FACULTY OF ENGINEERING

Scheme of Instruction & Examination

(With effect from Academic Year 2025-26)

and

Syllabi

B.E. III and IV Semester

of

Four Year Degree Programme

in

Electronics and Communication Engineering

(With effect from the academic year 2025-2026)

(As approved in the faculty meeting held on 6th June 2025)

Issued by

Dean, Faculty of Engineering

Osmania University, Hyderabad – 500 007

2025

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SCHEME OF INSTRUCTION & EXAMINATION
B.E. III- Semester
(ELECTRONICS AND COMMUNICATION ENGINEERING)

S. No	Course Code	Course Title	Scheme of Instruction				Scheme of Examination			Credits
			L	T	P/D	Contact Hrs/Wk	CIE	SEE	Duration in Hrs	
Theory Course										
1	HS 201EG	Effective Technical Communication in English	3	-	-	3	30	70	3	3
2	ES 401 EC	Signals & Systems	3	1	-	4	30	70	3	4
3	PC 302 EC	Digital Electronics	3	-	-	3	30	70	3	3
4	PC 303 EC	Probability Theory and Stochastic Processes	3	1	-	4	30	70	3	4
5	PC 304 EC	Electronic Devices	3	-	-	3	30	70	3	3
6	PC 305 EC	Network Theory	3	-	-	3	30	70	3	3
Practical / Laboratory Course										
7	PC 351EC	Electronic Devices Lab	-	-	2	2	25	50	3	1
8	PC 352EC	Electronic Workshop Lab	-	-	2	2	25	50	3	1
9	PC353EC	Logic DesignLab	-	-	2	2	25	50	3	1
Total			**18**	**2**	**6**	**26**	**255**	**570**	**27**	**23**

PC: Professional Course **MC:** Mandatory Course **L:**Lecture **T:**Tutorial

P: Practical **D:**Drawing **G**: Grade(E/VG/G/S/U)

CIE: Continuous Internal Evaluation **SEE**: Semester End Examination (Univ. Exam)

Note:

1. Each contact hour is a Clock Hour
2. The duration of the practical class is two clock hours, however it can be extended wherever necessary, to enable the student to complete the experiment

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Course Code	Course Title						Core/PE/OE
HS201EG	**EFFECTIVE TECHNICAL COMMUNICATION IN ENGLISH**						**Core**
	Contact Hours per Week				**CIE**	**SEE**	**Credits**
Prerequisite	**L**	**T**	**D**	**P**			
-	**3**	**-**	**-**	**-**	**30**	**70**	**3**

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Course Code	**Course Title**						**Core/PE/OE**
ES 401 EC	**SIGNALS AND SYSTEMS**						**Core**
	Contact Hours per Week				**CIE**	**SEE**	**Credits**
Prerequisite	**L**	**T**	**D**	**P**			
BS201MT	**3**	**1**	**0**	**0**	**30**	**70**	**4**

Course Objectives: The course is taught with the objectives of enabling the student to:

1. Analyze basic concepts related to signals and systems.
2. Familiarize with basic operations on signals and mathematical representation of periodic and aperiodic signals.
3. Define convolution, correlation operations on continuous signals.
4. Define the characterization of system using constant coefficient difference equations.
5. Analyze the response of systems upon application of step and ramp inputs using Fourier and Z transforms

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

1. Define and differentiate types of signals and systems in continuous and discretetime
2. Apply the properties of Fourier transform for continuous timesignals
3. Relate Laplace transforms to solve differential equations and to determine the response of the Continuous Time Linear Time Invariant Systems to knowninputs
4. Apply Z-transforms for discrete time signals to solve Differenceequations
5. Obtain Linear Convolution and Correlation of discrete time signals with graphical representation

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	3	2	-	-	1	-	-	-	-	1	-	2
CO2	3	3	2	-	2	-	-	-	-	1	-	2
CO3	3	3	2	2	2	-	-	-	-	1	-	2
CO4	3	3	2	2	2	-	-	-	-	1	-	2
CO5	3	2	-	2	2	-	-	-	-	1	-	2

Correlation rating: Low / Medium / High: 1 / 2 / 3 respectively.

UNIT I

Definitions and classifications: Classification of continuous time signals. Basic operations on continuous-time signals and classification of continuous-time systems.
Discrete-time signals and systems: Sampling, Classification of discrete-time signals, Basic operations on discrete time signals, Basic operations on discrete time signals, Classification of discrete time systems, properties of systems.

UNIT II

Representation of Continuous-time signals: Analogy between vectors and signals, signal representation by a discrete- set of orthogonal functions, orthogonality and completeness. Fourier series – Trigonometric and Exponential Fourier series, computational formulae, symmetry conditions, the complex Fourier spectrum.

Fourier Transform (FT): The direct and inverse FT, existence of FT, Properties of FT, The Frequency Spectrum**.**
UNIT III
Laplace Transform (LT): The direct LT, Region of convergence, existence of LT, properties of LT. The inverse LT, Solution of differential equations, system transfer function. Linear convolution of continuous time signals: Graphical interpretation, properties of convolution, Correlation between continuous-time signals: Auto and Cross correlation, graphical interpretation, properties of correlation.
UNIT IV
Z-Transform: The direct Z transform, Region of convergence, Z-plane and S-plane correspondence. Inverse Z transform, Properties of Z-transforms, Solution to linear difference equations, Linear constant coefficient systems, System transfer function
UNIT V
Discrete Fourier series, Frequency domain Representation of discrete-time systems and signals. Sampling the z-transform. Linear Convolution of discrete time signals: Graphical interpretation, properties of discrete convolution. Correlation between discrete time signals: Auto and Cross-correlation, graphical interpretation, properties of correlation.

Suggested Text Books:
1. B.P.Lathi,LinearSystemsandSignals,OxfordUniversityPress,2nd Edition,2009
2. Alan V O P Penheim, A. S. Wlisky , Signals and Systems, 2nd Edition, PrenticeHall
3. Rodger E. Ziemer, William H Trenter, D. Ronald Fannin, Signals and Systems, 4th Edition, Pearson1998.
Reference Text Books:
1. Douglas K. Linder, Introduction to Signals and Systems, McGraw Hill, 1999
2. P. Ramakrishna Rao, Signals and Systems, TMH
3. P.RameshBabu,R Ananda Natrajan,Signals and systems SCITECH

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Course Code	Course Title						Core/PE/OE
PC302EC	**DIGITAL ELECTRONICS**						**Core**
	Contact Hours per Week				**CIE**	**SEE**	**Credits**
Prerequisite	**L**	**T**	**D**	**P**			
BS202PH	**3**	**-**	**-**	**-**	**30**	**70**	**3**

Course Objectives : The course is taught with the objectives of enabling the student to:

1. Understand the fundamental principles of digital hardware design and number systems.
2. ApplyBoolean algebra and logic minimization techniques to implement combinational circuits efficiently.
3. Analyzethe functionality and timing characteristics of sequential circuits using various flip-flops and latches.
4. Design finite state machines (FSMs) for real-time digital applications using synchronous sequential logic.
5. Explore the architecture and design methodologies using programmable logic devices like PALs, PLAs, CPLDs, and FPGAs.

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

1. Explainthe fundamentals of digital hardware design, logic gates, Boolean algebra, and logic synthesis.
2. Design and optimize combinational circuits using K-Map and Quine-Mc Cluskey methods.
3. Construct and analyze various sequential circuits including flip-flops, registers, and counters.
4. Develop FSM-based digital systems for sequence detection and generation using Mealy/Moore models.
5. Implement combinational logic using PLDs such as PALs, PLAs, CPLDs, and FPGAs.

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	3	2	1	1	-	-	-	-	-	-	-	1
CO2	3	2	3	2	-	-	-	-	-	-	-	2
CO3	3	2	3	2	1	-	-	-	-	-	-	2
CO4	3	2	3	3	1	-	-	-	-	-	-	2
CO5	3	2	3	2	-	-	-	-	-	-	-	2

Correlation rating: Low / Medium / High: 1 / 2 / 3 respectively.

UNIT I

Design Concepts: Digital Hardware, Design process, Design of digital hardware. Number systems and codes. Introduction to logic circuits – Variables and functions, Logic gates and networks. Boolean algebra, Synthesis using gates, Design examples.

UNIT II

Logic Optimization: Optimized implementation of logic functions using K-Map and Quine-Mc Cluskey Tabular method.

Combinational Circuit Design: Adders and Subtractors, Multiplexers, Demultiplexers, Parity Checkers and Generators, Decoders, Encoders, Code converters, BCD to 7-segment

converter and Arithmetic comparator circuits.
UNIT III
Sequential Circuits: Basic Latch, Gated SR Latch, gated D Latch, Master-Slave edge triggered flip-flops, T Flip-flop, JK Flip-flop, Excitation tables, Timing diagrams and analysis, Flip flop conversions, Set-up and hold time, Registers and Counters.
UNIT IV
Synchronous Sequential Circuits: Basic Design Steps, Finite State machine (FSM) representation using Moore and Mealy state models, State minimization, Design of FSM for Sequence Generation and Detection, Algorithmic State Machine charts.
UNIT V
Design of combinational circuits using Programmable Logic Devices (PLDs): General structure of a Programmable Array Logic (PAL), Programmable Logic Arrays (PLAs), Structure of CPLDs and FPGAs, 2-input and 3-input lookup tables (LUTs).

Suggested Text Books:
1. Morris Mano and Michael D. Ciletti, "Digital Design", Pearson, 6/e, 2021.
2. Zvi Kohavi, "Switching and Finite Automata Theory", 3/e, Cambridge University Press New Delhi, 2011.
3. R. P Jain, "Modern Digital Electronics",4/e, McGraw Hill Education (India) Private Limited, 2010.
Reference Text Books:
1. John F. Wakerly, *Digital Design: Principles and Practices*, 5th Edition, Pearson Education, 2018.
2. Ronald J. Tocci, Neal S. Widmer, and Gregory L. Moss, *Digital Systems: Principles and Applications*, 12th Edition, Pearson Education, 2016.
3. A. Anand Kumar, *Fundamentals of Digital Circuits*, 4th Edition, PHI Learning, 2016.
4. Charles H. Roth Jr. and Larry L. Kinney, *Fundamentals of Logic Design*, 7th Edition, Cengage Learning, 2013.

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Course Code	Course Title						Core/PE/OE
PC 303 EC	PROBABILITY THEORY AND STOCHASTIC PROCESSES						Core
	Contact Hours per Week				CIE	SEE	Credits
Prerequisite	L	T	D	P			
BS201MT	3	1	-	-	30	70	4

Course Objectives : The course is taught with the objectives of enabling the student to:

1. Understand fundamentals of probability, repeated trials and Baye's theorem.
2. Learn Random variable and distribution and density functions of different variables along with their mean and variance.
3. Learn two Random variables along with joint moments and its properties.
4. Understand elementary concepts of the Stochastic Processes and their temporal characteristics
5. Understand elementary concepts of the Stochastic Processes and their Spectral characteristics

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

1. Understand axioms of probability and prove some basic theorems of probability.
2. To understand different types of Random variables, their density and distribution functions
3. To learn bi-variate distributions and the operations on them.
4. To understand elementary concepts of the Stochastic Processes in the Temporal domain.
5. To analyze the frequency domain information of Stochastic Processes.

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	-	-	-	-	-	-	-	1	-	1
CO2	3	2	-	-	-	-	-	-	-	1	-	1
CO3	3	2	-	-	-	-	-	-	-	1	-	1
CO4	3	2	-	-	-	-	-	-	-	1	-	1
CO5	3	2	-	-	-	-	-	-	-	1	-	1

Correlation rating: Low / Medium / High: 1 / 2 / 3 respectively.

UNIT I: Concept of Probability

Probability introduced through Set Theory and Operations – Definitions and Axioms, Probability Space – Discrete and Continuous, Events - Mutually Exclusive and independent events, Joint Probability, Conditional Probability, Total Probability & Baye's Theorem, Repeated Trials, Combined Experiments, Bernoulli Trials, Bernoulli's Theorem.

UNIT II: Random Variable, Distribution & Density Functions

Random Variable: Definition of a Random Variable, Conditions for a Function to be a Random Variable, Discrete, Continuous and Mixed Random Variables.

Distribution & Density Functions and Operations on One Random Variable

Distribution and Density functions and their Properties - Binomial, Poisson, Uniform, Gaussian, Gamma, Rayleigh Distribution functions, Conditional Density and its Properties.

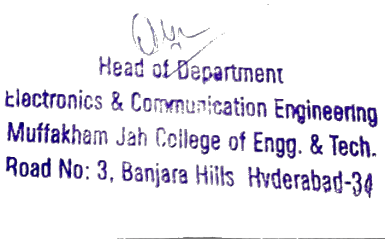
Expected Value of a Random Variable, Function of a Random Variable g(x) and its distribution, Moments about the Origin, Central Moments and Variance, Characteristic Function, Moment Generating Function.

UNIT-III: Two Random Variables and operations

Bi-Variate Distributions: Joint Distribution and Density Function and their properties, Joint

Moments,Co-Variance, Correlation and Degree of Correlation, Joint Characteristic Functions, Conditional Distributions, Conditional Expected Values. Central Limit Theorem (no proof).One Function of Two Random Variables, Two functions of two random variables.
UNIT-IV Stochastic Processes – Temporal Characteristics
Stochastic Processes – Temporal Characteristics Definitions and types of Stochastic Processes, Introduction to stationarity (First, Second and n^{th} order),Wide Sense and Strict Sense Stationary Processes, Statistical independence, Time averages and ergodicity, Mean-Ergodic Processes, Correlation-Ergodic Processes, Autocorrelation Function and its Properties, Cross-Correlation Function and its Properties, Covariance and its Properties.
UNIT-V Stochastic Processes – Spectral Characteristics
Stochastic Processes – Spectral Characteristics Power Spectral Density and its properties; Relationship between Power Spectrum and Autocorrelation Function; Relationship between Cross-Power Spectrum and Cross-Correlation Function; White and colored noise, Linear Systems, Response to linear systems for stochastic inputs, Introduction to Gaussian, Poisson and Markov Processes.

Suggested Text Books:
1. Henry Stark and John W. Woods, *Probability and Random Processes with Application to Signal Processing*, 3rd edition, Pearson Education, 2014. 2. Athanasius Papoulis and S. Unnikrishna Pillai, *Probability, Random Variables and Stochastic Processes*, 4th edition, McGraw Hill, 2006. 3. Peyton Z. Peebles, *Probability, Random Variables & Random Signal Principles*, 4th edition, Tata McGraw Hill, 2001.
Reference Text Books:
1. T Veerarajan, Probability, Statistics and Random Processes, McGraw Hill, 3rd edition
2. P Sri Hari, Probability and Random Variables,The Hi-Tech Publishers



Course Code	Course Title						Core/PE/OE
PC 304 EC	**ELECTRONIC DEVICES**						**Core**
	Contact Hours per Week				**CIE**	**SEE**	**Credits**
Prerequisite	**L**	**T**	**D**	**P/D**			
BS301EE	**3**	**-**	**-**	**-**	**30**	**70**	**3**

Course Objectives : The course is taught with the objectives of enabling the student to:

1. Study semiconductor physics and Analyze the behavior of Semiconductor diodes in Forward and Reverse bias.
2. Develop Half wave and Full wave rectifiers with L, C Filters.
3. Explain V-I characteristics of Bipolar Junction Transistor in CB, CE & CC configurations and Design of DC Biasing techniques
4. Design and analysis of small signal transistor amplifiers using exact and simplified hybrid models. Design and application of special devices like UJT, SCR, DIAC, TRIAC, and CCD
5. Explore V-I Characteristics , Biasing techniques, small signal model of FET's and MOSETS.

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

1. Analyze the behavior of semiconductor diodes in forward and reverse bias
2. Develop Half wave and Full wave rectifiers with L,C,LC & CLC Filters
3. Explain V-I characteristics of Bipolar Junction Transistor in CB,CE& CC configurations and Design DC Biasing techniques
4. Design Biasing techniques for BJT in Amplifier Applications
5. Explore V-I characteristics, analyze Amplifier configurations and Biasing circuits of FET and MOSFETS.

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	3	2	1	2	-	-	-	-	-	-	-	-
CO2	3	1	2	2	-	-	-	-	-	-	-	-
CO3	3	3	2	1	-	-	-	-	-	-	-	-
CO4	3	2	2	2	-	-	-	-	-	-	-	-
CO5	3	3	1	2	-	-	-	-	-	-	-	-

Correlation rating: Low / Medium / High: 1 / 2 / 3 respectively.

UNIT I

Junction Diode : Different types of PN Junction formation techniques, PNJunction Characteristics, biasing- band diagrams and current flow, Diode current equations under forward bias and reverse bias conditions, Junction breakdown in diodes and breakdown voltages, effect of temperature on diode characteristics, Diode as a circuit element, small signal diode models, Junction capacitance under forward bias and reverse bias, Diode switching characteristics, Zener Diodes, Zener voltage regulator and its limitation

UNIT II

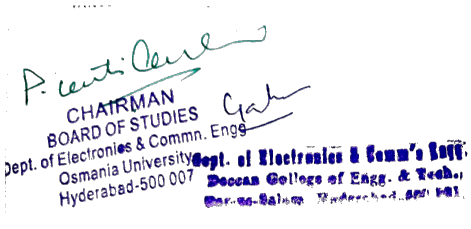
PN Diode Applications: Half wave, Full wave and Bridge rectifiers - theiroperation, performance characteristics, and analysis; Filters (L, C, LC and CLC filters) used in power supplies and their ripple factor calculations, design of Rectifiers with and without Filters.

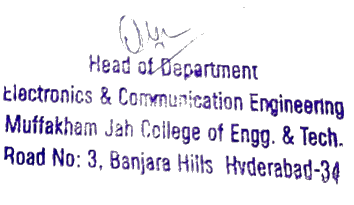
UNIT III

Bipolar Junction Transistor : Transistor Junction formation (collector-base,base-emitter Junctions) Transistor biasing-band diagram for NPN and PNP transistors, current

components and current flow in BJT, Modes of transistor operation, Early effect, BJT input and output characteristics in CB, CE CC configurations, BJT as an amplifier, BJT biasing techniques, Thermal runway, heat sinks and thermal stabilization, operating point stabilization against temperature and device variations, stability factors, Bias stabilization and compensation techniques, Biasing circuit design.
UNIT IV
Small Signal Transistors equivalent circuits: Small signal low frequencyh-parameter model of BJT, Determination of h parameters, analysis of BJT amplifiers using h-parameter, comparison of CB, CE and CC amplifier configurations, Analysis of BJT amplifier with approximate model. Introduction to low frequency Π and T models **Special Devices:** Working of photo diode, solar cells, LED.
UNIT V
Junction Field Effect Transistors (JFET): JFET formation, operation &current flow, pinch-off voltage, V-I characteristics of JFET. JFET biasing-zero current drift biasing, biasing against device variations. Low frequency small signal model of FETs. Analysis of CS, CD and CG amplifiers and their comparison. FET as an amplifier and as a switch. MOSFETs: MOSFETs, Enhancement & Depletion mode MOSFETs, V-I characteristics.

Suggested Text Books:
1. Jacob Millman, Christos C. Halkias, and Satyabrata Jit, *ElectronicDevices and Circuits*, 3rded.,McGraw Hill Education, 2010
2. Robert Boylestad and Louis Nashelsky, *Electronic Devices and Circuit Theory*, 11th ed., Pearson India Publications, 2015
3. S Salivahanan, N Kumar, and A Vallavaraj, Electronic Devices and Circuits, 2nd ed., McGraw Hill Education, 2007.
Reference Text Books:
1. David A. Bell, *Electronic Devices and Circuits*, 5th ed., Oxford University Press, 2009.
2. JB Gupta, Electronic Devices and Circuits, S.K Kataria & sons, 5th Edition, 2012
3. The Art of Electronics, Horowitz, 3rd Edition Cambridge University Press
4. Electronic Devices and Circuits,A.P Godse, U.A Bakshi , Technical Publications





Course Code	Course Title						Core/Elective
PC 305 EC	**NETWORK THEORY**						**Core**
Prerequisite	**Contact Hours per Week**				**CIE**	**SEE**	**Credits**
	L	**T**	**D**	**P**			
ES154EE BS102MT	**3**	**-**	**-**	**-**	**30**	**70**	**3**

Course Objectives : The course is taught with the objectives of enabling the student to:

1. Concepts of Two Port networks, study about the different two port parameter representations.
2. Concepts about the image impedance on different networks, design of attenuators.
3. Design concepts of equalizers.
4. Design concepts of different filters.
5. Design concepts of network synthesis

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

1. Able to Express given Electrical Circuit in terms of A,B,C,D and Z,Y Parameter Model and Solve the circuits and how they are used in real time applications.
2. Able to learn how to calculate properties of networks and design of attenuators.
3. Able to design of equalizers
4. Able to design different types of filters using passive elements.
5. Able to synthesize the RL & RC networks in Foster and Cauer Forms.

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	2	2	-	-	-	-	-	-	-	-
CO2	3	3	2	2	-	2	-	-	-	-	-	2
CO3	3	3		2	-	-	-	-	-	-	-	
CO4	2	2	-	-	-	2	2	-	-	-	-	2
CO5	2	-	-	-	-	2	2	-	-	-	-	

Correlation rating: Low / Medium / High: 1 / 2 / 3 respectively.

UNIT I

Two Port networks: Z, Y, h, g and ABCD parameters, equivalence of two ports networks, T-π transforms, Reciprocity theorem, Interconnection of two port networks and Brune's test for inter connections.

UNIT II

Symmetrical and Asymmetrical Networks: Characteristic impedance and propagation constant ofsymmetrical T and π networks, Image and iterative impedances, Image transfer constant and iterative transfer constant of asymmetrical L, T and π networks,

UNIT III

Constant k- Filters- Low pass, high pass, band pass and band elimination filter design, m-derived low pass and high pass filter design, Composite filter design and notch filter.

UNIT IV

Attenuators and Equalizers- Design of symmetrical T, π , Bridge-T and Lattice attenuators, impedance matching networks, Inverse networks, Equalizers, Constant resistance equalizer,

full series and full shunt equalizer**.**
UNIT V
Network Synthesis: Hurwitz polynomials, positive real functions, Basic Philosophy of Synthesis, L-CImmitance functions, RC impedance functions and RL admittance functions. RL impedance functions and RC admittance functions. Cauer and Foster's forms of RL impedance and RC admittance. Properties of RC, RL Networks**.**

Suggested Text Books:
1. William H. Hayt, Jack E. Kemmerly and Steven M. Durbin, "Engineering Circuit Analysis", 6th edition, Tata McGraw-Hill, 2007.
2. A Sudhakar and Shyammohan S Palli, "Circuits & Networks: Analysis and Synthesis", 3rd ed., Tata McGraw-Hill , 2007.
3. A. Sudhakar Shyammohan, *Circuits Networks: Analysis Synthesis*, 4th edition, Tata McGraw-Hill, 2010.
Reference Text Books:
1. Ryder J.D, *Network Lines Fields*, 2nd edition, Prentice Hall of India,1991.
2. P.K. Jain and Gurbir Kau, *Networks, Filters and Transmission Lines*, Tata McGraw-Hill Publishing Company Limited.
3. Van Valkenburg M.E, *Introduction to Modern Network Synthesis*, Wiley Eastern 1994.
4. S.P. Ghosh and A.K. Chakraborty, *Network Analysis and Synthesis*, McGraw Hill, 1st edition, 2009.

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Course Code	**Course Title**						**Core/PE/OE**
PC 351 EC	**ELECTRONIC DEVICES AND CIRCUITS LAB**						**Core**
	Contact Hours per Week				**CIE**	**SEE**	**Credits**
Prerequisite	**L**	**T**	**D**	**P**			
PC304EC				**2**	**25**	**50**	**1**

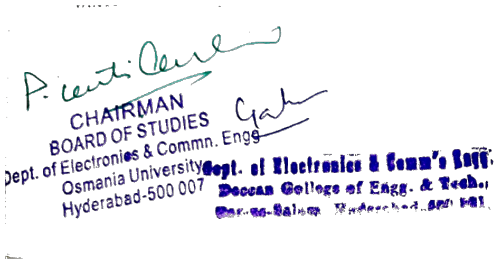
Course Objectives : The course is taught with the objectives of enabling the student to:
1. To learn the characteristics of Semiconductor diodes
2. To design the filters and rectifiers with and without capacitors.
3. Demonstrate the characteristics of different transistor Configurations
4. Design of Biasing Circuits for BJT and FET Amplifiers
5. To develop simulation skills using tools to model and analyze diode and rectifier circuits.
Course Outcomes : On completion of this course, the student will be able to :
1. Demonstrate the characteristics of Semiconductor diodes
2. Realize the filters and rectifiers with and without capacitors.
3. Demonstrate the characteristics of different transistor Configurations
4. Design of Biasing Circuits for BJT and FET Amplifiers
5. Design and simulate diode-based circuits and rectifier systems using electronic circuit simulation tools.

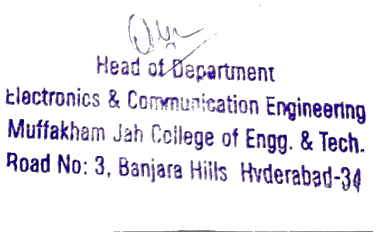
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	3	2	3	2	2	-	-	-	-	-	-	-
CO2	3	2	3	2	1	-	-	-	-	-	-	-
CO3	3	2	3	2	2	-	-	-	-	-	-	-
CO4	3	3	3	2	2	-	-	-	-	-	-	-
CO5	2	3	2	3	3	-	-	-	-	-	-	-

Correlation rating: Low / Medium / High: 1 / 2 / 3 respectively.

List of Experiments
1. V-I Characteristics of Silicon and Germanium diodes and measurement of static and dynamic resistances
2. Zener diode characteristics and its application as voltage regulator
3. Design, realization and performance evaluation of half wave rectifiers without filters and with LC & pi section filters
4. Design, realization and performance evaluation of full wave rectifiers without filters and with LC & pi section filters
5. Plotting the characteristics of BJT in Common Base configuration and measurement of h-parameters
6. Plotting the characteristics of BJT in Common Emitter configuration and measurement of h-parameters
7. Plotting the characteristics of JFET in CS configuration and measurement of Trans-conductance and Drain resistance
8. BJT biasing circuits , Fixed Biasing, Collector to base bias and Self bias
9. Design and Simulation of the V-I characteristics of a PN junction diode and Zener diode.
10. Design and Simulation of Half-wave and Full-wave rectifier circuits with and without filters

Suggested Text Books:
1. Paul B. Zbar, Albert P. Malvino, Michael A. Miller, *Basic Electronics,A Text - Lab Manual*, 7thed., McGraw Hill Education, 2001.
2. David Bell, *Fundamentals of electronic devices and circuits Lab Manual,* 5th ed., Oxford university press, 2009.
3. R.C. Jaeger & T. N. Blalock, *Micro Electronic circuit design,* 4th ed., Mc Graw Hill Higher Education, 2011.





Course Code	Course Title						Core/PE/OE
PC 352EC	**ELECTRONIC WORKSHOP LAB**						**Core**
	Contact Hours per Week				**CIE**	**SEE**	**Credits**
Prerequisite	**L**	**T**	**D**	**P**			
BS202PH				**2**	**25**	**50**	**1**

Course Objectives : The course is taught with the objectives of enabling the student to:

1. To identify and understand the function of basic electronic components and measurement tools.
2. To develop hands-on skills in soldering and PCB design.
3. To verify fundamental theorems of electrical networks using hardware.
4. To verify key network theorems both through hardware implementation and SPICE simulation.
5. To analyze and simulate electrical circuits to measure and interpret network parameters and resonance characteristics.

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

1. Identify and classify active, passive components, and use basic electrical measurement tools.
2. Demonstrate basic soldering, de-soldering skills, and design simple PCB layouts.
3. Apply and verify fundamental electrical theorems.
4. Measure and analyze two-port parameters, image impedance, and characteristic impedance using appropriate test setups..
5. Simulate and verify resonance conditions in electrical circuits using SPICE and analyze their frequency response.

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	3	2	2	1	1	-	-	-	-	-	-	1
CO2	2	3	2	-	2	-	-	-	-	-	-	2
CO3	3	2	3	2	1	-	-	-	-	-	-	1
CO4	3	2	3	2	2	-	-	-	-	-	-	2
CO5	2	2	2	1	2	-	-	-	-	-	-	1

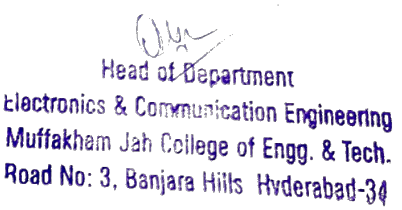
Correlation rating: Low / Medium / High: 1 / 2 / 3 respectively.

List of Expriments

1. Study of all types of discrete Active & passive devices, display devices, integrated components, electro mechanical components (switches, sockets, connectors etc.,) electromagnetic components (relays). Study and use of different meters (volt/ammeter, AVO/Multi meter) for the measurement of electrical parameters. Measurement of RLC components using LCR Meter.
2. Soldering and Desoldering.
3. PCB design and circuit assembling
4. Study of CRO and its applications.
5. Design and Verification of Superposition and Tellegan's theorem
6. Design and Verification of Thevenin's and Maximum Power Transfer Theorem.
7. Measurement of two-port network parameters.
8. Measurement of Image impedance and Characteristics impedance.
9. Design and Verification of SPICE simulationof Superposition and Tellegan's theorem.
10. Design and Verification of SPICE simulationof Thevenin's and Maximum Power Transfer.

11.Design and Verification of SPICE simulation of Series Resonance.
12.Design, Verification of SPICE simulation of Parallel Resonance.

Suggested Text Books:
1. David A. Bell,*Electronic Devices and Circuits Lab Manual*, 5th Edition, Oxford University Press, 2014.
2. Zbar, Malvino, andMiller, *Basic Electronics: A Text-Lab Manual*, McGraw Hill Education, 1993.
3. A. Sudhakar and Shyammohan S. Palli,*Circuits and Networks: Analysis and Synthesis*, 5th Edition, McGraw Hill Education, 2015.



Course Code	Course Title						Core/PE/OE
PC 353EC	**LOGIC DESIGN LAB**						**Core**
	Contact Hours per Week				**CIE**	**SEE**	**Credits**
Prerequisite	**L**	**T**	**D**	**P**			
ES301EE				**2**	**25**	**50**	**1**

Course Objectives: The course is taught with the objectives of enabling the student to:

1. To understand and verify the functionality of basic logic gates and standard combinational logic circuits.
2. To design and realize combinational circuits using universal gates, multiplexers, and decoders.
3. To verify and analyze the operation of various flip-flops and their conversions.
4. To design and simulate sequential circuits including counters and shift registers using simulation tools.
5. To introduce students to the basics of PCB design using CAD tools for digital/analog circuits.

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

1. Verify the truth tables of basic logic gates and implement simple code converters using logic gates.
2. Design and implement half and full adders/subtractors using universal gates, MUX, and decoders.
3. Analyze the working of different flip-flops and perform flip-flop conversions to implement required memory elements.
4. Simulate combinational and sequential logic circuits using digital design tools to validate logical functionality
5. Create and simulate PCB layouts for simple analog/digital circuits using PCB design tools.

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	3	2	2	2	3	-	-	-	-	-	-	1
CO2	3	3	3	2	3	-	-	-	-	-	-	2
CO3	3	3	2	3	3	-	-	-	-	-	-	2
CO4	2	3	2	3	3	-	-	-	-	-	-	1
CO5	3	2	3	2	3	-	-	-	-	-	-	1

Correlation rating: Low / Medium / High: 1 / 2 / 3 respectively.

List of Experiments:

1. Verification of truth tables of Logic gates and realization of Binary to Gray and Gray to Binary code converters.
2. Realization of Half adder/subtractor using universal logic gates.
3. Realization of Full adder/subtractor using universal logic gates.
4. Realization of Full adder/Sub using MUX and Decoder
5. Verification of truth tables of Flip Flops and Flip flop conversions form one form to the other.
6. Design and simulation of basic logic gates and verification of their truth tables.
7. Design and simulation of Combinational circuits such as adders, subtractors, multiplexers, and demultiplexers

8. Design and Simulation of Sequential Circuits such as JK and D Flip Flops.
9. Design and Simulation of Sequential Circuits such as Counters and Shift Registers
10. Design a simple PCB layout for a given analog/digital circuit using CAD tools.

Note: The Preferred Simulation Tools are LTspice – for analog circuit simulation, Multisim /PSpice – for analog and mixed-signal circuit simulation, Logisim – for basic digital logic circuits**.**

Suggested Text Books:
1. David A. Bell, Lab Manual for Electronic Devices and Circuits, 4th Edition, PHI.
2. Zbar, Malvino, Miller, Basic Electronics: A Text Lab Manual.
3. M. H. Rashid, SPICE for Circuits and Electronics Using PSpice, Pearson.
4. A. Sudhakar and Shyammohan S. Palli, Circuits and Networks: Analysis and Synthesis, McGraw Hill Education.

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R24

SCHEME OF INSTRUCTION & EXAMINATION
B.E. IV- Semester
(ELECTRONICS AND COMMUNICATION ENGINEERING)

S. No	Course Code	Course Title	Scheme of Instruction				Scheme of Examination			Credits
			L	T	P/D	Contact Hrs/Wk	CIE	SEE	Duration in Hrs	
Theory Course										
1	PC 401 EC	Analog Electronic Circuits	3	1	-	4	30	70	3	4
2	PC 402 EC	Computer Organization and Architecture	3	-	-	3	30	70	3	3
3	PC 403 EC	Electromagnetic Theory and Transmission Lines	3	-	-	3	30	70	3	3
4	PC 404 EC	Pulse and Linear Integrated Circuits	3	1	-	4	30	70	3	4
5	PC 405 EC	Digital Signal Processing	3	-	-	3	30	70	3	3
6	PC 406EC	Electronic Measurements and Instrumentation	3	-	-	3	30	70	3	3
Practical / Laboratory Course										
7	PC 451EC	Analog Electronic Circuits Lab	-	-	2	2	25	50	3	1
8	PC 452EC	Pulse and Linear Integrated Circuits Lab	-	-	2	2	25	50	3	1
9	PC 453EC	Digital Signal Processing Lab	-	-	2	2	25	50	3	1
Total			**18**	**2**	**6**	**26**	**255**	**570**	**27**	**23**

PC: Professional Course **MC:** Mandatory Course **L:**Lecture **T:**Tutorial
P: Practical **D:**Drawing **G**: Grade(E/VG/G/S/U)
CIE: Continuous Internal Evaluation **SEE**: Semester End Examination (Univ. Exam)

Note:

1. Each contact hour is a Clock Hour
2. The duration of the practical class is two clock hours, however it can be extended wherever necessary, to enable the student to complete the experiment

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Course Code	Course Title						Core/PE/OE
PC401EC	**Analog Electronic Circuits**						**Core**
	Contact Hours per Week				**CIE**	**SEE**	**Credits**
Prerequisite	**L**	**T**	**D**	**P**			
PC304EC	**3**	**-**	**-**	**-**	**30**	**70**	**4**

Course Objectives : The course is taught with the objectives of enabling the student to:

1. Analyze frequency response of Amplifiers in different frequency ranges.
2. Familiarize with concept and effect of negative feedback
3. Study positive feedback and Design different types of oscillators
4. Design Power Amplifiers and calculate their efficiencies
5. Familiarize with concept of tuned amplifiers

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

1. Design and analyzefrequencyresponse of differentamplifiers using BJT and FET.
2. Identify the type of negative feedback, analyze and design of negative feedback amplifiers
3. Design Audio Frequency and Radio Frequency oscillators.
4. Distinguish between the classes of Power Amplifiers and their design considerations.
5. Compare the performance of single and double tuned amplifiers

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	1	1	-	-	-	-	-	-	-	1
CO2	3	2	3	2	-	-	-	-	-	-	-	2
CO3	3	2	3	2	1	-	-	-	-	-	-	2
CO4	3	2	3	3	1	-	-	-	-	-	-	2
CO5	3	2	3	2	-	-	-	-	-	-	-	2

Correlation rating: Low / Medium / High: 1 / 2 / 3 respectively.

UNIT I

Small signal amplifiers: Classification of amplifiers. Mid-frequency, Low-frequency and high frequency analysis of single and Multistage RC coupled amplifier with BJT & FET. Analysis of Transformer coupled amplifier at mid-frequency, low-frequency and high frequency.

UNIT II

Feedback Amplifiers: The feedback concept, General characteristics of negative feedback amplifier, Effect of negative feedback on input and output impedances, voltage and current, series and shunt feedbacks, Stability considerations, Local Versus global feedback.

UNIT III

Oscillators: Positive feedback and conditions for sinusoidal oscillations, RC oscillators, LC oscillators, Crystal oscillator, Amplitude and frequency stability of oscillator.
Regulators: Transistorized series and shunt regulators**.**

UNIT IV

Large Signal Amplifiers: BJT as large signal audio amplifiers, Classes of operation, Harmonic distortion, power dissipation, efficiency calculations. Design considerations of transformer coupled and transform less push- pull audio power amplifiers under Class-A, Class-B, Class-D and Class-AB operations.

UNIT V

R.F. Voltage Amplifiers: General considerations, Analysis and design of single tuned and double tuned amplifiers with BJT, selectivity, gain and bandwidth. Comparison of multistage, single tuned amplifiers and double tuned amplifiers. The problem of stability in RF amplifiers, neutralization and uni-laterisation, introduction to staggered tuned amplifier**.**

Suggested Text Books:
1. Jacob Millman, Christos Halkias, Chetan Parikh, *Integrated Electronics*, 2nded.,McGraw Hill Education (India) Private Limited, 2011.
2. S Salivahanan, N Kumar,and A Vallavaraj, *Electronic Devices and Circuits*,McGraw Hill,3rd edition,2010.
3. Donald A.Neamen, *Electronic Circuits: Analysis and Design*, 3rd edition, McGraw Hill,2006.
Reference Text Books:
1. Robert Boylestad and Louis Nashelsky, *Electronic Devices and Circuit Theory*, 11th ed., Pearson India Publications, 2015.
2. J.B. Gupta. *Electronic Devices and Circuits*. Publisher, S.K. Kataria & Sons. Edition, 6th 2016.
3. Allen Mottershead, *Electronic Devices and Circuits: An introduction*, PHI Learning Private Limited,2011.
4. Sedra smith, Microelectronics circuits, oxford university press, 6th edition, 2009

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Course Code	Course Title						Core/PE/OE
PC 402 EC	**COMPUTER ORGANIZATION AND ARCHITECTURE**						**Core**
	Contact Hours per Week				**CIE**	**SEE**	**Credits**
Prerequisite	**L**	**T**	**D**	**P**			
PC302EC	**3**			**3**	**30**	**70**	**3**

Course Objectives : The course is taught with the objectives of enabling the student to:

1. Understand various number representations and perform binary, fixed-point, and floating-point arithmetic operations.
2. Learn the internal hardware organization of computers including control unit design using hardwired and microprogrammed techniques.
3. Analyze CPU design concepts including instruction formats, pipelining, and performance metrics such as CPI and Amdahl's Law.
4. Examine memory hierarchy, virtual memory, cache design, and modern memory technologies relevant to system performance.
5. Explore input-output interfacing techniques, communication protocols, and embedded system integration including SoC and modern ISAs like RISC-V and ARM.

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

1. Perform binary, fixed-point, and floating-point arithmetic relevant to computer systems and AI applications.
2. Design and describe the datapath and control units of a CPU using register-transfer level (RTL) principles.
3. Explain the instruction cycle and analyze the effect of control sequencing, pipelining, and interrupt mechanisms.
4. Analyze and evaluate memory systems, cache performance, and virtual memory operations in computing systems.
5. Design and assess I/O subsystems including DMA, bus communication, and interface protocols for peripheral devices.

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	3	2	-	-	-	-	-	-	-	-	-	-
CO2	-	3	2	-	-	-	-	-	-	-	-	-
CO3	3	-	-	2	-	1	-	-	-	-	-	-
CO4	2	-	-	-	3	-	-	2	-	-	-	-
CO5	-	-	3	-	-	-	2	-	1	-	-	-

Correlation rating: Low / Medium / High: 1 / 2 / 3 respectively.

UNIT I

Data Representation and Arithmetic Operations- Number systems and binary codes, Fixed and floating-point representation (IEEE-754).Binary arithmetic: addition, subtraction, Booth's multiplication, restoring and non-restoring division.Low-precision formats (INT8, bfloat16) and relevance to AI applications.

UNIT II

Computer Organization and Control Unit- Instruction codes, stored program concept, computer registers, common bus system. Instruction cycle: fetch, decode, execute, and interrupt. Control unit design: hardwired and microprogrammed control, RTL basics. Microinstruction sequencing and control word format.

UNIT III
CPU Architecture, Pipelining, and Modern ISAs- Register and stack-based organization, instruction formats, addressing modes.Datapath and control path design. RISC vs CISC architecture, Instruction pipelining, hazards. Performance metrics: CPI, IPC, Amdahl's Law, Introduction to RISC-V and ARM architectures.
UNIT IV
Input-Output and Communication - I/O interfacing: memory-mapped vs I/O-mapped I/O. Asynchronous data transfer: strobe and handshaking. Data transfer modes: programmed I/O, interrupt-driven I/O, and DMA, I/O protocols and buses: AMBA/AXI overview, Peripheral communication and CPU-IOP interactions.
UNIT V
Memory Systems and Emerging Technologies - Memory hierarchy: primary, secondary, cache, associative memory, Cache organization: mapping techniques, replacement policies. Virtual memory: paging, address translation, TLB. Modern memory technologies: DDR5, HBM, NVRAM, Memory design for embedded and AI systems.

Suggested Text Books:
1. David A. Patterson & John L. Hennessy, Computer Organization and Design: RISC-V Edition**,** Morgan Kaufmann. – 2nd Edition**,** 2017.
2. William Stallings, Computer Organization and Architecture: Designing for Performance, Pearson Education**.**8th Edition**,**2009.
3. Andrew S. Tanenbaum & Todd Austin, Structured Computer Organization, Pearson. Pearson, 6th Edition**, 2021.**
Reference Text Books:
1. John P. Hayes, Computer Architecture and Organization, McGraw Hil,3rd Edition**,**1998.
2. Carl Hamacher, Zvonko Vranesic, Safwat Zaky, Computer Organization, McGraw Hill.6th Edition**,** 20110
3. Steve Furber**,** ARM System-on-Chip Architecture, Pearson Education, 2nd Edition**,** 2000.

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Course Code	Course Title						Core/PE/OE
PC 403 EC	**ELECTROMAGNETIC THEORY AND TRANSMISSION LINES**						**CORE**
	Contact Hours per Week				**CIE**	**SEE**	**Credits**
Prerequisite	**L**	**T**	**D**	**P**			
BS201MT	**3**	**-**	**-**	**-**	**30**	**70**	**3**

Course Objectives : The course is taught with the objectives of enabling the student to:

1. Analyze fundamental concepts of vector analysis, electrostatics and magneto statics law and their applications to describe
2.
3. e the relationship between Electromagnetic Theory and circuittheory
4. Formulate the basic laws of static electricity and magnetism and extend them to time varying fields to define the Maxwell's equations in differential and integralform.
5. Derive the wave equations for conducting and di-electric mediums to analyze the wave propagation characteristics of Uniform Plane Waves (UPW) in normal and oblique incidences
6. Analyze fundamental concepts of Transmission lines and to formulate the basic relationship between distortion less transmission lines &applications.
7. Understand the concepts of RF Lines, their characteristics and analyze the applications of Smith Chart.

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

1. Understand the different coordinate systems, vector calculus, coulombs law and gauss law for finding electric fields due to different charge distributions.
2. Learn basic magneto-statics concepts and laws such as Biot-Savart law and Amperes law, their application in finding magnetic field intensity.
3. Distinguish between the static and time-varying fields, establish the corresponding sets of Maxwell's Equations and Boundary Conditions, and use them for solving engineering problems.
4. Determine the Transmission Line parameters to characterize the distortions and estimate the characteristics for differentlines.
5. Study the Smith Chart profile and stub matching features, and gain ability to practically use the same for solving practicalproblems

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	3	2	-	2	-	-	-	-	-	1	-	1
CO2	3	2	2	2	-	-	-	-	-	1	-	1
CO3	3	2	-	2	-	-	-	-	-	1	-	1
CO4	3	2	-	3	-	-	-	-	-	1	-	1
CO5	3	2	-	-	-	-	-	-	-	1	-	1

Correlation rating: Low / Medium / High: 1 / 2 / 3 respectively.

UNIT I : Electrostatics:

Review of coordinate systems. Coulomb's Law, Electric Field Intensity, Electric field due to Line Charge , Sheet Charge and Volume Charge Distribution, Electric flux, Flux density. Gauss's Law and its applications. Energy and Potential, Potential of a point

charge, System of Charges, Potential gradient.
UNIT II : Magneto-statics and Maxwell's Equations
Steady magnetic field -Biot-Savart's law, Ampere's law. Stoke's theorem, Magnetic flux and magnetic flux density. Scalar and vector magnetic potentials. Electric and Magnetic fields boundary conditions. Maxwell's equations for static and time varyingfields.
UNIT III : Wave Equations and Reflection
Uniform plane waves in free space and in conducting medium, Wave Polarization-Linear, Circular and Elliptical Polarization, Poynting theorem. Reflection of Uniform Plane Wave at Normal incidence and oblique incidence on dielectrics medium, Reflection Coefficient, Transmission Coefficient.
UNIT IV: Transmission Lines at Low Frequency
Types of Transmission Lines-Two wire lines and its circuit representation, Primary and secondary constants. Transmission Line equations, Infinite line, characteristic impedance of Open and short circuit lines and their significance. Distortion less transmission line, Concept of loading of a transmission line, Campbell's formula.
UNIT V: Transmission Lines at High Frequency
Impedance at any point on the transmission line- Input impedance. RF and UHF lines, transmission lines as circuit elements. Properties of λ/2, λ/4 and λ/8 Lines. Reflection and VSWR. Matching: Stub matching. Smith chart and its applications.

Suggested Text Books:
1. Matthew N.O. Sadiku, *Principles of Electro-magnetic*, 6th edition, Oxford University Press,2016
2. William H. Hayt Jr. and John A. Buck, *Engineering Electromagnetics*, 7th edition, Tata McGraw Hill,2006.
3. John D. Ryder, *Networks Lines and Fields*, 2nd edition, Pearson,2015.
Reference Text Books:
1. John D. Ryder, *Networks Lines and Fields*, 2nd edition, Pearson,2015.
2. E.C. Jordan and K.G. Balmain, *Electromagnetic Waves and Radiating Systems*, 2nd edition, Pearson,2015
3. K.D. Prasad, *Antennas and Wave Propagation*, KhannaPublications.

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Course Code	Course Title						Core/PE/OE
PC 404 EC	**PULSE AND LINEAR INTEGRATED CIRCUITS**						**Core**
	Contact Hours per Week				**CIE**	**SEE**	**Credits**
Prerequisite	**L**	**T**	**D**	**P**			
PC 304 EC	**3**	**1**	**-**	**-**	**30**	**70**	**4**

Course Objectives : The course is taught with the objectives of enabling the student to:

1. Discuss the behavior and applications of linear and non-linear wave shaping circuits.
2. Describe the design and operation of multivibrators and time base generator circuits
3. Analyze the characteristics of differential amplifiers and operational amplifiers
4. Implement OP-AMP-based circuits for amplification, filtering, and waveform generation.
5. Explain the functionality of 555 timer, PLL, and their applications in data converters and voltage regulation.

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

1. Analyze the response of linear wave shaping circuits to various input signals
2. Design multivibrator and sweep circuits using transistors
3. Analyze DC and AC characteristics of differential amplifier configurations using BJTs and operational amplifiers.
4. Implement various linear and non-linear applications of operational amplifiers
5. Demonstrate the various applications of 555 Timer and analyze the operation of the D/A andA/D converters.

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	1	2	1	1	1	-	-	-	-	1
CO2	3	3	3	1	1	1	1	-	-	-	-	1
CO3	3	3	1	3	1	1	1	-	-	-	-	1
CO4	3	3	3	1	3	1	1	-	-	-	-	1
CO5	3	3	2	3	3	1	1	-	-	-	-	1

Correlation rating: Low / Medium / High: 1 / 2 / 3 respectively.

UNIT I

LinearWaveShaping: Highpass,lowpassRCcircuits,theirresponseforsinusoidal,step, pulse, square and ramp inputs. RC network as differentiator and integrator, attenuators, its applications in CRO probe.

Non-Linear Wave Shaping: Diode clippers, Transistor clippers, clipping at two independentlevels,Comparators,applicationsofvoltagecomparators.Clampingoperation,clampingcircuit takingSourceandDiode resistancesintoaccount,Clampingcircuittheorem.

UNIT II

Multivibrators: AnalysisandDesignofBistable,Monostable,AstableMultivibratorsand Schmitt trigger using transistors.

TimeBaseGenerators: Generalfeaturesofatimebasesignal,methodsofgeneratingvoltage timebase waveform.

UNIT III

Differentialamplifiers:Classification,DCandACAnalysisofSingle/DualinputBalanced and Unbalanced output configurations using BJTs. Level Translator.

OperationalAmplifier:OPAMPBlockdiagram,idealOp-ampcharacteristics,Op-ampandits features, Op-amp parameters and Measurements, Input and Output Offset voltages and currents, Slew rate, CMRR, PSRR. Frequency response and Compensation Techniques
UNIT IV
OP-AMP Applications: Inverting and Non-Inverting Amplifiers, Integrator and differentiator, summing amplifier, precision rectifier, Schmitt trigger and its applications. Active filters: Lowpass, high pass, band pass and band stop. Log and Anti Log Amplifiers
UNIT V
555Timer:FunctionalDiagram,Monostable,AstableandSchmittTriggerApplications.Fixed and variable voltage regulators, PLL and its Applications. **DataConverters**:Digital-to-analogconverters(DAC):Weightedresistor,invertedR-2R ladder,Analog-to-digitalconverters(ADC):dualslope,successiveapproximation,flash, Specifications

Suggested Text Books:
1. Anand Kumar A, "Pulse and Digital Circuits", Prentice-Hall of India private Limited, NewDelhi, 2007.
2. D.Roy Chowdhury, ShailB.Jain, "Linear Integrated Circuits", 4/e, New Age International (P) Ltd., 2008.
3. David A. Bell, **"**Pulse Circuits and Systems**"**, Oxford University Press, New Delhi, 2008.
4. Venkatramani K. and Bhaskaran M., **"**Pulse and Digital Circuits**"**, McGraw-Hill Education (India), New Delhi, 2010
5. Salivahanan S. and Arivazhagan S., **"**Linear Integrated Circuits**"**, McGraw-Hill Education (India), New Delhi, 2018.
Reference Text Books:
1. J. Millman and H. Taub, "Pulse, Digital and Switching Waveforms" - McGraw-Hill, 1991.
2. DavidA.Bell, "*SolidStatePulsecircuits"*-PHI,4/e,2002
3. Ramakanth A. Gayakwad, "Op-Amps and Linear Integrated Circuits", Pearson, 4/e, 2018.
4. K. Lal Kishore, **"**Operational Amplifiers and Linear Integrated Circuits**"**, Pearson Education, New Delhi, 2012.
5. Schilling Donald L. and Belove Charles, **"**Electronic Circuits: Discrete and Integrated**"**, McGraw-Hill Education, New York, 2002.

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Course Code	Course Title						Core/PE/OE
PC 405 EC	**DIGITAL SIGNAL PROCESSING**						**Core**
	Contact Hours per Week				**CIE**	**SEE**	**Credits**
Prerequisite	**L**	**T**	**D**	**P**			
PC 301 EC	**3**	**-**	**-**	**-**	**30**	**70**	**3**

Course Objectives : The course is taught with the objectives of enabling the student to:

1. To describe the necessity and efficiency of digital signal processing.
2. To analyze signals in the frequency domain using the principles and applications of Fast Fourier Transform (FFT) for improved computational efficiency.
3. To discuss various design methods of FIR & IIR filters.
4. To describe the concepts of Multirate signal processing
5. Identify important features of TMS320C67XX DSP processors.

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

1. Apply the knowledge of FFT Algorithms for computation of DFT.
2. Design of FIR filters using various methods.
3. Design of IIR filters using various methods.
4. Apply decimation and interpolation concepts for the design of sampling rate converters.
5. Understand TMS320C67XX DSP processors for the design of digital filters.

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	3	2	2	-	-	-	-	-	-	-	-	3
CO2	2	2	2	3	-	-	-	-	-	-	-	3
CO3	2	3	1	-	-	-	-	-	-	-	-	3
CO4	2	2	1	-	-	-	-	-	-	-	-	3
CO5	3	3	1	-	-	-	-	-	-	-	-	3

UNIT I

Discrete Fourier Transform and Fast Fourier Transform: Discrete Fourier Transform (DFT), Computation of DFT- Linear and Circular Convolution, FFT algorithms: Radix-2 Decimation in Time and Decimation in Frequency algorithms, In place computation, Bit reversal.

UNIT II

Finite Impulse-Response Filters (FIR): Linear phase filters, Windowing techniques for design of Linear phase FIR Filters-Rectangular, triangular, Bartlett, Hamming, Hanning, Kaiser windows, Realization of filters, Finite word length effects.

UNIT III

Infinite Impulse-Response Filters (IIR): Introduction to filters, comparison between practical and theoretical filters, Butterworth and Chebyshev approximation, IIR digital filter design Techniques, Impulse Invariant technique, Bilinear transformation technique, Digital Butterworth & Chebyshev filters, Implementation, Digital filters structures, Comparison between FIR and IIR.

UNIT IV

Multirate Digital Signal Processing: Introduction, Decimation by factor D and interpolation by a factor I, Sampling Rate conversion by a Rational factor I/D. Implementation of Sampling Rate Conversion: Multistage implementation of sampling rate conversion, Application of

Multirate Signal Processing.
UNIT V
Introduction toDSPProcessors: Difference between DSP and other microprocessors architectures Importance of DSP Processors- General purpose DSP processors TMS320C67XX processor, architecture, registers, pipelining, addressing modes and Introduction to instruction set.

Suggested Text Books:
1. Digital Signal Processing: Principles, Algorithms, and Applications by John G. Proakis and Dimitris G. Manolakis, Pearson Education / PHI, 2007.
2. Discrete-Time Signal Processing by Alan V. Oppenheim and Ronald W. Schafer, PHI.
3. Digital Signal Processing by S. Salivahanan, A. Vallavaraj, and C. Gnanapriya, TMH, 2009.
Reference Text Books:
1. Ashok Ambardar, "Digital Signal Processing : A Modern Introduction," Cengage Learning, 2009.
2. Alan V. Oppenheim & Ronald W. Schafer, "Digital Signal Processing," PHI, 2nd edition, 2014.
3. Li Tan, "Digital Signal Processing: Fundamentals and Applications," Elsevier,2012.
4. B.Venkataramani& M. Bhaskar, "Digital Signal Processor Architecture, Programming and Application," TMH, 2e 2013.

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Course Code	Course Title						Core/Elective
PC 406 EC	**ELECTRONIC MEASUREMENTS AND INSTRUMENTATION**						**Core**
Prerequisite	**Contact Hours per Week**				**CIE**	**SEE**	**Credits**
	L	**T**	**D**	**P**			
BS202PH	**3**	**-**	**-**	**-**	**30**	**70**	**3**

Course Objectives : The course is taught with the objectives of enabling the student to:
1. Understand the different standards of measurements.
2. Study different types of transducers.
3. List various types of physical quantities measurements.
4. Learn the design of measuring Instruments.
5. Study various types of bio-medical instruments
Course Outcomes : On completion of this course, the student will be able to :
1. Describe characteristics of electronic measurements and state different Standards of measurements.
2. Identify and explain different types of Transducers.
3. Interpret types of transducers for Sound, Temperature.
4. Design and analyze the digital voltmeters, spectrum analyzers and Prioritize the instruments.
5. Identify and classify types of Biomedical instruments.

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	2	1	-	-	-	-	-	-	-	-	-	-
CO2	2	-	1	-	-	-	-	-	-	-	-	-
CO3	1	1	1	-	-	-	-	-	-	-	-	-
CO4	1	1	2	-	-	-	-	-	-	-	-	-
CO5	1	-	1	-	-	1	-	-	-	-	-	-

Correlation rating: Low / Medium / High: 1 / 2 / 3 respectively.

UNIT I
Electronic Measurement fundamentals: Accuracy, Precision, Resolution and Sensitivity. Errors and their types. Standards of measurement, classification of standards, IEEE standards.
UNIT II
Transducers: Classification, factors for selection of a transducer, transducers for measurement of velocity, Pressure and Humidity. Passive electrical transducers- Strain gauges and strain measurement, LVDT and displacement measurement, capacitive transducer and thickness measurement. Active electrical transducers: Piezo electric, photo conductive, photo voltaic and photo emissive transducers.
UNIT III
Electronic Sensors: Characteristics of sound, pressure, power and loudness measurement. Microphones and their types. Temperature measurement, resistance wire thermometers, semiconductor thermometers and thermo-couples. Optical and Magnetic sensors, pH sensor.

UNIT IV
Measuring instruments: Block diagram, specification and design considerations of different types of DVMs. Spectrum analyzers. The IEEE488 or GPIB Interface and protocol. Delayed time base oscilloscope and Digital storage oscilloscope. Introduction to virtual instrumentation, SCADA. Data acquisition system block diagram
UNIT V
Biomedical Instrumentation: Human physiological systems and related concepts. Bio-potential electrodes Bio-potential recorders – ECG, EEG, EMG, X- ray machines and CT scanners, magnetic resonance and imaging systems, Ultrasonic Imaging systems.

Suggested Text Books:
1. Albert D. Helfric, and William D. Cooper, "Modern Electronic Instrumentation and Measurement Techniques", PHI, 2010.
2. H S Kalsi, "Electronic Instrumentation", 3/e, TMH, 2011
Reference Text Books:
1. Robert A Witte, "Electronic Test Instruments: Analog and Digital Measurements", 2/e, 2002
2. Nakra B.C, and Chaudhry K.K., "Instrumentation, Measurement and Analysis", TMH, 2004
3. Khandpur. R.S., "Handbook of Bio-Medical Instrumentation", TMH, 2003

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Course Code	**Course Title**						**Core/PE/OE**
PC 451 EC	**ANALOG ELECTRONIC CIRCUIT LAB**						**Core**
	Contact Hours per Week				**CIE**	**SEE**	**Credits**
Prerequisite	**L**	**T**	**D**	**P**			
PC 401 EC	**-**	-	-	2	**25**	**50**	**1**

Course Objectives : The course is taught with the objectives of enabling the student to:

1. Analyze and Verify frequency response of BJT and FET amplifiers
2. Design different negative feedback amplifiers circuits
2. Design AF and RF oscillator circuits
4. Design power amplifiers
5. Demonstrate various circuits using PSPICE and verifying functionality

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

1. Design, construct, and evaluate RC-coupled amplifiers using BJTs.
2. Understand and implement different types of feedback topologies in amplifier circuits
3. Design and construct sinusoidal oscillator circuits
4. Analyze and design various amplifier circuits tuned, and power amplifiers using BJT and FET,
5. Apply circuit simulation tools (like SPICE) to verify and analyze the behavior of amplifier

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	3	2	3	2	2	-	-	-	-	-	-	-
CO2	3	2	3	2	1	-	-	-	-	-	-	-
CO3	3	2	3	2	2	-	-	-	-	-	-	-
CO4	3	3	3	2	2	-	-	-	-	-	-	-
CO5	2	3	2	3	3	-	-	-	-	-	-	-

Correlation rating: Low / Medium / High: 1 / 2 / 3 respectively.

PART A

1. Design and plot the frequency response of a single-stage RC coupled amplifier using a BJT. Analyze the gain and bandwidth of the amplifier.
2. Design and plot the frequency response of a single-stage RC coupled amplifier using a FET. Compare performance with BJT-based amplifiers.
3. Design and analyze a voltage series negative feedback amplifier. Measure the gain and observe the effect of feedback on bandwidth and distortion.
4. Design and analyze a current shunt negative feedback amplifier. Determine the changes in input/output impedance due to feedback.
5. Design and analyze a voltage shunt negative feedback amplifier. Observe and explain the changes in amplifier gain due to feedback.
6. Design, construct, and study a current series negative feedback amplifier. Measure the impact of feedback on the amplifier's stability and frequency response.
7. Simulate and analyzeBJT amplifier circuits using SPICE. Plot frequency responses and compare simulation results with theoretical calculations

PART B
1. Design and analyze Hartley and Colpitts oscillators using BJTs. Calculate and compare the theoretical and practical oscillation frequencies.
2. DesignRC phase shift oscillator using a BJT. Verify the frequency of oscillation and waveform .
3. Design and construct a Class-A power amplifier. Plot the input-output characteristics and evaluate power efficiency and distortion levels
4. Design and plot the frequency response of single-tuned amplifiers. Study selectivity and bandwidth characteristics.
5. Design and implement a transistor-based voltage regulator. Test its line and load regulation capabilities under different load conditions.
6. Simulate and analyze FET amplifier circuits using SPICE. Plot frequency responses and compare simulation results with theoretical calculations
7. Design and plot the frequency response of single-tuned amplifiers. Study selectivity and bandwidth characteristics

Note :Students are required to perform minimum 10 experiments, 5 experiments from Part A and 5 experiments Part B.

Suggested Text Books:
1. Paul B. Zbar, AlbertP.Malvino, Michael Miller, *Basic Electronics, A Text- Lab Manual*,7th ed., McGraw Hill Education (India) Private Limited,2001
2. David Bell A, *Laboratory Manual for Electrical Circuits*, PHI-New Delhi, 2009
3. Hayt W H Kemmerly J.E and Durbin SM, *Engineering Circuit Analysis*, 8th ed., McGraw Hill Education (India) Private Limited, 2013.

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Course Code	**Course Title**						**Core/PE/OE**
PC 452 EC	**PULSE AND LINEAR INTEGRATED CIRCUITS LAB**						**Core**
	Contact Hours per Week				**CIE**	**SEE**	**Credits**
Prerequisite	**L**	**T**	**D**	**P**			
PC 404 EC	**-**	**-**	**-**	**2**	**25**	**50**	**1**

Course Objectives : The course is taught with the objectives of enabling the student to:

1. Analyze low-pass and high-pass RC circuits, clipping, and clamping circuits for waveform shaping and filtering.
2. Design and construct transistor-based bistable, monostable, and astable multivibrators.
3. Demonstrate the working of OPAMP circuits like amplifiers, followers, integrators, differentiators, and filters.
4. Develop and test NE555 timer and OPAMP-based multivibrator circuits for timing applications.
5. Apply waveform generation principles to build and analyze Schmitt triggers, Miller sweep, and UJT relaxation oscillators.

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

1. Analyze RC circuits, clippers, and clampers for their waveform shaping characteristics.
2. Design and evaluate transistor-based multivibrator circuits.
3. Implement OPAMP-based circuits for signal conditioning and processing.
4. Develop timer-based multivibrators using NE555 IC and OPAMPs.
5. Construct waveform generators like Schmitt triggers, sweep circuits, and UJT oscillators.

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	3	3	2	2	2	1	-	-	1	3	1	-
CO2	3	3	3	2	2	1	-	-	1	3	1	-
CO3	3	2	3	2	3	1	-	-	1	3	1	-
CO4	3	3	3	2	3	1	-	-	1	3	1	-
CO5	3	3	3	2	2	1	-	-	1	3	1	-

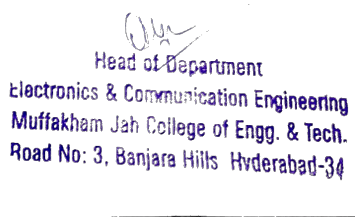
Correlation rating: Low / Medium / High: 1 / 2 / 3 respectively.

PART A
1. Analyze the response of low-pass and high-pass RC circuits for various time constants
2. Verify the characteristics clipping circuits
3. Verify the characteristics Clamping Circuits
4. Study the characteristics of a transistor used as a switch
5. Design and analyze the characteristics of a collector-coupled bistable multivibrator using transistors
6. Design and analyze the characteristics of a collector-coupled Monostable Multivibrator using transistors
7. Design and analyze the characteristics of a collector-coupled Collector Coupled

Astable Multivibrator using transistors
PART B
1. Design and verify the characteristics of inverting, non-inverting and voltage follower using Op-Amp.
2. Design and verify the characteristics of Op-Amp based integrator and differentiator circuits
3. Design and verify the characteristics of active low-pass, high-pass, and band-pass filters using Op-Amp.
4. Construct and analyze a Schmitt trigger using Op-Amp to understand hysteresis and waveform shaping.
5. Design and verify the characteristics of astable and monostable multivibrator circuits using the NE555 timer IC.
6. Verify the characteristics of a Miller sweep circuit for linear ramp voltage generation
7. Verify the characteristics of a UJT relaxation oscillator for waveform generation.

Note : A minimum of 10 experiments should be performed with atleast 5 from each section

Suggested Text Books:
1. Anand Kumar A, "Pulse and Digital Circuits", Prentice-Hall of India private Limited, NewDelhi, 2007
2. D.Roy Chowdhury, ShailB.Jain, "Linear Integrated Circuits", 4/e, New Age International (P) Ltd., 2008.
3. Ramakanth A. Gayakwad, "Op-Amps and Linear Integrated Circuits", Pearson, 4/e, 2018.



Course Code	Course Title						Core/PE/OE
PC 453EC	DIGITAL SIGNAL PROCESSING LAB						Core
	Contact Hours per Week				CIE	SEE	Credits
Prerequisite	L	T	D	P			
PC405EC	-	-	-	2	30	70	1

Course Objectives : The course is taught with the objectives of enabling the student to:

1. To develop MATLAB programs for operation of sequences.
2. To implement the program of DFT,IDFT, FFT and IFFT on discrete time signals.
3. To design and obtain the frequency response of various digital filters.
4. To familiarize students with the architecture and functionality of the TMS320C67XX DSP processor and to utilize the DSP kit for real- time processing and manipulation of audio signals.
5. To interface input/output devices with the DSP kit and implement real-time FIR and IIR filters for data acquisition and output signal processing.

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

1. Develop MATLAB files for the verification of system response.
2. Design and analyze the digital filters using MATLAB.
3. Verify the functionality of FFT algorithms.
4. Experiment with multirate techniques using MATLAB & CCS.
5. Design and implement the digital filters on DSP processor.

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	2	3	3	-	-	-	-	-	-	-
CO2	3	3	3	2	3	-	-	-	-	-	-	-
CO3	3	3	2	3	2	-	-	-	-	-	-	-
CO4	2	3	2	3	3	-	-	-	-	-	-	-
CO5	3	3	3	3	3	-	-	-	-	-	-	-

Correlation rating: Low / Medium / High: 1 / 2 / 3 respectively.

PART A: Perform the following programs using MATLAB Simulator

1. Introduction to MATLAB and signal generation.
2. Perform Linear Convolution.
3. Perform Circular Convolutions.
4. Perform DFT and FFT algorithm
5. Perform FIR filters design using different window functions.
6. Perform IIR filters design: Butterworth and Chebyshev, LPF, HPF, BPF & BSF filter.
7. Perform Interpolation and Decimation.
8. Implementation of multi-rate systems.

PART B :Implement the following experiments using DSK(TMS320C67XX)

1. Introduction to DSP processors and Study of procedure to work in real-time.
2. Implement Solution of difference equations.
3. Implement Impulse Response.
4. Implement Linear Convolution.
5. Implement Circular Convolution.
6. Implement Fast Fourier Transform Algorithms.

7. Design of FIR (LP/HP) USINGwindows :(a) Rectangular (b) Triangular(c)Hamming windows.
8. Design of IIR (HP/LP) filters.

Note:

1. Atleast ten experiments to be conducted in the semester.
2. Minimum of 5 from Part A and Part B is compulsory.
3. For Section-A 'MATLAB with different toolboxes like signal processing. block set and SIMULINK/MATHEMATICA/ any popular software can be used.

Suggested Text Books:
1. Digital Signal Processing: Principles, Algorithms, and Applications by John G. Proakis and Dimitris G. Manolakis, Pearson Education / PHI, 2007.
2. Discrete-Time Signal Processing by Alan V. Oppenheim and Ronald W. Schafer, PHI.
3. Digital Signal Processing by S. Salivahanan, A. Vallavaraj, and C. Gnanapriya, TMH, 2009

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R24

SCHEME OF INSTRUCTION & EXAMINATION
B.E. III- Semester
(CSE/ CSE allied courses, IT)

S. No	Course Code	Course Title	Scheme of Instruction				Scheme of Examination			Credits
			L	T	P/D	Contact Hrs/Wk	CIE	SEE	Duration in Hrs	
Theory Course										
1	ES301EC	Basic Electronics	3	-	-	3	30	70	3	3
Practical / Laboratory Course										
2	ES351EC	Basic Electronics Lab	-	-	2	2	25	50	3	1
Total			**3**		**2**	**5**	**55**	**120**	**6**	**4**

R24

SCHEME OF INSTRUCTION & EXAMINATION
B.E. IV- Semester
(CSE/ CSE allied courses, IT)

S. No	Course Code	Course Title	Scheme of Instruction				Scheme of Examination			Credits
			L	T	P/D	Contact Hrs/Wk	CIE	SEE	Duration in Hrs	
Theory Course										
1	ES401EC	Digital Electronics	3	-	-	3	30	70	3	3
2	ES401EC	Signals and Systems	3	-	-	3	30	70	3	3
Total			**6**			**6**	**60**	**140**	**6**	**6**

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Course Code	Course Title						Core/PE/OE
ES301EC	**BASIC ELECTRONICS**						**Core**
	Contact Hours per Week				**CIE**	**SEE**	**Credits**
Prerequisite	**L**	**T**	**D**	**P/D**			
BS202PH	**3**	**-**	**-**	**-**	**30**	**70**	**3**

Course Objectives : The course is taught with the objectives of enabling the student to:

1. Understand the characteristics of diodes and its applications.
2. Understand the design concepts of biasing of BJT and FET
3. Understand the design concepts of feedback amplifiers and oscillators
4. Study the design concepts of OP Amp.
5. Understand the concepts of Data Acquisition Systems and data converters

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

1. Study and analyze the rectifiers and regulator circuits.
2. Study and analyze the performance of BJTs, FETs on the basis of their operation and working.
3. Study& design oscillator circuits.
4. Studyand analyze different Op amps and its applications.
5. Study and analyze different data acquisition systems

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	1	1	-	-	-	-	-	-	-	1
CO2	3	2	3	2	-	-	-	-	-	-	-	1
CO3	3	2	3	2	-	-	-	-	-	-	-	1
CO4	3	2	3	3	-	-	-	-	-	-	-	1
CO5	3	2	3	2	-	-	-	-	-	-	-	1

Correlation rating: Low / Medium / High: 1 / 2 / 3 respectively.

UNIT I

PN Junction Diode: Characteristics, Half wave rectifier, Full wave rectifier, filters, ripple, regulation, TIF and efficiency, Zener diode and Zener diode regulators. CRT construction and CRO applications.

UNIT II

Transistors: BJT construction and working, modes of operation, configurations of BJT (CB, CE, CC), small signal h-parameter model of CE, CE amplifier analysis. Construction and working of JFET, V-I characteristics of JFET.

UNIT III

Feedback concepts: Types of negative feedback – modification of gain, bandwidth, input and output impedances, applications.
Oscillators: RC Phase shift, Wein bridge, LC and crystal Oscillators (Qualitative treatment only).

UNIT IV

Operational Amplifier: OP-AMP Block diagram, Ideal OP-AMP, DC and AC Characteristics, Inverting and Non-Inverting Amplifiers, Adder/Subtractor, Integrator, Differentiator, Precision rectifier , Schmit trigger and its applications.

UNIT V

Data Acquisition Systems: Construction and Operation of transducers- Strain

guageLVDT, Thermo couple, Instrumentation systems. **Data Converters:** R-2R Ladder DAC, Successive approximation and Flash ADC.

Suggested Text Books:
1. Robert Boylestad L. and Louis Nashelsky, Electronic Devices and Circuit Theory, PHI,2007. 2 st Edition, Prentice Hall of India, 2006.
2. Helfrick Dand David Cooper, Modern Electronic Instrumentation and Measurements Techniques, 1st edition
3. Salivahanan, Suresh Kumar and Vallavaraj, Electronic Devices and Circuits, 2nd Edition, Tata McGraw-Hill,2010.
Reference Text Books:
1. David A. Bell, *Electronic Devices and Circuits,* 5th ed., Oxford University Press, 2009
2. JB Gupta, Electronic Devices and Circuits, S.K Kataria & sons, 5th Edition, 2012
3. The Art of Electronics, Horowitz, 3rd Edition Cambridge University Press
4. Electronic Devices and Circuits,A.P Godse, U.A Bakshi , Technical Publications

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Course Code	Course Title						Core/PE/OE
ES 351 EC	**BSIC ELECTRONICS LAB**						**Core**
	Contact Hours per Week				**CIE**	**SEE**	**Credits**
Prerequisite	**L**	**T**	**D**	**P**			
ES301EC				**2**	**25**	**50**	**1**

Course Objectives : The course is taught with the objectives of enabling the student to:
1. To understand the characteristics of diodes and transistor configurations.
2. To understand the design concepts of biasing of BJT and FET
3. To understand the design concepts of feedback amplifiers and oscillators
4. To study the design concepts of OP Amp and data converters
Course Outcomes : On completion of this course, the student will be able to :
1. Ability to design diode circuits & understand the application of Zener diode.
2. Ability to analyze characteristics of BJTs &FETS.
3. Ability to understand the different oscillator circuits.
4. Ability to understand operation of HWR & FWR circuits with & without filters.
5. Ability tom design Analog-to-Digital converters & Digital-to-Analog converters.

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	3	2	2	-	-	-	-	-	-	-
CO2	3	2	3	2	1	-	-	-	-	-	-	-
CO3	3	2	3	2	2	-	-	-	-	-	-	-
CO4	3	3	3	2	2	-	-	-	-	-	-	-
CO5	2	3	2	3	3	-	-	-	-	-	-	-

Correlation rating: Low / Medium / High: 1 / 2 / 3 respectively.

LIST OF EXPRIMNETS
1. CRO-Applications, Measurements of R. L and C using LCR meter, Colour code method and soldering practice.
2. Characteristics of Semiconductors diode Ge. Si and Zener.
3. Static Characteristics of BJT-Common Emitter.
4. Static Characteristics of BIT-Common Base.
5. Static Characteristics of FET.
6. RC-Phase Shift Oscillator.
7. Hartley and Colpitts Oscillators.
8. Common Emitter Amplifier.
9. Astable Multivibrator.
10. Full-wave rectifier with and without filters using BJT.
11. Operational Amplifier Applications.
12. Strain Gauge Measurement.
13. Analog-to-Digital and Digital to Analog Converters.
Suggested Text Books:
1. Paul B. Zbar, Albert P. Malvino, Michael A. Miller, *Basic Electronics,A Text - Lab Manual,* 7th ed., McGraw Hill Education, 2001.
2. David Bell, *Fundamentals of electronic devices and circuits Lab Manual,* 5th ed., Oxford university press, 2009.
3. R.C. Jaeger & T. N. Blalock, *Micro Electronic circuit design,* 4th ed., Mc Graw Hill Higher Education, 2011.

Course Code	**Course Title**						**Core/PE/OE**
ES401EC	**DIGITAL ELECTRONICS**						**Core**
	Contact Hours per Week				**CIE**	**SEE**	**Credits**
Prerequisite	**L**	**T**	**D**	**P/D**			
BS202PH	**3**	**-**	**-**	**-**	**30**	**70**	**3**

Course Objectives : The course is taught with the objectives of enabling the student to:

1. Understandthe fundamental principles of digital hardware design and number systems.
2. ApplyBoolean algebra and logic minimization techniques to implement combinational circuits efficiently, modelling of circuits using Verilog HDL.
3. Analyzethe functionality and timing characteristics of sequential circuits using various flip-flops and latches.
4. Design finite state machines (FSMs) for real-time digital applications using synchronous sequential logic.
5. Explore the architecture and design methodologies using programmable logic devices like PALs, PLAs, CPLDs, and FPGAs.

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

1. Explainthe fundamentals of digital hardware design, logic gates, Boolean algebra, and logic synthesis.
2. Design and optimize combinational circuits using K-Map and Quine-Mc Cluskey methods and modelled using Verilog HDL.
3. Construct and analyze various sequential circuits including flip-flops, registers, and counters.
4. Develop FSM-based digital systems for sequence detection and generation using Mealy/Moore models.
5. Implement combinational logic using PLDs such as PALs, PLAs, CPLDs, and FPGAs.

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	3	2	1	1	-	-	-	-	-	-	-	1
CO2	3	2	3	2	-	-	-	-	-	-	-	2
CO3	3	2	3	2	1	-	-	-	-	-	-	2
CO4	3	2	3	3	1	-	-	-	-	-	-	2
CO5	3	2	3	2	-	-	-	-	-	-	-	2

UNIT – I

Design Concepts: Digital Hardware, Design process, Design of digital hardware. Number systems and codes. Introduction to logic circuits – Variables and functions, Logic gates and networks. Boolean algebra, Synthesis using gates, Design examples.

UNIT – II

Number representation: Addition and Subtraction of signed and unsigned numbers. Combinational circuit building blocks: Adders and Subtractors, Multiplexers. Demultiplexers, Parity Checkers and Generators, Decoders. Encoders. Code converters, BCD to 7-segment converter, Arithmetic comparator circuits. Verilog modeling of simple combination circuits.

Logic Optimization: Optimized implementation of logic functions using K-Map and Quine-Mc Cluskey Tabular method.

Combinational Circuit Design: Adders and Subtractors, Multiplexers, Demultiplexers, Parity Checkers and Generators, Decoders, Encoders, Code converters, BCD to 7-segment converter and Arithmetic comparator circuits. Verilog modeling (Gate level and Dataflow) of simple

combination circuits.
UNIT – III
Sequential Circuits: Basic Latch, Gated SR Latch, gated D Latch, Master-Slave edge triggered flip-flops, T Flip-flop, JK Flip-flop, Excitation tables, Timing diagrams and analysis, Flip flop conversions, Set-up and hold time, Registers and Counters.
UNIT – IV
Synchronous Sequential Circuits: Basic Design Steps, Finite State machine (FSM) representation using Moore and Mealy state models, State minimization, Design of FSM for Sequence Generation and Detection, Algorithmic State Machine charts.
UNIT – V
Design of combinational circuits using Programmable Logic Devices (PLDs): General structure of a Programmable Array Logic (PAL), Programmable Logic Arrays (PLAs), Structure of CPLDs and FPGAs, 2-input and 3-input lookup tables (LUTs).

Suggested Text Books:
1. Morris Mano and Michael D. Ciletti, "Digital Design", Pearson, 6/e, 2021.
2. Zvi Kohavi, "Switching and Finite Automata Theory", 3/e, Cambridge University Press New Delhi, 2011.
3. R. P Jain, "Modern Digital Electronics",4/e, McGraw Hill Education (India) Private Limited, 2010.
4. Samir Palnitkar, "Verilog HDL A Guide to Digital Design and Synthesis", 2/e, Pearson
Reference Text Books:
1. John F. Wakerly, *Digital Design: Principles and Practices*, 5th Edition, Pearson Education, 2018.
2. Ronald J. Tocci, Neal S. Widmer, and Gregory L. Moss, *Digital Systems: Principles and Applications*, 12th Edition, Pearson Education, 2016.
3. A. Anand Kumar, *Fundamentals of Digital Circuits*, 4th Edition, PHI Learning, 2016.
4. Charles H. Roth Jr. and Larry L. Kinney, *Fundamentals of Logic Design*, 7th Edition, Cengage Learning, 2013.

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Course Code	Course Title						Core/Elective
ES401EC	SIGNALS AND SYSTEMS						Core
Prerequisite	Contact Hours per Week				CIE	SEE	Credits
	L	T	D	P			
BS201MT	3	-	-	-	30	70	3

Course Objectives : The course is taught with the objectives of enabling the student to:

1. Analyze basic concepts related to continuous time signals and systems, mathematical representation of periodic signals.
2. Familiarize with basic operations on signals and mathematical representation of aperiodic signals using Fourier and Laplace transform.
3. Analyze basic concepts related to discrete time signals and systems, mathematical representation discrete time signals.
4. Describe the concept of Z- Transform and its properties and illustrate their applications to analyze systems.

Define convolution, correlation operations on continuous and discrete time signals.

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

1. Define and differentiate types of signals and systems in continuous and discrete time.
2. Apply the properties of Fourier transform for continuous time signals.
3. Relate Laplace transforms to solve differential equations and to determine the response of the Continuous Time Linear Time Invariant Systems to known inputs.
4. Apply Z-transforms for discrete time signals to solve Difference equations.
5. Obtain Linear Convolution and Correlation of discrete time signals with graphical representation.

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	1	1	-	-	-	-	-	-	-	1
CO2	3	2	3	2	-	-	-	-	-	-	-	2
CO3	3	2	3	2	-	-	-	-	-	-	-	2
CO4	3	2	3	3	-	-	-	-	-	-	-	1
CO5	3	2	3	2	-	-	-	-	-	-	-	1

Correlation rating: Low / Medium / High: 1 / 2 / 3 respectively.

UNIT I

Definitions and classifications: Classification of signals. Elementary continuous time signals, Basic operations on continuous-time signals.

Classification of continuous-time systems: continuous time &discrete time systems, lumped-parameter & distributed –parameter systems, static & dynamic systems, causal & non-causal systems, Time-invariant & time-variant systems, stable & unstable systems.

UNIT II

Representation of Continuous-time signals: Analogy between vectors and signals, orthogonality and completeness.

Fourier series Analysis of Continuous-time signals: Fourier series – Existence of Fourier series, Trigonometric and Exponential Fourier series, computational formulae, symmetry conditions, complex Fourier spectrum.

UNIT III

Continuous-time Fourier Transform (FT): The direct and inverse FT, existence of FT, Properties of FT, FT of standard signals, properties of FT, The Frequency Spectrum. **Linear Convolution of continuous time signals**: Graphical interpretation, properties of convolution, Correlation between continuous-time signals: Auto and Cross correlation, graphical interpretation, properties of correlation.
UNIT IV
Discrete-time signals and systems: Sampling, Classification of discrete-time signals, Basic operations on discrete time signals, Classification of discrete time systems, properties of systems. **Linear Convolution of discrete time signals:** Graphical interpretation, properties of discrete convolution **Fourier analysis of discrete-time signals:** Discrete-time Fourier transform (DTFT),properties of DTFT, Transfer function, Discrete Fourier transform properties of DFT.
UNIT V
Z-Transform analysis of signals & systems: The direct Z transform, Region of convergence, Z-plane and S-plane correspondence. Inverse Z transform, Properties of Z-transforms. Solution to linear difference equations, Linear constant coefficient systems, System transfer function.

Suggested Text Books:
1. Alan V O P Penheim, A. S. Wlisky, *Signals and Systems*, 2nd Edition, Prentice Hall.
2. Rodger E. Ziemer, William H Trenter, D. Ronald Fannin, *Signals and Systems*, 4th Edition, Pearson 1998.
3. Douglas K. Linder, *Introduction to Signals and Systems*, McGraw Hill, 1999.
Reference Text Books:
1. P. Ramesh babu, R Ananada Natarajan, *Signals and Systems*, SCITECH, 3rd edition 2009.

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R24

SCHEME OF INSTRUCTION & EXAMINATION
B.E. III- Semester
(EEE / EIE)

S. No	Course Code	Course Title	Scheme of Instruction				Scheme of Examination			Credits
			L	T	P/D	Contact Hrs/Wk	CIE	SEE	Duration in Hrs	
Theory Course										
1	ES302EC	Analog Electronics	3	-	-	3	30	70	3	3
Practical / Laboratory Course										
2	ES352EC	Analog Electronics Lab	-	-	2	2	25	50	3	1
Total			3		2	5	55	120	6	4

SCHEME OF INSTRUCTION & EXAMINATION
B.E. III- Semester
(Mechanical / Production)

S. No	Course Code	Course Title	Scheme of Instruction				Scheme of Examination			
			L	T	P/D	Contact Hrs/Wk	CIE	SEE	Duration in Hrs	
Theory Course										
1	ES303EC	MicrocontrollerandInterfacing	3	-	-	3	30	70	3	
Total			**3**			3	30	70	3	

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Course Code	**Course Title**						**Core/PE/OE**
ES302EC	**Analog Electronic Circuits**						**Core**
	Contact Hours per Week				**CIE**	**SEE**	**Credits**
Prerequisite	**L**	**T**	**D**	**P**			
ES301EE	**3**	**-**	**-**	**-**	**30**	**70**	**4**

Course Objectives : The course is taught with the objectives of enabling the student to:

1. Study the characteristics of diode in forward and reverse bias and applications of diodes.
2. Describe the construction and working of Bipolar Junction Transistor in various modes and JFET.
3. Familiarize with feedback concepts and identify various types of feedback amplifiers.
4. Study the importance of power amplifiers and Oscillators.
5. Understand the operation and applications of op-amps.

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

1. Interpret the characteristics and apply diode models to analyze various applications of diodes
2. Discriminate the BJT configurations to recognize appropriate transistor configuration for any given application and design the biasing circuits with good stability
3. Analyze and compare feedback amplifiers.
4. Distinguish various classes of Power Amplifiers.
5. Analyze the operation of OPAMP and its applications.

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	3	2	1	1	-	-	-	-	-	-	-	1
CO2	3	2	3	2	-	-	-	-	-	-	-	2
CO3	3	2	3	2	1	-	-	-	-	-	-	2
CO4	3	2	3	3	1	-	-	-	-	-	-	2
CO5	3	2	3	2	-	-	-	-	-	-	-	2

Correlation rating: Low / Medium / High: 1 / 2 / 3 respectively.

UNIT I

P-N junction characteristics, V-I characteristics, Avalanche breakdown, Zener diode, Applications of Diodes as rectifiers. Filters (L, C), LED, photodiode. Basic Clipping and clamping circuits using diodes. (One level only).

UNIT II

Bipolar Junction Transistor - V-I characteristics, JFET - I-V characteristics, andvarious configurations (such as CE/CS, CB/CG, CC/CD) and their features. Small signal models of BJT and JFET. Analysis of BJT as an amplifier, estimation of voltage gain, current gain, input resistance, output resistance.

Transistor Biasing: Fixed bias, collector to base bias, self-bias, thermal stability, heat sinks.

UNIT III

Concept of Feedback - positive and negative, Feedback topologies: Voltage series,current series, voltage shunt, current shunt, effect of feedback on gain, bandwidth etc., and concept of stability. (Qualitative treatment only).

UNIT IV
Oscillators: Barkhausen criterion, RC oscillators (phase shift, Wien bridge), LC oscillators (Hartley, Colpitts), CRYSTAL Oscillator. (Qualitative treatment only) **Power Amplifiers:** Various classes of operation (Class A, B, and AB), their power efficiency and distortion (Qualitative treatment only).
UNIT V
OP-AMP Block diagram, Ideal OP-AMP,DC and AC Characteristics, Inverting and Non-Inverting Amplifiers, Adder/Subtractor, Integrator, Differentiator, Comparator, Zero crossing detector, Square and Triangular wave generators, Peak detector, Sample and Hold circuit and Precision Rectifiers.

Suggested Text Books:
4. Jacob Millman, Christos Halkias, Chetan Parikh, *Integrated Electronics*, 2nd ed.,McGraw Hill Education (India) Private Limited, 2011.
5. S Salivahanan, N Kumar,and A Vallavaraj, *Electronic Devices and Circuits*,McGraw Hill,3rd edition,2010.
6. Donald A.Neamen, *Electronic Circuits: Analysis and Design*, 3rd edition, McGraw Hill,2006.
Reference Text Books:
5. Robert Boylestad and Louis Nashelsky, *Electronic Devices and Circuit Theory*, 11th ed., Pearson India Publications, 2015.
6. J.B. Gupta. *Electronic Devices and Circuits*. Publisher, S.K. Kataria & Sons. Edition, 6th 2016.
7. Allen Mottershead, *Electronic Devices and Circuits: An introduction*, PHI Learning Private Limited,2011.
8. Sedra smith, Microelectronics circuits, oxford university press, 6th edition, 2009

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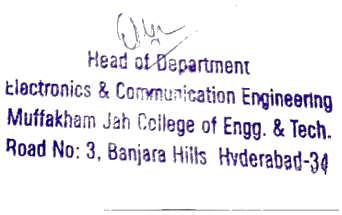
Course Code	**Course Title**						**Core/PE/OE**
PC 352 EC	**ANALOG ELECTRONIC CIRCUIT LAB**						**Core**
	Contact Hours per Week				**CIE**	**SEE**	**Credits**
Prerequisite	**L**	**T**	**D**	**P**			
ES301EE	**-**	**-**	**-**	**2**	**25**	**50**	**1**
Course Objectives : The course is taught with the objectives of enabling the student to:							
Designing basic circuits of rectification with and without filters usingdiodes							
Designing wave shaping circuit usingdiodes.							
Designing of single and multistage amplifiercircuits.							
Demonstrate negative feedback in amplifier circuits and positive feedback inOscillators							
Design of P, PI and PIDcontrollers.							
Course Outcomes : On completion of this course, the student will be able to :							
Calculate ripple factor, efficiency and % regulation of rectifiercircuits							
Analyse feedback amplifiers and op-amp oscillatorcircuits							
Design single, and multi-stage amplifier, wave shaping and controllercircuits							
Understand the characteristics of electronicsdevices							
Design of P, PI and PID controllers usingop-amps.							

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	3	2	3	2	2	-	-	-	-	-	-	-
CO2	3	2	3	2	1	-	-	-	-	-	-	-
CO3	3	2	3	2	2	-	-	-	-	-	-	-
CO4	3	3	3	2	2	-	-	-	-	-	-	-
CO5	2	3	2	3	3	-	-	-	-	-	-	-

Correlation rating: Low / Medium / High: 1 / 2 / 3 respectively.

List of Experiments
1. Characteristics of Silicon, Germanium and Zener Diode in forward bias and reversebias
2. Application of diode as a full wave rectifier with and without filters. Calculation of Ripple factor, voltage regulation and efficiency with variousloads
3. Static characteristics of BJT in CEconfiguration
4. Static characteristics of MOSFET in CSconfiguration
5. Frequency response of Single and two stage BJT amplifier in CEconfiguration
6. Frequency response of Single and two stage MOSFET amplifier in CSconfiguration
7. Inverting amplifier usingop-amp.
8. Non inverting amplifier usingop-amp.
9. Instrumentationamplifier.
10. Design of integrator and differentiator usingop-amp.
11. RC Phase Oscillator and Wein Bridge Oscillator usingop-amp.
12. A/Dconverters.
13. Clippingcircuits
14. ClampingCircuits.
15. Monostable Multivibrator usingop-amp.
16. Generation of triangular and square wave usingop-amp.
17. Design of P, PI and PID controller usingop-amp.
18. Design of Lead/lag compensator usingop-amp

Suggested Text Books:
4. Paul B. Zbar, AlbertP.Malvino, Michael Miller, *Basic Electronics, A Text- Lab Manual*,7th ed., McGraw Hill Education (India) Private Limited,2001
5. David Bell A, *Laboratory Manual for Electrical Circuits*, PHI-New Delhi, 2009
6. Hayt W H Kemmerly J.E and Durbin SM, *Engineering Circuit Analysis*, 8th ed., McGraw Hill Education (India) Private Limited, 2013.



Course Code	**Course Title**						**Core/PE/OE**
ES303EC	**MICROCONTROLLER AND INTERFACING**						**Core**
	Contact Hours per Week				**CIE**	**SEE**	**Credits**
Prerequisite	**L**	**T**	**D**	**P/D**			
-	**3**	**-**	**-**	**-**	**30**	**70**	**3**

Course Objectives : The course is taught with the objectives of enabling the student to:
1. Understand the architecture and programming of 8051 Microcontroller.
2. Learn the memory organization & instruction set of 8051 microcontroller.
3. Getfamiliarityofassemblylanguage programmingof I/O ports, Timers/Counters& UART using 8051 Microcontroller.
4. Todevelopinterfacing of real time programmable devices like ADC, DAC, LCD and stepper motor with 8051.
Course Outcomes: On successful completion of the course, the students will be able to:
1. Explaintheinternal architectureof an8-bit8051 Microcontroller
2. Explain the Memory Organization, 8051 Pin Configuration & Instruction Set of 8051Microcontroller.
3. Learn the 8051 Addressing modes, 8051 Instruction Set & write simple ALPs.
4. Program Timers/Counters, Serial Communication & Interrupts
5. Interface different programmable peripheral devices to 8051 microcontroller.

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	3	2	1	1	-	-	-	-	-	-	-	2
CO2	3	2	3	2	-	-	-	-	-	-	-	2
CO3	3	2	3	2	-	-	-	-	-	-	-	2
CO4	3	2	3	3	1	-	-	-	-	-	-	2
CO5	3	2	3	2	1	-	-	-	-	-	-	2

Correlation rating: Low / Medium / High: 1 / 2 / 3 respectively.

UNIT I
Introduction to Microcontrollers& its Architecture: Overview of Microprocessors andMicrocontrollers, Differences between Microprocessors andMicrocontrollers, Hexadecimal numbering system,Salient features of 8051 Microcontroller, 8051 Microcontroller family, Internal Architecture of 8051 Microcontroller, PSW.
UNIT II
8051 Memory, Pin Configuration & Instruction Set:8051 Memory Organization (Internal & External Memories), 8051 Pin Configuration, Crystal Oscillator frequency, Machine cycles, Stack of 8051, 8051 Instruction Set.
UNIT III
8051 Addressing Modes& Assembly Language Programming: Addressing modes, bit addressable features, I/O port structures, Assembly Language Programming using data transfer, arithmetic, logical and branch instructions with simple programs.
UNIT IV
8051 Timers,Serial PortandInterrupts: 8051 Timers/Counters and its programming, Serial data communication, Serial port and its programming, 8051 interrupts, Interrupt vector table, Interrupts programming.

UNIT V
8051Interfacing: Interfacingof8051withDigital-Analog Converter,Analog-Digital Converter,Steppermotor&LCDinterfacing.

Suggested Text Books:
1. MazidiM.A,MazidiJ.G and Rolin D.Mckinlay,—The 8051 Microcontroller & Embedded Systems Using Assembly and C ǁ,2/e, Pearson Education, 2008.
2. Ayala K.J,—The 8051 Microcontroller Architecture, programming & Applications ǁ, Penram International, 2007.
3. Scott Mackenzie and Raphael C. W. Phan. —The 8051 Microcontroller, 4th Edition, Pearson education, 2008.

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