signal.
10. Write a program to find the Fourier transform of a given signal and plotting its magnitude and Phase spectrum.
11. Gibbs Phenomenon.
12. Generation of Laplace transform of standard signals
13. inverse Laplace transform of the given signal X(s)
14. Write a program for Sampling theorem and its verification.
15. Write a program for locating the zeros and poles and plotting the pole-zero maps in Z-plane for the given transfer function.

SKILL COURSE

Credits	Periods			Exam Hrs.	Sessional Marks	Exam Marks	Total Marks
	Theory	Tutorial	Lab				
2	1	-	2	3	50	50	100

PROBLEM SOLVING USING PYTHON

COURSE OBJECTIVES

1. Learn basic programming of Python.
2. To learn functions and statements.
3. To develop programs using Python packages.
4. To learn Communication concepts using Python programming.

COURSE OUTCOMES

At the end of the course student will be able to

CO1 Develop the Python programs using operators, conditional and looping statements and strings **(L3)**.

CO2 Implement programs using functions and different types of Data structures **(L3)**.

CO3 Develop the programs using Python NumPy and Pandas Packages**. (L3)**

CO4 Analyze the programs using Python Packages to real time communication applications**. (L4)**

1. Introduction:

History of Python, Need of Python Programming, Python Installation, Python basics.

2. Operators in python, conditional statements

1. Accept two numbers from the user and calculate Addition, Subtraction, multiplication and Division.
2. Write a Program for checking whether the given number is an even number or not.
3. Given a two integer numbers return their product and if the product is greater than 1000, then return their sum.
4. A student will not be allowed to sit in exam if his/her attendance is less than 75%. Take following input from user - Number of classes held, Number of classes attended, and print percentage of class attended Is student is allowed to sit in exam or not.

3. Iterations, continue and break statements.

1. Accept number from user and calculate the sum of all number between 1 and given number

2. Print the following pattern

```
1
1 2
1 2 3
```

3. Given a number count the total number of digits in a number

4. Strings, string functions, string slicing

1. Given 2 strings, s1 and s2, create a new string by appending s2 in the middle of s1.
2. Given a string input Count all lower case, upper case, digits, and special symbols.
3. Given an input string, count occurrences of all characters within a string.

5. Lists and Tuples

1. Write a Python program to get the largest number and smallest number from a list.
2. Write a Python program to remove duplicates from a list.
3. Write a Python program to find the length of a tuple.
4. Write a Python program to convert a list to a tuple.

6. Sets and Dictionaries

1. Dictionaries and dictionary methods, Sets and set methods.
2. Write a Python script to merge two Python dictionaries
3. Write a Python program to sort a dictionary by key

7. Functions:

1. Write a Python program to reverse a string using functions
2. Write a Python function to check whether a number is perfect or not

8. Basics of NumPy and Pandas packages.

1. Add the following two NumPy arrays and modify a result array by calculating the

square of each element.

2. Write a Python program to convert a dictionary to a Pandas series

9. Write a program to generate basic signals: Sinusoidal and Complex exponential signals.

10. Write a program to compute energy and power of defined signals.

11. Write a program to analyze the implications of sampling theorem at variable sampling rates for a sine wave input signal.

12. Write a program to analyze basic operations on Signals: Time shifting, Time Reversal Amplitude scaling and Time scaling.

REFERENCES:

1. Head-First Python: A Brain-Friendly Guide (2nd Edition).
2. Python Programming: An Introduction to Computer Science (3rd Edition)
3. Fluent Python: Clear, Concise, and Effective Programming (1st Edition)
4. Programming Python: Powerful Object-Oriented Programming (4th Edition)

WEB RESOURCES:

1. https://www.tutorialspoint.com/python/index.htm
2. https://www.geeksforgeeks.org/python-programming-language/
3. https://nptel.ac.in/courses/106106145

PROPOSED SCHEME FOR II/IV B.TEC II SEMESTER (4TH SEMESTER) (R-22)

Category	Course Code	Course	Hours Per Week			Maximum Marks			Credits
			Theory	Tutorial	Lab	Exam	Sessional	Total	
PCC		Analog Communications	3	0	0	70	30	100	3
PCC		Electromagnetic Field Theory & Transmission Lines	3	0	0	70	30	100	3
PCC		Microprocessors & Microcontrollers	3	0	0	70	30	100	3
PCC		Probability theory & Random Process	3	0	0	70	30	100	3
PCC		Linear ICs & Applications	3	0	0	70	30	100	3
ESC		Control Systems	3	0	0	70	30	100	3
PCC		Linear ICs & Pulse Circuits Lab	0	0	3	50	50	100	1.5
SC		Electronic Circuit Simulation	0	1	2	50	50	100	2
MC		Environmental Science	2	0	0	70	30	100	0
		Total	**20**	**1**	**5**	**590**	**310**	**900**	**21.5**
Honors/Minor courses (The hours distribution can be 3-0-2 or 3-1-0)			3	1	0	70	30	100	4

Summer Internship/Community Service Project

ANALOG COMMUNICATIONS

Credits	Periods			Exam Hrs.	Sessional Marks	Exam Marks	Total Marks
	Theory	Tutorial	Lab				
3	3	-	-	3	30	70	100

COURSE OBJECTIVES:

1. To impart knowledge on Amplitude Modulation principles, generation and its types.
2. To impart knowledge on Angle modulation principles and generation and to study Various demodulation methods and compare them
3. To provide in-depth analysis of noise performance in various receivers.
4. To understand the basic concepts of Radio Transmitters.
5. To make the students to know the working of Radio Receivers.

COURSE OUTCOMES:

After successful completion of this course, the students will be able to

CO 1: Understand and **Analyze** various linear modulation and demodulation techniques **(L4)**.

CO 2: Understand and **Analyze** various Angle Modulation and Demodulation Techniques **(L5)**.

CO 3: Examine the performance of the communication system in the presence of noise**(L4).**

CO 4: Examine various types of Linear and Angle Modulation Transmitters **(L4).**

CO 5: Examine the various types of receivers like AM, FM, ISB etc. **(L4)**.

SYLLABUS

UNIT-I: LINEAR MODULATION SYSTEMS:

Need for Modulation, Frequency Translation, Method of Frequency Translation, Amplitude Modulation, Modulation Index, Spectrum of AM Signal, Modulators and Demodulators (Diode detector), DSB-SC Signal and its Spectrum, Balanced Modulator, Synchronous Detectors, SSB Signal, SSB Generation Methods, Power Calculations in AM Systems, Application of AM Systems.

UNIT-II: ANGLE MODULATION SYSTEMS:

Angle Modulation, Phase and Frequency Modulation and their Relationship, Phase and Frequency Deviation, Spectrum of an FM Signal, Bandwidth of Sinusoidally Modulated FM Signal, Effect of the Modulation Index on Bandwidth, Spectrum of Constant Bandwidth FM, Phasor Diagram for FM Signals, FM Generation: Parameter variation method, Indirect method of Frequency Modulation (Armstrong Method), Frequency Multiplication, PLL FM Demodulator, Pre – emphasis and De – emphasis.

UNIT-III: NOISE IN AM AND FM SYSTEMS:

Sources of Noise, Resistor Noise, Shot Noise, Calculation of Noise in a Linear System, Frequency Domain representation of Noise, The effect of Filtering on the Probability density of Gaussian Noise, Effect of filter on the power spectral Density of Noise, Narrow Bandwidth, Quadrature components of Noise, Power spectral density of Noise, Probability Density of Noise and their time derivatives, representation of Noise using Orthonormal coordinates, Noise in AM Systems, Noise in Angle Modulation Systems, Comparison between AM and FM with respect to Noise.

UNIT-IV: RADIO TRANSMITTERS:

Classification of Radio Transmitters, Principle of a Radio Transmitters, AM and FM Transmitters, Radio Telegraph and Radio Telephone Transmitters, SSB Transmitters.

UNIT-V: RADIO RECEIVERS:

Radio receiver Types, AM Receivers – RF Section, Frequency Changing and Tracking, Intermediate Frequency and IF Amplifiers, Automatic Gain Control (AGC); FM Receivers – Amplitude Limiting, FM Demodulators, Ratio Detectors, ISB Receiver, Comparison with AM Receivers, Extensions of the Super-heterodyne Principles, Additional Circuits.

TEXT BOOKS:

1. Principles of Communication Systems, H.Taub, D. L. Schilling and GouthamSahe, TMH 3rd edition, 2007.
2. Principle of Communication Systems, Simon Haykins (2nd Edition).
3. Electronic Communication Systems, G. Kennedy, McGraw Hill, 1977 (2nd Edition).

REFERENCES:

1. Modern Digital and Analog Communication Systems, B. P. Lathi (2nd Edition).
2. Communication Systems, R.P.Singh and S.D.Sapre 2nd edition TMH 2008
3. Electronic Communications Modulation and Transmission, Robert J. Schoenbeck, PHI N. Delhi, 1999.

WEB RESOURCES:

1. https://www.tutorialspoint.com/analog_communication/analog_communication_introduction.htm
2. https://link.springer.com/book/10.1007/978-3-031-19584-6

ELECTROMAGNETIC FIELD THEORY & TRANSMISSION LINES

Credits	Periods			Exam Hrs.	Sessional Marks	Exam Marks	Total Marks
	Theory	Tutorial	Lab				
3	3	-	-	3	30	70	100

COURSE OBJECTIVES:

1. To introduce students with different coordinate systems.
2. To familiarize the students with the different concepts of electrostatic, magneto static and time varying electromagnetic systems.
3. To make the students understand the Maxwell's equations and boundary conditions.
4. To expose the students to the ideas of electromagnetic waves and their characteristics.
5. To familiarize the students about the Transmission lines, their characteristics and to make aware of Smith chart & its applications.

COURSE OUTCOMES:

After successful completion of this course, the students will be able to

CO1: Describe static electric fields and their behavior in different media, associated laws**. (L2)**

CO2: Describe magnetic fields, their behavior in different media, associated laws**. (L2)**

CO3: Apply integral and point form of Maxwell`s equations for solving the problems of Electromagnetic field theory**. (L3)**

CO4: Explain the concept of Electromagnetic wave and its characteristics in different Propagation media**. (L2)**

CO5: Evaluate the basic transmission line parameters and transmission line systems using Smith Chart**. (L5)**

SYLLABUS

UNIT–I: ELECTROSTATICS

Coulomb's Law, Electric Field Intensity – Fields due to Different Charge Distributions, Electric Flux Density, Gauss Law and Applications, Electric Potential, Maxwell's Two Equations for Electrostatic Fields, Energy density, Convection and Conduction Currents, Continuity Equation, Poisson's and Laplace's Equations; Capacitance - Parallel plate, Co-axial and Spherical capacitors, Illustrative Problems.

UNIT–II: MAGNETOSTATICS

Biot-Savort's Law, Ampere's Circuital Law and Applications, Magnetic Flux Density, Maxwell's Two Equations for Magneto static Fields, Magnetic Scalar and Vector Potentials, Forces due to Magnetic Fields, Inductances and Magnetic Energy, Illustrative Problems.

UNIT–III: MAXWELL'S EQUATIONS

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 a Boundary Surface: Dielectric - Dielectric and Dielectric – Conductor Interfaces. Illustrative Problems.

UNIT–IV: ELECTROMAGNETIC WAVES

Wave Equations for Conducting and Perfect Dielectric Media, Uniform Plane Waves, Wave Propagation in Lossless and Conducting Media, Conductors & Dielectrics – Characterization, Polarization, 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, Surface Impedance, Poynting Vector and Poynting Theorem, Illustrative Problems.

UNIT–V: TRANSMISSION LINES

Introduction to Transmission line equations, Primary & Secondary constants Expressions for Characteristic Impedance, Propagation Constant, Phase and Group Velocities, Loss lessness Low Loss Characterization, Distortion, Loading, SC and OC Lines, Reflection Coefficient, VSWR, $\lambda/8$, $\lambda/4$, $\lambda/2$ line impedance Transformations, Smith Chart–Configuration and Applications, Single and Double Stub Matching, Illustrative Problems.

TEXT BOOKS:

1. Matthew N.O. Sadiku "Elements of Electromagnetic", 3rd Edition, OxfordUniv.Press,2001.
2. G, Sasibhushana Rao "Electromagnetic Field Theory and Transmission Lines", 1st Ed.Wiley India Pvt.Ltd.New Delhi ,2012.
3. Transmission lines and Networks- Umesh Sinha, Satya Prakashan, 2001, (Tech, India Publications), New Delhi.

REFERENCES:

1. William H.Hayt,Jr.JohnA.Buck "Engineering Electromagnetics",Sixth Edition,McGraw Hill.
2. G.S.N. Raju "Electromagnetic Field Theory and Transmission Lines", Pearson Education Pvt., Ltd. New Delhi,2005
3. Krausand Fleisch"ElectromagneticswithApplications",McGrawHill,1999.
4. Electromagnetic waves and Radiating Systems- E.C. Jordan and K.G. Balmain, 2ndEd. 2000, PHI.

WEB RESOURCES:

1. https://nptel.ac.in/courses/108/104/108104087/
2. https://nptel.ac.in/courses/117/101/117101056/
3. https://nptel.ac.in/courses/117/101/117101057/

MICROPROCESSORS & MICROCONTROLLERS

Credits	Periods			Exam Hrs.	Sessional Marks	Exam Marks	Total Marks
	Theory	Tutorial	Lab				
3	3	-	-	3	30	70	100

COURSE OBJECTIVES:

1. Understand the architectures and instruction sets of microprocessors.
2. Develop logical programming skills in 8086 using assembly language.
3. Develop applications which involve interfacing of peripherals to microprocessors
4. Understand features and importance of Advanced Microprocessors.
5. To provide an in-depth understanding of the operations of microcontrollers and its applications.

COURSE OUTCOMES:

After successful completion of this course, the students will be able to

CO1:Analyze the architecture of 8086 microprocessors. **(L4)**

CO2: Implement assembly language programs using instructions related to I/O, MEMORY and ISR. **(L3)**.

CO3: Illustrate how peripherals are interfaced with Microprocessor. **(L4)**

CO4: Differentiate 8086 processor and advanced processors. **(L4)**

CO5: Develop Small systems using Microcontrollers. **(L6)**

SYLLABUS

UNIT-I: 8086/8088 MICROPROCESSORS

Register organization of 8086, Architecture, signal description of 8086, physical memory organization, general bus operation, I/O addressing capability, special purpose activities, Minimum mode, maximum mode of 8086 system and timings, the processor 8088, machine language instruction formats, addressing mode of 8086, instruction set off 8086, assembler directives and operators.

UNIT-II: PROGRAMMING WITH 8086 MICROPROCESSOR

Machine level programs, programming with an assembler, Assembly language programs, introduction to stack, stack structure of 8086/8088, interrupts and interrupt service routines, interrupt cycle of 8086, non-mask able interrupt and mask able interrupts, interrupt programming.

UNIT-III: BASIC AND SPECIAL PURPOSE PROGRAMMABLE PERIPHERALS AND THEIR INTERFACING WITH 8086/8088

Semiconductor memory interfacing, dynamic RAM interfacing, interfacing i/o ports, PIO 8255 modes of operation of 8255, interfacing to D/A and A/D converters, stepper motor interfacing, control of high power devices using 8255.Programmable interrupt controller 8259A, the keyboard /display controller8279, programmable communication interface 8251 USART, DMA Controller8257.

UNIT-IV: ADVANCED MICROPROCESSORS

Salient features of 80386DX, architecture and signal description of 80386, register organization of 80386 and addressing modes, data types of 80386, real address mode of 80386, protected mode of 80386, segmentation and Paging, virtual 8086 mode and enhanced mode. Instruction set of 80386. The coprocessor 80387.

UNIT-V: 8051 MICROCONTROLLER AND ARM 32-BIT MICROCONTROLLER

Introduction to microcontrollers, 8051Microcontrollers, 8051pin description, connections, I/O ports and memory organization, MCS51addressing modes and instructions, assembly language programming tools. ARM architecture and organization, ARM / Thumb programming model, ARM / Thumb instruction set.

TEXT BOOKS:

1. A.K.Ray, K.M.Bhurchandi,"Advanced Microprocessors and Peripherals", Tata McGraw Hill Publications, 2000.
2. N.Sentil Kumar, M.Saravanan, S.Jeevananthan, "Microprocessors and Microcontrollers", Oxford University Press, 2010.

REFERENCES:

1. Douglas V Hall, "Microprocessors and Interfacing" Tata McGraw Hill Publications, 2005.
2. Ajay V Deshmukh," Microcontrollers", TATA McGraw Hill publications, 2012.
3. Krishna Kant, "Microprocessors and Microcontrollers", PHI Publications, 2010.
4. M. A. Mazidi, Sarmad Naimi "The AVR Microcontroller and Embedded Systems Using Assembly and C: Using Arduino Uno and Atmel Studio", 2nd Edition, Micro Digital Edition.

WEB RESOURCES:

1.https://www.tutorialspoint.com/microprocessor/microprocessor_io_interfacing_overview.htm

2. https://nptel.ac.in/courses/108105102

3. https://infonics.files.wordpress.com/2015/03/advanced-microprocessors.pdf

PROBABILITY THEORY & RANDOM PROCESS

Credits	Periods			Exam Hrs.	Sessional Marks	Exam Marks	Total Marks
	Theory	Tutorial	Lab				
3	3	-	-	3	30	70	100

COURSE OBJECTIVES:

The goal of this course is

1. To understand the fundamentals of Probability Theory
2. To understand concept of random variables and probability density and distribution functions.
3. To know some important operations that can be performed on a random variable or multiple random variables.
4. To understand the mathematical concepts and analysis related to random processes
5. To Know spectral characteristics of random processes and basic applications

COURSE OUTCOMES:

After successful completion of this course, the students will be able to

CO1 **Apply** the basic theorems and concepts of probability. **(L4)**

CO2 **Apprehend** a single random variable and its operations to **estimate** statistical properties of a distribution function **(L2)**

CO3 **Extend** the concepts of single random variable to multiple random variables to **estimate** the statistical properties of a distribution function. **(L2)**

CO4 **Analyze** the temporal characteristics of a random process to estimate correlation and covariance. **(L4)**

CO5 **Analyze** the spectral characteristics of a random process to estimate power spectral density (L4)

SYLLABUS

UNIT-I: PROBABILITY THEORY

Sample spaces, Events, Probability definition and Axioms, Mathematical model of experiments, Probability as relative frequency, Joint and conditional probability, Properties of joint probability and conditional probability, Total probability, Bayes' theorem, Independent events: Two events and multiple events, properties of independent events.

UNIT-II: RANDOM VARIABLES AND MULTIPLE RANDOM VARIABLES

Random variable concept, Distribution function, Density function, Gaussian random variable, Conditional distribution and density function, Expectation, Moments, Functions that

give moment, Transformations of a random variable. Vector random variables, Joint distribution and its properties, Joint density and its properties, Conditional distribution and density, statistical independence, Distribution and density of a sum of random variables, Central limit theorem.

UNIT-III: OPERATIONS ON MULTIPLE RANDOM VARIABLES

Expected values of a function of random variables: Joint moments about the Origin, joint central moments, Joint characteristic functions, Joint Gaussian random variables: Two random variables, n-random variables, properties of Gaussian random variables, Transformations of multiple random variables: One function, Multiple functions, Inequalities of Chebyshev and Schwartz.

UNIT-IV: RANDOM PROCESSES

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

UNIT-V: SPECTRAL CHARACTERISTICS OF RANDOM PROCESSES

The Power Density Spectrum and its Properties, Weiner-Khinchin theorem, Noise definitions, System Response – Convolution, Mean and Mean squared Value of System Response, autocorrelation Function of Response, Cross-Correlation Functions of Input and Output, Power Density Spectrum of Response, Cross-Power Density Spectrums of Input and Output, System evaluation using random noise, Noise Band width.

TEXT BOOKS:

1. Peyton Z. Peebles, Jr "Probability Theory and Random Signal Principles", 4th edition Tata McGrew Hill Publishers, 2002.
2. Athanasios Papoulis and S. Unnikrishna Pillai "Probability, Random Variables and Stochastic Processes", 4th Edition, PHI, 2002.

REFERENCES:

1. Henry Stark, John W. Woods, Probability and Random Processes with Application to Signal Processing, 3/e, Pearson Education, 2002.
2. B. Prabhakara Rao, T.S.R.Murthy Probability theory and Stochastic Processes , BS Publications, Hyderabad, 2012.
3. S. P. Eugene Xavier" Probability Theory and Random Processes", S. Chand and Co. New Delhi, 1998(2nd Edition).

WEB RESOURCES:

1. https://ocw.mit.edu/courses/18-440-probability-and-random-variables-spring-2014/
2. https://nptel.ac.in/courses/117105085/
3. https://ee.stanford.edu/~gray/arp.pdf

LINEAR ICs & APPLICATIONS

Credits	Periods			Exam Hrs.	Sessional Marks	Exam Marks	Total Marks
	Theory	Tutorial	Lab				
3	3	-	-	3	30	70	100

COURSE OBJECTIVES:

1. To understand the basic building blocks and characteristics of operational amplifier.
2. To design and analyze different linear, non-linear and mathematical application circuits using operational amplifier.
3. To design and analyze different filters using operational Amplifier.
4. To introduce the operation and applications of timers and PLL.
5. To discuss the concept and applications of ADC and DAC

COURSE OUTCOMES:

After successful completion of this course, the students will be able to

CO1: Understand the characteristics of op-amp **(L2)**.

CO2: Analyze linear applications using op-amps **(L4)**.

CO3: Analyze non-linear applications and filters using op-amps **(L4)**.

CO4: Design Timers and PLL using functional ICs **(L4)**.

CO5: Design A/D and D/A converters using Op-amp **(L4).**

SYLLABUS

UNIT-I: OPERATIONAL AMPLIFIERS

Design Aspects of Monolithic Op-Amps, Ideal Characteristics, AC and DC Characteristics, Data sheet Specifications, Offset Voltages and Currents, Frequency Compensation Techniques, Measurement of Op-Amp Parameters.

UNIT-II: LINEAR APPLICATIONS OF OP-AMPS

Inverting and Non-Inverting Amplifiers, adder, Subtractor, Instrumentation Amplifiers, Voltage to Current and Current to Voltage Converters, Integrator, Differentiator, Oscillators, RC phase shift Oscillator, Wein-bridge Oscillator.

UNIT-III: NON-LINEAR APPLICATIONS OF OP-AMPS

SIGNAL CONDITIONING CIRCUITS: Rectifiers, Peak Detection, Logarithmic Amplifier, Wave form Generators, Multi vibrators, Square Wave Generators, Comparators and Schmitt trigger, Analog Multiplexers, Sample and Hold Circuit.

ACTIVE FILTERS: Low pass filter, High pass filter, Band pass filter, Band elimination filter, All-pass Filters, Higher Order Filters and their Comparison.

UNIT-IV: SPECIAL ICs

555 Timers, 556 Function Generator ICs and their Applications, Three Terminal IC Regulators, IC 1496 (Balanced Modulator), IC 565 PLL and its Applications, Function Generators.

UNIT-V: DIGITAL TO ANALOG AND ANALOG TO DIGITAL CONVERTERS

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 type ADC, DAC and ADC specifications.

TEXT BOOKS:

1. Ramakant A.Gayakward, "Op-Amps and Linear Integrated Circuits", 4th Edition, PHI, 2010.
2. Choudhary D. Roy, Shail B. Jain "Linear Integrated Circuits", 5th Edition New Age International Publishers.
3. G B Clayton, "Operational Amplifiers", 5th Edition, Elsevier science, 2003.

REFERENCES:

1. K.R. Botkar, "Integrated Circuits", 5th Edition, Khanna Publications 2010.
2. Jacob Millman, Arvin Grabel, "Microelectronics" 2nd Edition, McGraw Hill.

WEB RESOURCES:

1. http://nptel.ac.in/courses/117108038/
2.http://ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-01sc-introduction-to-electrical-engineering-and-computer-science-i-spring-2011/unit-3-circuits/op-amps/

CONTROL SYSTEMS

Credits	Periods			Exam Hrs.	Sessional Marks	Exam Marks	Total Marks
	Theory	Tutorial	Lab				
3	3	-	-	3	30	70	100

COURSE OBJECTIVES:

The goal of this course is

1. To introduce different types of systems and to interpret different physical and mechanical systems in terms of electrical system, to construct equivalent electrical models for analysis.
2. To introduce Block Diagram systems and Signal Flow graphs modelling
3. To employ time domain analysis and diagnose transient performance parameters of the system for standard input functions.
4. To formulate expressions in frequency domain to explain the nature of stability of the system.
5. To examine system stability in both time and frequency domains including stability margins.

COURSE OUTCOMES:

After successful completion of this course, the students will be able to

CO1: **Interpret** different physical and mechanical systems in terms of electrical system to construct equivalent electrical models for analysis **(L2)**

CO2: Analyze Block Diagram systems and Signal Flow graphs modelling **(L4)**

CO3: Examine time domain analysis to predict and diagnose transient performance parameters of the system for standard input functions **(L3)**

CO4: Analyze stability of system by using RH Criteria and Root Locus. **(L4)**

CO5: Correlate different types of analysis in frequency domain to explain the nature of stability of the system**. (L4)**

SYLLABUS

UNIT-I: INTRODUCTION TO CONTROL SYSTEMS

Control system, Comparison between open loop and closed loop systems, Introduction to Mathematical Modeling of Physical Systems, Equations of Electrical Networks, Modeling of Mechanical Systems, Equations of Mechanical Systems, Analogous Systems.

UNIT-II: TRANSFER FUNCTIONS OF LINEAR SYSTEMS

Block Diagrams of Control Systems, Reduction Techniques for Complex Block Diagrams Signal Flow Graphs, conversion of Block diagram to signal flow graph, Signal Flow Graphs reduction (Simple Examples),

UNIT-III: TIME DOMAIN ANALYSIS

Time Response, Test Signals, Order and Type number of a system, Response of First order system for unit step input, Second Order System response with step and impulse Input Signals, Time domain specifications, Response with P, PI, PD and PID controllers, Steady State Error Constants, Simple Problems to understand theory

UNIT-IV: STABILITY ANALYSIS

Concepts of stability, Necessary conditions for Stability, Routh-Hurwitz Criterion, the Concept and Construction of Root Loci, Analysis of Control Systems with Root Locus (Simple Problems to understand theory).

UNIT-V: FREQUENCY DOMAIN ANALYSIS AND STABILITY

Frequency domain specifications, Frequency Response Plots, Bode Plot, Polar Plot, Nyquist Stability Criterion, Constant M and N Circles.

TEXT BOOKS:

1. Control Systems Engineering, I. J. Nagrath and M. Gopal, Wiley Eastern Ltd.
2. Control Systems by A. Nagoor Kani, RBA Publications

REFERENCES:

1. Modern Control Engineering, Ogata, PHI.
2. Control Systems Principles and Design, M.Gopal, McGrawHill.

WEB RESOURCES:

1. http://nptel.ac.in/courses/108101037
2. http://ocw.mit.edu/courses/aeronautics-and-astronautics/16-30-feedback-control-systemsfall-2010

HONORS
MICROELECTRONICS

Credits	Periods			Exam Hrs.	Sessional Marks	Exam Marks	Total Marks
	Theory	Tutorial	Lab				
3	3	-	-	3	30	70	100

COURSE OBJECTIVES:

1. To learn the fabrication flow of NMOS, PMOS, CMOS, and BiCMOS.
2. To understand NMOS, CMOS, ECL technologies design methods.
3. To implement logical operations using combinational logic circuits and programmable Logic Circuits.
4. To design sequential logic circuits
5. To learn FPGA Architecture and design process.

COURSE OUTCOMES:

After successful completion of this course, the students will be able to

CO1: Understand the fabrication process of NMOS, PMOS, CMOS and BiCMOS. **(L2)**.

CO2: Design of logic gates using NMOS, CMOS, ECL technologies. **(L5)**.

CO3: Design small combinational circuits and devices **(L5)**.

CO4: Design small sequential circuits and devices **(L5)**.

CO5: Understand FPGA Architecture and design process **(L2).**

SYLLABUS

UNIT-I: INTEGRATED- CIRCUIT FABRICATION

Monolithic Integrated - Circuit (microelectronics) technology- The planar processes - Bipolar Transistor Fabrication - Fabrication of FETs - CMOS Technology - Monolithic Diodes- The Metal – Semiconductor Contact - IC Resistor - IC Capacitors - IC Packaging - Characteristics of IC Components – Microelectronic circuit layout.

UNIT-II: BASIC DIGITAL CIRCUITS

MOS Technology - NMOS, CMOS, Inverters, Logic gates - ECL circuits.

UNIT-III: COMBINATIONAL CIRCUITS

Arithmetic functions - Comparators - Multiplexers – De multiplexers - Memory – Memory applications - PAL- PLAs.

UNIT-IV: SEQUENTIAL CIRCUITS

1 - Bit memory - The circuit properties of bistable latch - The clocked SR Flip-Flop - J-K, T, and D-type Flip-flops. Shift-registers - Ripple Counters - synchronous counters - Applications of counters.

UNIT-V: DESIGN OF FPGA'S

Basic FPGA architecture, FPGA configuration, configuration modes, FPGA Design Process-FPGA design flow, FPGA families, Step-by-step approach of FPGA design process on Xilinx environment.

TEXT BOOKS:

1. Microelectronic by Jocob Milliman, Arbin Grabel second edition, TMH
2. S.Trimberger, Edr., Field Programmable Gate Array Technology, Kluwer Academic Pub.

REFERENCES:

1. Part 2 of Integrated Circuits, Design Principles and Fabrications by editors, Warner and Fordem walt, 1965, Motorola Series, McGraw Hill.
2. MOS LSI Design and Applications by Dr. William N. Carr and Dr. Jack P. Mize, McGraw Hill, 1972.
3. Microelectronic circuits and devices second edition Horenstien, PHI.
4. S. Brown,R.Francis,J.Rose, Z.Vransic, Field Programmable Gate Array, Kluwer Pub.

WEB RESOURCES:

1. https://onlinecourses.nptel.ac.in/noc21_ee86/preview
2. https://ocw.mit.edu/courses/6-012-microelectronic-devices-and-circuits-fall-2005/pages/lecture-notes/

LINEAR ICs & PULSE CIRCUITS LAB

Credits	Periods			Exam Hrs.	Sessional Marks	Exam Marks	Total Marks
	Theory	Tutorial	Lab				
1.5	-	-	3	3	50	50	100

COURSE OBJECTIVES:

The main objectives of this course is

1.To know the Linear and Non-Linear characteristics of Wave shaping circuits

2.To Measure the Parameters of Op-Amp

3.To Measure the frequency response of Active Filters

4.To check the working of Op-Amp in different applications

COURSE OUTCOMES:

After successful completion of the Course students able to

CO1: **Understand** the linear and Non-Linear behavior of the wave shaping circuits

CO2: Analyze and design the frequency response of active filters

CO3: Measure the parameters of Op Amp

CO4: Demonstrate the applications of Op Amp and special IC circuits

LIST OF EXPERIMENTS

1. Linear wave shaping
2. Non-linear wave shaping
3. UJT as a Relaxation oscillator
4. Measurement of parameters of Op-amp
5. Schmitt trigger
6. Frequency response of Active filters
7. Op-Amp as adder and subtractor.
8. Op-amp as Wave form generator
9. IC-555 as an Astable Multivibrator
10. Study of Instrumentation Amplifier
11. Voltage regulator using IC-723
12. Monostable Multivibrator using IC-555

SKILL COURSE

ELECTRONIC CIRCUIT SIMULATION LAB

Credits	Periods			Exam Hrs.	Sessional Marks	Exam Marks	Total Marks
	Theory	Tutorial	Lab				
2	-	1	2	3	50	50	100

COURSE OBJECTIVES:

1. To study the V-I characteristics of Semiconductor Devices practically
2. To study the Frequency response characteristics of single stage and Multistage Amplifiers practically
3. To study responses of Feedback Amplifiers and oscillators.
4. To study responses of power amplifiers and tuned amplifiers practically.

COURSEOUTCOMES:

After successful completion of this course, the students will be able to

CO1: Analyze the V-I characteristics of Semiconductor Devices. **(L3)**

CO2: Design and verify Frequency response characteristics of single stage and Multistage Amplifiers. **(L6)**

CO3: Verify various types of Feedback Amplifiers and oscillators. **(L4)**

CO4: Determine the efficiency of power amplifiers and resonant frequency of tuned amplifier. **(L4)**

LIST OF EXPERIMENTS

1. V-I Characteristics of Diode
2. Input and output characteristics of CB configuration.
3. Drain and transfer Characteristics of JFET
4. Common emitter Amplifier
5. Common source FET Amplifier
6. Two stage RC coupled Amplifier
7. Current series feedback Amplifier
8. Voltage Shunt Feedback Amplifier
9. Colpitt's oscillator
10. Heartly Oscillator
11. RC Phase shift oscillator using transistors
12. Class-B complementary symmetry Amplifier
13. Class-A Power Amplifier (transformer less)
14. Tuned Voltage Amplifier

Note: Any TWELVE of the experiments are to be conducted.