SCHOOL OF STUDIES OF ENGINEERING & TECHNOLOGY
GURU GHASIDAS VISHWAVIDYALAYA, BILASPUR (C.G.)

(A CENTRAL UNIVERSITY)

CBCS-NEW SYLLABUS

B. TECH. THIRD YEAR (Electronics and Communication Engineering)

(W.E.F. SESSION 2022-23)

Vision and Mission of the Institute

Vision		To be a leading technological institute that imparts transformative education to create globally competent technologists, entrepreneurs, researchers and leaders for a sustainable society
Mission	1	To create an ambience of teaching learning through transformative education for future leaders with professional skills, ethics, and conduct.
	2	To identify and develop sustainable research solutions for the local and global needs.
	3	To build a bridge between the academia, industry and society to promote entrepreneurial skills and spirit

Vision and Mission of the Department

Vision		The Department endeavours for academic excellence in Electronics & Communication Engineering by imparting in depth knowledge to the students, facilitating research activities and cater to the ever-changing industrial demands, global and societal needs with leadership qualities.
Mission	1	To be the epitome of academic rigour, flexible to accommodate every student and faculty for basic, current and future technologies in Electronics and Communication Engineering with professional ethics.
	2	To develop an advanced research centre for local & global needs.
	3	To mitigate the gap between academia, industry & societal needs through entrepreneurial and leadership promotion.

Program Educational Objectives (PEOs)

The graduate of the Electronics and Communication Engineering Program will

PEO1: Have fundamental and progressive knowledge along with research initiatives in the field of Electronics & Communication Engineering.

PEO2: Be capable to contrive solutions for electronic & communication systems for real world applications which are technically achievable and economically feasible leading to academia, industry, government and social benefits.

PEO3: Have performed effectively in a multi-disciplinary environment and have self-learning & self-perceptive skills for higher studies, professional career or entrepreneurial endeavors to be confronted with a number of difficulties.

PEO4: Attain team spirit, communication skills, ethical and professional attitude for lifelong learning.

Programme Outcomes: Graduates will be able to:

PO1: Fundamentals: Apply knowledge of mathematics, science and engineering.

PO2: Problem analysis: Identify, formulate and solve real time engineering problems using first principles.

PO3: Design: Design engineering systems complying with public health, safety, cultural, societal and environmental considerations

PO4: Investigation: Investigate complex problems by analysis and interpreting the data to synthesize valid solution.

PO5: Tools: Predict and model by using creative techniques, skills and IT tools necessary for modern engineering practice.

PO6: Society: Apply the knowledge to assess societal, health, safety, legal and cultural issues for practicing engineering profession.

PO7: Environment: Understand the importance of the environment for sustainable development.

PO8: Ethics: Apply ethical principles and commit to professional ethics, and responsibilities and norms of the engineering practice.

PO9: Teamwork: Function effectively as an individual and as a member or leader in diverse teams and multidisciplinary settings.

PO10: Communication: Communicate effectively by presentations and writing reports.

PO11: Management: Manage projects in multidisciplinary environments as member or a team leader.

PO12: Life-long learning: Engage in independent lifelong learning in the broadest context of technological change.

Programme Specific Outcomes:

PSO1: Identify, formulate and apply concepts acquired through Electronics & Communication Engineering courses to the real-world applications.

PSO2: Design and implement products using the cutting-edge software and hardware tools to attain skills for analyzing and developing subsystem/processes.

PSO3: Ability to adapt and comprehend the technology advancement in research and contemporary industry demands with demonstration of leadership qualities and betterment of organization, environment and society.

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CBCS-NEW, EVALUATION SCHEME

(W.E.F. SESSION 2022-23)

B. TECH. THIRD YEAR (SEMESTER- V)

(Electronics and Communication Engineering)

S. No.	COURSE No.	SUBJECT	PERIODS			EVALUATION SCHEME			CREDITS
			L	T	P	IA	ESE	TOTAL	
THEORY									
1.	EC205TPC08	LIC & its Application	3	1	-	30	70	100	4
2.	EC205TPC09	Digital Communication	3	1	-	30	70	100	4
3.	EC205TPC10	Digital Signal Processing	3	1	-	30	70	100	4
4.	EC205TES06	Electromagnetic Waves	3	-	-	30	70	100	3
5.	EC205THS03	Probability Theory & Random Process	3	-	-	30	70	100	3
6.	EC205THS04	Effective Technical Communication	2	-	-	-	-	-	-
		TOTAL	**17**	**3**	**-**	**150**	**350**	**500**	**18**
PRACTICALS									
1	EC205PPC06	LIC Lab	-	-	2	30	20	50	1
2.	EC205PPC07	Analog and Digital Communication Lab	-	-	2	30	20	50	1
3.	EC205PPC08	Digital Signal Processing Lab	-	-	2	30	20	50	1
		TOTAL	**-**	**-**	**6**	**90**	**60**	**150**	**3**
		GRAND TOTAL	**17**	**3**	**6**	**240**	**410**	**650**	**21**

Total Credits: **21** Total Contact Hours**: 26** Total Marks**: 650**

L**:** LECTURE, T**:** TUTORIAL, P**:** PRACTICAL, IA**:** INTERNAL ASSESSMENT, ESE**:** END SEMESTER EXAMINATION

*INTERNAL ASSESSMENT- Two Class Test of 15 Marks each will be conducted.

SCHOOL OF STUDIES OF ENGINEERING & TECHNOLOGY

GURU GHASIDAS VISHWAVIDYALAYA, BILASPUR (C.G.)

(A CENTRAL UNIVERSITY)

CBCS-NEW, EVALUATION SCHEME

PROPOSED (W.E.F. SESSION 2022-23)

B. TECH. THIRDYEAR (SEMESTER- VI)

(Electronics and Communication Engineering)

S. No.	COURSE No.	SUBJECT	PERIODS			EVALUATION SCHEME			CREDITS
			L	T	P	IA	ESE	TOTAL	
THEORY									
1.	EC206TPC11	CMOS Digital VLSI Design	3	1	-	30	70	100	4
2.	EC206TPC12	Data Communication & Computer Networks	3	-	-	30	70	100	3
3.	EC206TPC13	Microprocessor & Microcontroller	3	-	-	30	70	100	3
4.	EC206TES07	Electronic Measurements and Sensors	3	-	-	30	70	100	3
5.	EC206TPE0X	**Program Elective-1**	3	-	-	30	70	100	3
6.		**Open Elective-1**	3	-	-	30	70	100	3
		TOTAL	**18**	**1**	**-**	**180**	**420**	**600**	**19**
PRACTICALS									
1.	EC206PPC09	CMOS Digital VLSI Design Lab	-	-	2	30	20	50	1
2.	EC206PPC10	Data Communication & Computer Networks Lab	-	-	2	30	20	50	1
3.	EC206PES06	Electronic Measurement and Sensors Lab	-	-	2	30	20	50	1
		TOTAL	**-**	**-**	**6**	**90**	**60**	**150**	**3**
		GRAND TOTAL	**18**	**1**	**6**	**270**	**480**	**750**	**22**

Total Credits**: 22** Total Contact Hours**: 25** Total Marks**: 750**

L**:** LECTURE, T**:** TUTORIAL, P**:** PRACTICAL, IA**:** INTERNAL ASSESSMENT, ESE**:** END SEMESTER EXAMINATION

*INTERNAL ASSESSMENT- Two Class Test of 15 Marks each will be conducted.

Program Elective - 1	
EC206TPE01	Information Theory & Coding
EC206TPE02	Advance Signal Processing
EC206TPE03	Renewable Energy Sources
EC206TPE04	Introduction to MEMS
Open Elective – 1 (for other branches)	
EC206TOE01	Introduction to Electronic Devices & Circuits

Sub Code	L	T	P	Duration	IA	ESE	Total	Credits
EC205TPC08	3	1	-	4 Hours	30	70	100	4

LIC & ITS APPLICATIONS

Course Objectives:

- To develop basic concept of differential amplifiers & OPAMP IC 741.
- To analyze and perform different applications and frequency response of OPAMP.
- To develop the concept and analysis of active filters, phase lock loop, multiplier, timer, regulator.
- To help students develop various designs of OPAMP and its applications.
- To analyze and perform the theoretical concepts through laboratory and simulation experiments.

UNIT-I

Basic Building Blocks for ICs & OPAMP: Basic differential amplifiers & analysis, Introduction to OPAMP**,** Ideal OPAMP characteristics, OPAMP ICs: 741Pin diagram and function, Inverting amplifier, Non-inverting amplifier, Definition of OPAMP parameters, Frequency response of OPAMP, Open loop & closed loop configuration of OPAMP and its comparisons, Voltage comparator, Zero crossing detector, Level detector.

UNIT-II

Applications of OPAMP: Introduction, Adder, Substractor/Difference amplifier, Voltage follower, Integrator, Differentiator, Comparator IC such as LM339, Window detector, Current to voltage and voltage to current converter, Instrumentation amplifier, Precision half wave rectifier, Precision full wave rectifier, Log & antilog amplifier, Schmitt trigger, Bridge amplifier, Peak detectors/Peak follower, Sample and hold amplifiers, Square wave generator, Saw-tooth wave generator, Triangular wave generator, Astable multivibrator, Monostable multivibrator, Dead zone circuit with positive output, with negative output, Precision clipper circuit, Generalized Impedance Converter (GIC) and its application.

Frequency Response of OPAMP: Open loop voltage gain as a function of frequency, Unity gain bandwidth, Close loop frequency response, Slew rate.

UNIT-III

Active Filters & PLL - Introduction to filters, Merits & demerits of active filters of over passive filter, Classification of filters, Response characteristics of filter, First order and second order active high pass, Low pass, Band pass and Band reject butterworth filters.

Phase Lock Loop: Operating principle of the PLL, Linear model of phase lock loop, Lock range and capture range, Application of the PLL, Voltage controlled oscillator (VCO).

UNIT-IV

D/A and A/D Converters & Analog Multiplier: D/A converter ladder, R-2R, A/D converters, Ramp, Continuous conversion, Flash ADC, Dual slope ADC, Successive approximation, Voltage to time converters, Timing and circuits comparisons, DAC/ADC specifications.

Analog Multiplier: Basic analog multiplication techniques, Applications of multiplier- frequency doubling, Phase-angle difference detection, Voltage dividing action, Square root of a signal, Function realization by multiplier, Amplitude modulator, Standard modulator circuit, Demodulation of AM signal.

UNIT-V

Timer & Regulators: Monolithic 555 timer, Functional diagram, Monostable and astable operation using 555 Timer, Voltage regulators: Basic configurations parameters for voltage regulators, Basic blocks of linear IC voltage regulators, Positive and negative voltage regulators, Positive and negative voltage regulators, General purpose IC regulator (723): Important features and internal structure, Switching regulators.

Text/Reference Books:

1. R. A. Gayakwad, "Op-Amps and Linear Integrated Circuits", 4th ed. PHI, 2015
2. R. F. Coughlin and F. F. Driscoll, "Operational Amplifiers and Linear Integrated Circuits", 6th ed., PHI/Pearson, 2001.
3. M. H. Rashid, "Microelectronic Circuits Analysis and Design", Cengage Learning, 2nd ed., 2012.
4. S. Franco "Design with Operational Amplifiers and Analog Integrated Circuits", 4th ed., Tata McGraw Hill, 2016.
5. Fiore, "Opamps & Linear Integrated Circuits Concepts & applications", Cengage, 2010.

Course Outcomes:

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

CO1 Understand and analyze DC and AC characteristics of OP-Amp and is effect on output.

CO2 Illustrate and design the linear and non linear application of OP-Amp and its effect on output.

CO3 Design active filters and explains the working of PLL.

CO4 Comprehend the working principle of data converters and multipliers.

CO5 Demonstrate the function of timer and regulators and their applications.

Course Outcomes and their mapping with Program Outcomes & Program Specific Outcomes:

CO	PO												PSO		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	2	1	1				3			3	3	1	2
CO2	3	3	2	1	1				3			3	3	1	2
CO3	3	3	2	1	1				3			3	3	1	2
CO4	3	3	2	1	1				3			3	3	1	2
CO5	3	3	2	1	1				3			3	3	1	2

Weightage: **1-Sightly; 2-Moderately; 3-Strongly.**

Sub Code	L	T	P	Duration	IA	ESE	Total	Credits
EC205TPC09	3	1	-	4 Hours	30	70	100	4

DIGITAL COMMUNICATIONS

Course Objectives:

- To study process of sampling, quantization that are fundamental to the digital transmission of analog signals.
- To study baseband and band pass signal transmission and reception techniques.
- To Study concept of signaling
- To study digital modulation methods and optimum receiver.
- To study the noise in digital communication, optimum filter and matched filter.
- To study the error control and channel coding concept.

UNIT-I

Digital Transmission of Analog Signal: Sampling theorem, Quantization, Companding, PAM, PWM, PPM, PCM, Differential PCM (DPCM), Delta modulation, Adaptive delta modulation, Delta sigma modulation, Channel bandwidths of PCM, TDM, Noises in PCM PWM, PPM, DM, Noise in PCM and DM, PCM transmission: Calculation of SNR in PCM, Delta modulation transmission: Signals to quantization noise ratio calculation.

UNIT-II

Principle of Digital Data Transmission: Line coding: PSD of various line codes, Polar signaling, On-Off signaling, Bipolar signaling, Pulse shaping: Nyquist criterion for zero ISI, Scrambling, Regenerative repeater: Eye diagram, Detection error probability for polar signal, ON-Off and bipolar signals.

UNIT-III

Digital Modulation Techniques: Fundamentals of BASK, BPSK and BFSK, Generation, Detection, Spectrum and geometrical representation of BPSK and BFSK, Fundamentals of DPSK, DEPSK and QPSK, Generation and detection of DPSK, DEPSK and QPSK, Signal space representation of QPSK, M-ary PSK, MSK signaling scheme.

UNIT-IV

Optimal Reception of Digital Signal: A baseband signal receiver, Probability of error, Optimal receiver design, Signal space representation and probability of error calculation.

UNIT-V

Information Theory and Coding: Introduction, Unit of information, Rate of information, Joint and conditional entropy, Mutual information, Channel capacity: Noise free channel, Symmetrical channel, Binary symmetrical channel, Cascaded channel, Shannon’s theorem, Capacity of Gaussian channel, Shannon’s Hartley theorem, Bandwidth S/N tradeoff, Coding efficiency, Source coding, Channel coding.

Text/Reference Books:

1. D. L. Schilling and H. Taub, ”Principles of Communication Systems”, Tata Mcgraw Hill Education Private Limited, 2007.
2. B. P. Lathi and Z. Ding, “Modern Digital and Analog Communication Systems”, Oxford University Press, Inc., 2010.
3. S. Haykin, “Communication Systems”, John Wiley & Sons, 2008.
4. J. G. Proakis and M. Salehi, “Fundamentals of Communication Systems”, Pearson Education India, 2007.
5. G. Kennedy, B. Davis, and S. R. M. Prasanna, “Electronic Communication Systems”. vol. 20, Tata McGraw-Hill Publishing Co. Ltd., New Delhi.
6. A. Saha, N. Manna, and S. Mandal, “Information Theory, Coding and Cryptography”, Pearson Education India, 2013.
7. S. Lin and D.J. Costello Jr., “Error Control Coding”, Prentice” Hall, 1983.

Course Outcomes:

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

CO1 Acquire idea about analog to digital conversion. Understand simultaneous transmission of digital signals.

CO2 Learn communication techniques for wired and wireless channels.

CO3 Analyze and mitigate interference in wired channels. Differentiate between different coding and modulation strategies.

CO4 Understand the basic concepts of Information theory, source and channel coding, channel capacity and relation among them

CO5 Learn and be able to apply basics of random process, modeling and analysis of systems with random signals.

Course Outcomes and their mapping with Program Outcomes & Program Specific Outcomes:

CO	PO												PSO		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	2	1	-	-	-	-	-	-	-	3	2	2
CO2	3	3	2	3	2	-	-	-	-	-	-	-	3	3	2
CO3	3	3	2	3	2	-	-	-	-	-	-	-	3	3	3
CO4	3	3	3	3	2	-	-	-	-	-	-	-	3	3	3
CO5	3	3	2	3	2	-	-	-	-	-	-	-	3	3	3

Weightage: **1-Sightly; 2-Moderately; 3-Strongly**

Sub Code	L	T	P	Duration	IA	ESE	Credits
EC205TPC10	3	1	-	4 Hours	30	70	4

DIGITAL SIGNAL PROCESSING

Course Objectives:

- To summarize and analyze the concepts of signals, systems in time and frequency domain with corresponding transformations
- To introduce the diverse structures for realizing digital filters.
- To develop the understanding the concept of design and implementation of digital filters.
- To develop basic idea of multi rate filter bank design.
- To utilize the appropriate tools for design and realization of signal processing modules

UNIT-I

Basic Elements of Digital Signal Processing: Introduction of discrete time signals and systems, Discrete time Fourier transform (DTFT), Discrete Fourier series (DFS), Discrete Fourier transform (DFT), Fast Fourier transform (FFT) using DIT and DIF algorithms, Inverse FFT using DIT and DIF algorithms, Circular convolution, Correlation, MATLAB programs based illustrations.

UNIT-II

Realization of Systems: Realization of discrete time systems, Structures for infinite impulse response (IIR) and finite impulse response (FIR) systems, Basic realization block diagram and signal flow graph. **Realization of IIR filter:** Direct forms structure, Transposed structure, Cascade structure, Parallel structure, Lattice structure, Ladder structure. Realization of FIR filter: Direct forms structure, Cascade structure, linear phase realization, Lattice structure.

UNIT-III

FIR Filter Design: Linear phase response, Symmetric and anti-symmetric, Design characteristics of FIR filters, Frequency response of FIR filters, Design FIR filter by window functions: Rectangular, Triangular, Hanning, Hamming, Blackman & Kaiser, Design FIR filter by frequency sampling method, MATLAB programs based illustrations for FIR filters.

UNIT-IV

IIR Filter Design: Transformation of analog filter to digital filters by: Approximation of derivatives, Impulse invariance method, Bilinear transformation method, Design of digital butterworth and chebyshev filter, Frequency transformations in analog and digital domain, MATLAB programs based illustrations for IIR filters.

UNIT-V

Multi-Rate Digital Signal Processing: Introduction of multi rate system, Sampling rate conversion, Decimation, Interpolation, Sampling rate alteration, Poly-phase decomposition, Digital filter bank, Application of DSP: speech and image.

Text/Reference Books:

1. S. K. Mitra, “Digital Signal Processing: A Computer based Approach”, McGraw Hill, 2011.
2. A. V. Oppenheim and R. W. Schafer, “Discrete Time Signal Processing”, Prentice Hall, 1989.
3. J. G. Proakis and D. G. Manolakis, “Digital Signal Processing: Principles, Algorithms and Applications”, Prentice Hall, 1997.

4. L. R. Rabiner and B. Gold, "Theory and Application of Digital Signal Processing", Prentice Hall, 1992.
5. J. R. Johnson, "Introduction to Digital Signal Processing", Prentice Hall, 1992.
6. D. J. DeFatta, J. G. Lucas, and W. S. Hodgkiss, "Digital Signal Processing", John Wiley & Sons, 1988.
7. A. Kumar, "Digital Signal Processing", PHI 2013.

Course Outcomes:

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

CO1 Represent signals mathematically in discrete-time, and in the frequency domain.

CO2 Realize digital filters by use of systematic structure to simplify the complexity of the system.

CO3 Design and develop digital filters for various applications.

CO4 Analyze different signals using multi-rate systems.

CO5 Apply digital signal processing modules for the analysis of real-life signals.

Course Outcomes and their mapping with Program Outcomes & Program Specific Outcomes:

CO	PO												PSO		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	1	1	1						2	3	2	2
CO2	3	3	2	3								2	2	2	2
CO3	3	3	2	1		1						1	2	2	3
CO4	3	3	3	1								2	2	2	3
CO5	3	3	3	1	1	1						1	2	3	3

Weightage: **1-Sightly; 2-Moderately; 3-Strongly**

Sub Code	L	T	P	Duration	IA	ESE	Total	Credits
EC205TES06	3	-	-	3 Hours	30	70	100	3

ELECTROMAGNETIC WAVES

Course Objectives:

- To develop the basic concept of analysis and design of transmission line
- To develop the concepts, working principles, and laws of electromagnetic waves.
- To perform analysis and characterization of uniform plane wave at different media
- To perform analysis and design of the waveguide.
- To develop the concept of radiation and antenna.

UNIT-I

Transmission Lines: Equations of voltage and current on TX line, Propagation constant and characteristic impedance, Reflection coefficient and VSWR, Impedance transformation on loss-less and low loss transmission line, Power transfer on TX line, Smith chart, Admittance smith chart, Applications of transmission lines: Impedance matching, Use of transmission line sections as circuit elements.

UNIT-II

Maxwell's Equations: Basics of vectors, Vector calculus, Basic laws of electromagnetic, Maxwell's equations, Boundary conditions at media interface.

UNIT-III

Uniform Plane Wave: Uniform plane wave, Propagation of wave, Wave polarization, Wave propagation in conducting medium, Phase and group velocity, Power flow and poynting vector, Surface current and power loss in a conductor, Plane waves at a media interface, Plane wave in arbitrary direction, Reflection and refraction at dielectric interface, Total internal reflection, Wave polarization at media interface, Reflection from a conducting boundary.

UNIT-IV

Waveguide: Wave propagation in parallel plane waveguide, Analysis of waveguide general approach, Rectangular waveguide, Modal propagation in rectangular waveguide, Surface currents on the waveguide walls, Field visualization, Attenuation in waveguide.

UNIT-V

Radiation: Solution for potential function, Radiation from the Hertz dipole, Power radiated by hertz dipole, Radiation parameters of antenna, Receiving antenna, Monopole and dipole antenna

Text/Reference Books:

1. R. K. Shevgaonkar, "Electromagnetic Waves", Tata McGraw Hill India, 2005
2. E. C. Jordan & K. G. Balmain, "Electromagnetic Waves & Radiating Systems", 2nd ed., Prentice Hall, India, 2013.
3. N. N. Rao, "Engineering Electromagnetics", 6th ed., Prentice Hall, 2004.
4. D. K. Cheng, "Field & Wave Electromagnetics", 2nd ed., Prentice Hall, 1989.

Course Outcomes:

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

1. Impedance transformation on transmission line and evaluate sections of transmission line for realizing circuit elements
2. Apply the basic laws of electromagnetic in high frequency wave propagation
3. Characterize uniform plane wave and to evaluate reflection and transmission of waves at media interface
4. Analyze wave propagation in metallic waveguides.
5. Comprehend the principle of radiation and radiation characteristics of an antenna

Course Outcomes and their mapping with Program Outcomes & Program Specific Outcomes:

CO	PO												PSO		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	3	2	2				2			3	3	2	2
CO2	3	3	2	3					2			3	3	1	2
CO3	3	3	2	3					2			3	3	1	2
CO4	3	3	3	3	2				2			3	3	2	2
CO5	3	3	1	2	2				2			3	3	1	2

Weightage: **1-Sightly; 2-Moderately; 3-Strongly**

Sub Code	L	T	P	Duration	IA	ESE	Total	Credits
EC205THS03	3	-	-	3 Hours	30	70	100	3

PROBABILITY AND RANDOM PROCESSES

Course Objectives:

- To provide mathematical background and sufficient experience so that student can read, write and understand sentences in the language of probability theory.
- To introduce students to the basic methodology of "probabilistic thinking" and apply it to problems.
- To understand basic concepts of Probability theory and Random Variables, how to deal with multiple Random Variables.

UNIT-I

Introduction to Probability: Set theory, Experiments and sample spaces, Discrete and continuous sample spaces, Events, Probability definitions and axioms, Mathematical model of experiments, Joint probability, Conditional probability, Total probability, Bayes' theorem, and Independent events, Bernoulli's trials.

UNIT-II

Random Variables: Definition, Conditions for a function to be a random variable, Discrete, Continuous and mixed random variable, Distribution and density functions, Properties, Binomial, Poisson, Uniform, Gaussian, Exponential, Rayleigh, Methods of defining conditioning event, Conditional distribution, Conditional density and their properties, Operation on one random variable: Expected value of a random variable, Function of a random variable, Moments about the origin, Central moments, Variance and skew, Characteristic function, Moment generating function, Transformations of a random variable, Monotonic transformations for a continuous random variable, Non monotonic transformations of continuous random variable, Transformations of discrete random variable.

UNIT-III

Multiple Random Variables: Vector random variables, Joint distribution function and its properties, Marginal distribution functions, Conditional distribution and density-point conditioning, Conditional distribution and density-Interval conditioning, Statistical independence, Sum of two random variables, Sum of several random variables, Central limit theorem, (Proof not expected), Unequal distribution, Equal distributions, Expected value of a function of random variables: Joint moments about the origin, Joint central moments, Joint characteristic functions, Jointly Gaussian random variables: Two random variables case, N random variable case, properties, Transformations of multiple random variables, Linear transformations of Gaussian random variables.

UNIT-IV

Stochastic Processes-Temporal Characteristics: The stochastic process concept, Classification of processes, Deterministic and nondeterministic processes, Distribution and density functions, Statistical independence and concept of stationary: First-order stationary processes, Second order and wide-sense stationarity, Nth order and strict-sense stationary, Time averages and ergodicity, Mean-ergodic processes, Correlation-ergodic processes, Autocorrelation function and its properties, Cross-correlation function and its properties, Covariance functions and its properties, Gaussian random processes, Linear system response: Mean and mean-squared value, Autocorrelation, Cross-correlation functions.

UNIT-V

Stochastic Processes-Spectral Characteristics: The Power spectrum and its properties, Relationship between power spectrum and autocorrelation function, The cross-power density spectrum and properties, Relationship between cross-power spectrum and cross-correlation function. Spectral characteristics of system response: Power density spectrum of response, Cross power spectral density of input and output of a linear system.

Text/Reference Books:

1. H. P. Hsu, "Schaum's outline of theory and problems of probability, random variables, and random processes", New York, 1997.
2. A. Papoulis, "Probability, Random variables and Stochastic Processes", 4th ed., McGraw Hill, 2017.
3. P. Z. Peebles Jr "Probability, random variables, and random signal principles", McGraw-Hill, 2001.
4. W. B. Davenport, "Probability and Random Processes for Scientist and Engineers", McGraw-Hill, 1970.
5. H. Stark and J. W. Woods, "Probability, random processes, and estimation theory for engineers", Prentice-Hall, Inc., 1986.

Course Outcomes:

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

CO1Understand and communicate the axiomatic formulation of modern Probability Theory and think of random variables as an intrinsic need for the analysis of random phenomena.

CO2 Characterize probability models and function of random variables based on single & multiples random variables.

CO3 Evaluate and apply moments & characteristic functions and understand the concept of inequalities and probabilistic limits.

CO4 Understand the concept of random processes and determine covariance and spectral density of stationary random processes.

CO5 Demonstrate the specific applications to Poisson and Gaussian processes and representation of low pass and band pass noise models.

Course Outcomes and their mapping with Program Outcomes & Program Specific Outcomes:

CO	PO												PSO		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	1	1	1	1							3	2	1
CO2	3	3	3	1	2	2							3	3	2
CO3	3	3	2	2	2	2							3	3	2
CO4	3	3	3	2	2	2							3	3	2
CO5	3	3	2	3	2	2							3	3	3

Weightage: **1-Sightly; 2-Moderately; 3-Strongly**

Sub Code	L	T	P	Duration	IA	ESE	Total
EC205THS04	2	-	-	3Hours	-	-	-

EFFECTIVE TECHNICAL COMMUNICATION

Course Objectives:

- To participate actively in writing activities (individually and in collaboration)
- To understand how to apply technical information and knowledge in practical documents
- To practice the unique qualities of professional writing style, including sentence conciseness, readability, clarity, accuracy, honesty, avoiding wordiness or ambiguity, previewing.
- To recognize, explain and use the genres of technical communication: technical abstracts, data based research reports, instructional manuals, technical descriptions, and web pages
- To recognize and develop professional format features in print, html, and multimedia modes, as well as use appropriate nonverbal cues and visual aids.

UNIT I

Information Design and Development: Different kinds of technical documents, Information development life cycle, Organization structures, Factors affecting information and document design, Strategies for organization, Information design and writing for print and for online media.

UNIT II

Grammar and Editing: Basics of grammar, Study of advanced grammar, Editing strategies to achieve appropriate technical style.

UNIT III

Oral communication: Public speaking, Group discussion, Oral presentation, Interviews, Graphic presentation, Presentation aids.

UNIT IV

Technical Writing: Writing reports, Project proposals, Brochures, Newsletters, Technical articles, Manuals, Official notes, Business letters, Memos, Progress reports, Minutes of meetings, Event report.

UNIT V

Ethics: Business ethics, Engineering ethics, Etiquettes in social and office settings, Email etiquettes, Telephone etiquettes, Work culture in jobs.

Text/Reference Books:

1. D. F. Beer and D. McMurrey, “Guide to Writing as an Engineer”, John Willey, NewYork, 2004.
2. D. Hacker, “Pocket Style Manual”, Bedford Publication, New York, 2003.
3. S. Khera, “You Can Win”, Macmillan Books, New York, 2003.
4. R. Sharma, “Technical Communications”, Oxford Publication, London, 2004.
5. D. Jungk, “Applied Writing for Technicians”, McGraw Hill, New York, 2004.
6. R. Sharma, K. Mohan, “Business Correspondence and Report Writing”, TMH New Delhi 2002.
7. Xebec, “Presentation Book”, TMH New Delhi, 2000.

Course Outcomes:

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

CO1 Develop employability skill.

CO2 Improved their technical vocabulary & their accent.

CO2 Comprehend technical communication strategies and personality skills.

CO4 Illustrate various technical scripts/letters.

CO5 Demonstrate ethical awareness and the ability to apply ethical principles in decision-making

Course Outcomes and their mapping with Program Outcomes & Program Specific Outcomes:

CO	PO												PSO		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	1	1			1			2			3	2		1
CO2	2	1	1			1			2			3	2		1
CO3	2	1	1			1			2			3	2		1
CO4	2	1	1			1			2			3	2		1
CO5	2	1	1			1			2			3	2		1

Weightage: **1-Sightly; 2-Moderately; 3-Strongly**

Sub Code	L	T	P	Duration	IA	ESE	Total	Credits
EC205PPC06	-	-	2	2 Hours	30	20	50	1

LIC & ITS APPLICATIONS LAB

Course Objectives:

- To develop basic operations of IC 741.
- To design and implement different linear and nonlinear applications of OPAMP.
- To design different filter, oscillator, and waveform generator circuits using OPAMP ICs.
- To design different multivibrator, modulator circuits using IC 555.

LIST OF EXPERIMENTS:

1. To use IC 741 as inverting and non-inverting amplifier and to study the effect of frequency on the performance (frequency response) of OPAMP IC 741.
2. To use IC 741 as adder and subtractor circuit.
3. To use IC 741 as an integrator and differentiator and to study corresponding effect of frequency on the performance (frequency response).
4. To study IC 741 performance as LOG and ANTI-LOG amplifier.
5. To design and study the performance of timer IC 555 as multivibrator: i) astable, ii) bistable and iii) monostable modes of operation.
6. To design and study IC 741 and IC 555 performance as schmitt trigger circuit.
7. To design and study IC 741 performance as low-pass filter of 1^{ST} and 2^{ND} order.
8. To design and study IC 741 performance as high-pass filter of 1^{ST} and 2^{ND} order.
9. To design and study IC 741 performance as wide and narrow band-pass filter of 1^{st} and 2^{nd} order.
10. To design and study IC 741 performance as phase-shift oscillator.
11. To design and study IC 741 performance as wein-bridge oscillator.
12. To design and study IC 741 performance as half-wave rectifier.
13. To design and study IC 741 performance as full-wave rectifier.
14. To design and study timer IC 555 performance as PWM modulator.

Course Outcomes:

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

CO1 Design and develop different linear and nonlinear applications of OPAMP.

CO2 Implement different multivibrator circuits.

CO3 Demonstrate and design filter using OPAMP ICs.

CO4 Demonstrate and design oscillator and waveform generator circuits using OPAMP ICs.

CO5 Implement different multivibrator circuits.

Course Outcomes and their mapping with Program Outcomes & Program Specific Outcomes:

CO	PO												PSO		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	1	1	1	1			2			3	2		1
CO2	3	2	1	1	1	1			2			3	2		1
CO3	3	2	1	1	1	1			2			3	2		1
CO4	3	2	1	1	1	1			2			3	2		1
CO5	3	2	1	1	1	1			2			3	2		1

Weightage: **1-Sightly; 2-Moderately; 3-Strongly**

Sub Code	L	T	P	Duration	IA	ESE	Total	Credits
EC205PPC07	-	-	2	2 Hours	30	20	50	1

ANALOG AND DIGITAL COMMUNICATION LAB

Course Objectives:

- Introduce the basic principles of continuous wave modulation and pulse modulation
- To Study the basics analog and digital modulation techniques
- To get the real time and practical exposure of communication system with detailed analysis of analog and digital communication techniques.

LIST OF EXPERIMENTS:

1. To study of amplitude modulation and demodulation.
2. To study of SSB-SC modulation and demodulation.
3. To study of frequency modulation and demodulation.
4. To study of phase modulation and demodulation.
5. To study of sampling techniques.
6. To study of pulse amplitude modulation and time division multiplexing.
7. To study of pulse width modulation & demodulation.
8. To study of pulse position modulation & demodulation.
9. To study of pulse code modulation & demodulation.
10. To study of line coding, performance of unipolar and bipolar systems.
11. To study of ASK, FSK and PSK modulation schemes.

Course Outcomes:

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

CO1 Analyze the fundamental concepts of analog communication systems.

CO2 Perform sampling process.

CO3 Implement the various the pulse modulation schemes for digital communication.

CO4 Examine the performance of coding in digital system.

CO5 Demonstrate the various digital modulation techniques.

Course Outcomes and their mapping with Program Outcomes & Program Specific Outcomes:

CO	PO												PSO		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	2	1		1			2			3	2		1
CO2	3	2	2	1		1			2			3	2		1
CO3	3	2	2	1		1			2			3	2		1
CO4	3	2	2	1		1			2			3	2		1
CO5	3	2	2	1		1			2			3	2		1

Weightage: **1-Sightly; 2-Moderately; 3-Strongly**

Sub Code	L	T	P	Duration	IA	ESE	Total	Credits
EC205PPC08	-	-	2	2 Hours	30	20	50	1

DIGITAL SIGNAL PROCESSING LAB

Course Objectives:

1. To develop basic signal operation such as linear and circular convolution.
2. To implement different transformation algorithms
3. To design FIR and IIR filters using different methods.
4. To analyze the concept of sampling rate conversion.
5. To implement real DSP modules for real time application.

LIST OF EXPERIMENTS:

1. To generate the random sequences and determine the correlation.
2. To verify linear and circular convolutions.
3. To compute DFT of sequence and its spectrum analysis.
4. To implement 8-point FFT algorithm.
5. To design of FIR filters using rectangular window techniques.
6. To design of FIR filters using triangular window techniques.
7. To design of FIR filters using kaiser window.
8. To design of butterworth IIR filter.
9. To design of chebyshev IIR filter.
10. To generate the down sample (decimation) by an integer factor,
11. To generate the up sample (interpolation) by an integer factor
12. To remove the noise in 1-D and 2-D signals

Course Outcomes:

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

CO1 Design and develop basic modules for signal generation and its operation

CO2 Demonstrate the applications of FFT to DSP.

CO3 Implement digital filters for various applications of DSP.

CO4 Implement multirate system

CO5 Analyze effect of DSP systems.

Course Outcomes and their mapping with Program Outcomes & Program Specific Outcomes:

CO	PO												PSO		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	2	1		1						3	2		1
CO2	3	2	2	1		1						3	2		1
CO3	3	2	2	1		1						3	2		1
CO4	3	2	2	1		1						3	2		1
CO5	3	2	2	1		1						3	2		1

Weightage: **1-Sightly; 2-Moderately; 3-Strongly**

B. TECH. III YEAR VI SEMESTER SCHEME

Sub Code	L	T	P	Duration	IA	ESE	Total	Credits
EC206TPC11	3	1	-	4 Hours	30	70	100	4

CMOS DIGITAL VLSI DESIGN

Course Objectives:

- To introduce the physics of MOSFETs.
- To understand MOS inverter and switching characteristics.
- To build upon the theoretical, mathematical and physical analysis of digital VLSI circuits, for proper understanding of concept, working, analysis and design.
- To impart knowledge of VHDL language.

UNIT-I

Fundamentals of MOSFETS: Introduction to MOS transistor, Basic operation, Threshold voltage, V-I characteristic, Depletion MOSFET, Transconductance, PMOS and its V-I characteristic, Aspect ratio and its implication, Channel length modulation, Substrate bias effect, Electrical parameters of MOSFETS, PMOS and NMOS Inverters.

UNIT-II

CMOS INVERTER: Introduction, Ideal inverter, Logic level standards, VTC of inverter, Noise margin, Basic NMOS inverter, CMOS inverter, Design technique, Inverter switching characteristic, Delay times, Transient effects, Power dissipation, Introduction to Bi-CMOS inverter

UNIT-III

Static and Dynamic Logic Circuits: Introduction, Various Static CMOS logic gate design, Pseudo-NMOS gates, Pass transistor logic, Transmission gates, Tristate buffer, Dynamic logic, Evaluate logic, Domino CMOS logic, Non ideal effects of dynamic logic circuits

UNIT-IV

Sequential and Combinational Circuits: Types of regenerative circuits, Bi-stability principle, Basics S-R flip flop, JK flip-flop, Master slave flip flop, D latch, Static Vs dynamic latch, Memory system, Types of semiconductor memory, Dynamic RAM, Static RAM.

UNIT-V

Introduction to VHDL: Introduction and use of VHDL, Entity and architecture declaration, Types of models of architecture, Data objects, Data types, Operators, Concurrent and sequential statements, Process statements, Case, If, When statements, Design of sequential and combinational circuits.

Text/Reference Book:

1. D. A. Pucknell & K. Eshraghian "Basic VLSI Design", 3rd ed., New York: Prentice Hal, 1994.
2. S. M. Kang and Y. Leblebici, "CMOS Digital Integrated Circuits", McGraw Hill, 2003.
3. N. H. E. Weste, D. Harris, and A. Banerjee, "CMOS VLSI Design- A Circuits and Systems Perspective", 3rd ed., Pearson Education, 2011.
4. J. Bhaskar, "A VHDL Primer", Revised ed., Prentice Hall, 1994.
5. S. Brown and Z. Vranesic, "Fundamentals of VLSI Design Techniques with VHDL", 3rd ed., McGraw

Hill, 2009.

Course Outcomes:

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

CO1 Comprehend the fundamental of MOS transistor and short channel effects.

CO2 Design a MOS inverter with different loads and analyze switching characteristics.

CO3 Understanding and designing of static & dynamic logic circuits.

CO4 Illustrate and design CMOS combinational & sequential Circuits.

CO5 Design an application using VHDL.

Course Outcomes and their mapping with Program Outcomes & Program Specific Outcomes:

CO	PO												PSO		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	2	1	1	1			2			2	3	1	2
CO2	3	3	2	1	1	1			2			2	3	1	2
CO3	3	3	3	1	1	1			2			2	3	3	2
CO4	3	3	3	1	1	1			2			2	3	3	2
CO5	3	3	1	1	1	1			2			2	3	1	1

Weightage: **1-Sightly; 2-Moderately; 3-Strongly**

Sub Code	L	T	P	Duration	IA	ESE	Total	Credits
EC206TPC12	3	-	-	3 Hours	30	70	100	3

DATA COMMUNICATION & COMPUTER NETWORK

Course Objectives:

- Build an understanding of the fundamental concepts of data communication in computer networking.
- Familiarize the student with the basic taxonomy and terminology of the computer networking area.
- Introduce the student to advanced networking concepts, preparing the student for entry Advanced courses in computer networking.
- Develop an understanding of modern network architectures from a design and performance perspective.

UNIT-I

Model of a digital communication system, OSI reference model, TCP/IP, Analog and digital transmission, Parallel and serial transmission, Asynchronous and synchronous transmission, Introduction to computer networks and the internet: Application layer, Principles of network applications, The web and hyper text transfer protocol, File transfer, Electronic mail, Domain name system, Peer-to-peer file sharing, Layering concepts, Review of different types of encoding.

UNIT-II

Switching in networks: Classification and requirements of switches, A generic switch, Circuit switching, Time-division switching, Space-division switching, Crossbar switch and evaluation of blocking probability, 2-stage, 3-stage and n-stage networks, Packet switching, Blocking in packet switches, Three generations of packet switches, Buffering, Multicasting.

UNIT-III

Multiplexing, Transport layer, Connectionless transport, User datagram protocol, Connection oriented transport, Transmission control protocol, Transport layer: Connectionless transport, User datagram protocol, Connection-oriented transport, Transmission control protocol, Congestion control and resource allocation, Issues in resource allocation, Queuing disciplines, TCP congestion control, Congestion avoidance mechanisms and quality of service.

UNIT-IV

Network layer: Virtual circuit and datagram networks, Router, Internet protocol, Routing algorithms, Broadcast and multicast routing.

UNIT-V

Link layer: ALOHA, Multiple access protocols, IEEE 802 standards, Local area networks, Addressing, Ethernet, Hubs, and Switches.

Text/Reference Book:

1. W. Stallings, “Data and computer communications”, 9th ed., Pearson Education, India, 2013.
2. B. A. Forouzan, “Data Communications and Networking”, Tata McGraw Hill, 4th ed., 2017.

3. J.F. Kurose and K. W. Ross, "Computer Networking – A top down approach featuring the Internet", Pearson Education, 6th ed., Pearson Education, 2017.
4. L. Peterson and B. Davie, "Computer Networks – A Systems Approach" 5th ed., Morgan Kaufmann, 2011.
5. T. Viswanathan, "Telecommunication Switching System and Networks", Prentice Hall Ltd., 1994.
6. A. Tanenbaum, "Computer networks", 6th ed., Prentice Hall, 2022.
7. D. Comer, "Computer Networks and Internet/TCP-IP", 8th ed., Prentice Hall, 2007.

Course Outcomes:

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

CO1 Contrast the concept of signals, OSI & TCP/IP reference models and discuss the functionalities of each layer in these models.

CO2 Comprehend and analyze the concepts of networking switching.

CO3 Illustrates the details of transport layer protocols (UDP, TCP) and suggest appropriate protocol in reliable/unreliable communication.

CO4 Describe and analyze the function of the network layer.

CO5 Discuss and analyze the function of the link layer.

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Course Outcomes and their mapping with Program Outcomes & Program Specific Outcomes:

CO	PO												PSO		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	1	1	1	2				2			2	2	1	2
CO2	3	2	2	1	2				2			2	2	1	2
CO3	3	2	2	1	2				2			2	2	1	2
CO4	3	2	2	1	2				2			2	2	1	2
CO5	3	2	2	1	2				2			2	2	1	2

Weightage: **1-Sightly; 2-Moderately; 3-Strongly**

Sub Code	L	T	P	Duration	IA	ESE	Total	Credits
EC206TPC13	3	-	-	3 Hours	30	70	100	3

MICROPROCESSOR AND MICROCONTROLLER

Course Objectives:

- To develop basic concept of microprocessor and learn assembly language programming.
- To learn about the memory interfacing and concept of advance microprocessor.
- To learn the basic concept of various programmable interfacing devices.
- To get the basic knowledge of concept of microcontroller and its programming tools.
- To learn the interfacing of various devices with microcontroller and also learn the introductorypart of embedded system.

UNIT-I

History and evolution of microprocessor and microcontroller, Microprocessor based system, Architecture and pin diagram of 8085 microprocessor, Register organization, Timing and control module, Multiplexing concept of buses, Instruction set and assembly language program.

UNIT-II

Addressing modes, Memory interfacing, I/O interfacing, Address decoding, Interrupts, Instruction execution cycle, Subroutine instructions, Stack, Stack related instructions.

Advanced microprocessor, Intel 8086 Architecture, Register organization, Memory organization, Pipeline structure, Instructions set, 8086 Interrupt.

UNIT-III

8255 PPI, Various modes of operation, 8254 timer/ counter, Serial communication standards, Serial data transfer schemes, 8251 USART architecture and interfacing, DMA controller and its operation, Interrupt controller, LCD & keyboard interfacing-ADC, DAC & sensor interfacing, External memory interface, Stepper motor and waveform generation.

UNIT-IV

Microcontroller: Introduction to microcontroller, Embedded Vs external memory devices, CISC and RISC processor, Harvard and von neumann architecture, 8051 Microcontroller, Architecture, Register and memory organization, 8051 Assembly language programming tools.

UNIT-V

PIC Microcontrollers: Introduction to PIC 16C6X/7X, Family microcontroller, Architectures, Registers, Register file structure, Addressing mode, Instruction set, Interrupt structure, Timers, Counters, I/O port concepts, Peripheral interfacing and application.

Basic of ARM Architecture: Introduction to ARM, Microprocessor and its features, Architecture, Programming model, CISC and RISC architectures comparison, Advantages of RISC.

Introduction to embedded system, Characteristics of embedded system, Designing issues and challenges in embedded system, Various designing methods of embedded system.

Text/Reference Book:

1. D. V. Hall, “Microprocessors and Interfacing”, Tata McGraw Hill, 2nd ed., 2006.
2. A. K. Ray and K. M. Bhurchandani, “Advanced Microprocessors and Peripherals”, 3rd ed., Tata

McGraw Hill, 2013.
3. R. S. Gaonkar, " Microprocessor Architecture, Programming and Application with the 8085", 6th ed., Penram International Publishing, 2013.
4. Liu and G. A. Gibson, "Microcomputer System 8086/8088 Family Architecture, Programming and Design", 2nd ed., Prentice Hall India Learning Private Ltd., 1985.
5. K. J. Ayala, "The 8051 Microcontroller", Cengage Learning India, 2007.
6. K. U. Rao and A. Pallavi, "The 8051 Microcontrollers, Architecture, Programming and Applications", Pearson, 2009.
7. A. V. Deshmukh, "Microcontrollers and Application", Tata McGraw Hill, 2005.

Course Outcomes:

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

CO1 Make Assembly language program and project based on it.

CO2 Apply the knowledge of interfacing and advanced level of programming.

CO3 Apply the knowledge of interfacing devices and its modes of operations.

CO4 Apply the knowledge of microcontroller and its programming.

CO5 Make the project based on the microcontroller and can design the embedded system.

Course Outcomes and their mapping with Program Outcomes & Program Specific Outcomes:

CO	PO												PSO		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	2	2							3	3	2	
CO2	3	3	3	2	1							3	3	2	
CO3	3	2	2	2	1							3	3	2	
CO4	3	2	2	2	1							3	2	2	
CO5	3	2	2	2	2							3	3	2	

Weightage: **1-Sightly; 2-Moderately; 3-Strongly**

Sub Code	L	T	P	Duration	IA	ESE	Total	Credits
EC206TES07	3	-	-	3 Hours	30	70	100	3

ELECTRONIC MEASUREMENTS AND SENSORS

Course Objectives:

- To understand the working of basic measurement system and sources in measurement system.
- To study static and dynamic characteristic of instrument.
- To study the design of bridge circuit and different types of electronic voltmeter.
- To understand the working principle of sensors and transducers.
- To study the basic features of display devices, DVM, Recorders and CRO.

UNIT-I

Measurements and Measurement System: Measurements, Significance of measurement, Methods of measurement- Direct and indirect method, Instruments and measurement system: Mechanical, Electrical, Electronic instruments, Classification of instruments: Deflection and null type instruments, Analog and digital mode of operation, Application of measurement system, Characteristics of instrument and measurement system: static & dynamic, Elements of a generalized measurement system: Primary sensing element, Variable conversion element, Data presentation element, Accuracy and precision, Significant figure, Types of error, Gross error, Systematic error, Instrumental, Environmental, Observational errors, Random error, Probability of error, Probable error of a finite number of readings for combination of components, Limiting error.

UNIT-II

Electromechanical Indicating Instruments: Operating forces, Constructional details, Types of support, Torque/weight ratio, Control system, Damping-air friction and eddy current damping, D'Arsonaval galvanometer construction, Torque equation, Dynamic behavior, Undamped, Damped, Over damped motion, Response of galvanometer, Ballistic galvanometer, PMMC-construction, Torque equation, Voltage/current measurement: Ammeter, Voltmeter, Ohmmeter, Multimeter (V.O.M.), Ratiometer, Megger, High frequency measurement: Q-meter.

UNIT-III

AC Bridge: Introduction, Sources and detectors, General equation for bridge balance, General form of AC bridge, Maxwell's bridge, Hay's bridge, Anderson's bridge, De-Sauty's bridge, Schering bridge, Wien's bridge, Electronic Instruments: Introduction, Advantage of electronic voltmeter, VTVM, Differential voltmeter, Electronic voltmeter using rectifier, True RMS reading voltmeter, Calorimeter, Power meter, Energy meter.

UNIT-IV

Sensor & Transducers: Classification of transducer, Primary & secondary, Passive & active, Analog & digital, Potentiometer, Loading effect, Strain Gauge, Thermistor, Construction of thermistor, Thermocouple, LVDT, Advantage & disadvantage of LVDT, RVDT, Capacitive transducer, Piezo-electric transducer, Hall effect transducer, Capacitive transducer, Pressure transducer, Mechanical sensors, Fiber-optic sensors, Nano-sensors, Magnetic field, Microwave and radiation sensors, Vision and imaging sensors, Chemical sensor, Comparisons and selection.

UNIT-V

Display Devices: Digital display method, Segmental display-7segment & 14 segment display, Dot matrix, LED, LCD, TFT, Plasma display, DLP, Digital voltmeter (DVM): Types of DVM, Ramp type DVM, Integrating type DVM, Potentiometer type (non-integration type), Recorder: Analog recorder, Null type recorder, Single point recorder, Graphical strip chart, X-Y recorders, Magnetic tape recorder, FM recorder CRO: Introduction, Oscilloscope block diagram, CRT, Functional block diagram of sampling, Storage, Dual trace and dual beam oscilloscope.

Text/Reference Book:

1. W. D. Cooper and A. D. Helfrick, "Modern Electronic Instrumentation and Measurement Technique", PHI, 2000.
2. A. K. Sawhney, "A Course in Electrical and Electronic Measurements and Instrumentation", Dhanpat Rai & Sons, 2010.
3. E. Udd and W. B. Spillman Jr., "Fiber Optics Sensors: An Introduction for Engineers and Scientists", Wiley Publishers, 2011.
4. K. Kant, "Microprocessor based Instrumentation for Agriculture Industry", PHI Publication, 2010.

Course Outcomes:

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

CO1 Explain the principle of operation of generalized measurement system and different sources of errors in measurements.

CO2 Analyze different static and dynamic characteristics of instrument & based on this will able to select particular instrument for measurement.

CO3 Design AC bridges for relevant parameters measurement and application of electronic voltmeter.

CO4 Classify and select transducer for particular applications.

CO5 Demonstrate the use of different types of display devices, digital voltmeter, recorders and CRO.

Course Outcomes and their mapping with Program Outcomes & Program Specific Outcomes:

CO	PO												PSO		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	2	1					3	1		2	3	2	2
CO2	3	3	2	3	3	3			3	1		2	3	2	3
CO3	3	3	2	3	3	3			3	1		2	3	3	3
CO4	3	3	2	3	3	3			3	1		2	3	3	3
CO5	3	3	2	3	3	3			3	1		2	3	3	3

Weightage: **1-Sightly; 2-Moderately; 3-Strongly**

Sub Code	L	T	P	Duration	IA	ESE	Total	Credits
EC206PPC09	-	-	2	2 Hours	30	20	50	1

CMOS DIGITAL VLSI DESIGN LAB

Course Objectives:

- To know the basic language features of verilog HDL and the role of HDL in digital logic design.
- To know the behavioural modeling of combinational and simple sequential circuits.
- To know the data flow modeling of combinational and simple sequential circuits.
- To know the structural modeling of combinational and simple sequential circuits.
- To know the synthesis of combinational and sequential descriptions.

LIST OF EXPERIMENTS:

1. To design and simulate various gates using VHDL.
2. To design and simulate half adder using VHDL.
3. To design and simulate full adder using VHDL.
4. To design and simulate multiplexer using VHDL.
5. To design and simulate demultiplexer using VHDL.
6. To design and simulate encoder using VHDL.
7. To design and simulate decoder using VHDL.
8. To design and simulate parity generator using VHDL.
9. To design different types of flip flops using VHDL.
10. To design and different types of counters using VHDL.

Course Outcomes:

CO1 Demonstrate knowledge on HDL design flow, digital circuits design, counter's flip flops.
CO2 Design and develop the combinational and sequential circuits using behavioral modeling.
CO3 Design and develop the combinational and sequential circuits using Data flow modeling.
CO4 Design and develop the combinational and sequential circuits using Structural modeling.
CO5 Analyze the process of synthesizing the combinational and sequential descriptions.

Course Outcomes and their mapping with Program Outcomes & Program Specific Outcomes:

CO	PO												PSO		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	2	2	3				3			3	3	2	2
CO2	3	2	2	2	3				3			3	3	2	2
CO3	3	2	2	2	3				3			3	3	3	2
CO4	3	2	2	2	3				3			3	3	3	3
CO5	3	2	2	2	3				3			3	3	3	3

Weightage: **1-Sightly; 2-Moderately; 3-Strongly**

Sub Code	L	T	P	Duration	IA	ESE	Total	Credits
EC206PPC10	-	-	2	2 Hours	30	20	50	1

DATA COMMUNICATION AND COMPUTER NETWORK LAB

Course Objectives:

- Channel capacity theorem and its analysis.
- Details of ethernet and network topologies.
- Details of different network protocols.

LIST OF EXPERIMENTS:

1. Study of channel capacity theorems.
2. Study of shannon- feno code.
3. Study of differential manchester code.
4. Program to calculate channel capacity and its plot.
5. Program to calculate received SINR from given channel capacity and bandwidth and also its plot.
6. Design of Ethernet.
7. Study of network topologies.
8. Study of flow control protocols.
9. Study of selective repeat protocol.
10. Study of pure aloha protocol.

Course Outcomes:

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

CO1 Analyze channel capacity and its analysis.

CO2 Comprehend different types of ethernet and its design.

CO3 Comprehend different types of network topologies and its working.

CO4 Illustrates different types of flow control methods and its working

CO5 Illustrates different other network protocols.

Course Outcomes and their mapping with Program Outcomes & Program Specific Outcomes:

CO	PO												PSO		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	1	2	2	3							3	3	2	1
CO2	3	1	2	2	3							3	3	2	1
CO3	3	1	2	2	3							3	3	2	2
CO4	3	1	2	2	3							3	3	2	2
CO5	3	1	2	2	3							3	3	2	2

Weightage: **1-Sightly; 2-Moderately; 3-Strongly**

Sub Code	L	T	P	Duration	IA	ESE	Total	Credits
EC206PES06	-	-	2	2 Hours	30	20	50	1

ELECTRONIC MEASUREMENT AND SENSORS LAB

Course Objectives:

- To introduce students to monitor, analyze and control any physical system.
- To understand students how different types of meters work and their construction.
- To introduce students a knowledge to use modern tools necessary for electrical projects.

LIST OF EXPERIMENTS:

1. Measurement of unknown self-inductance using Maxwell inductance bridge.
2. Measurement of unknown self-inductance of high quality factor using Hay's bridge.
3. Measurement of unknown self-inductance using Anderson bridge.
4. Measurement of unknown capacitance using De-Saunty's bridge.
5. Measurement of unknown capacitance using Wein's series resistance bridge.
6. Measurement of unknown capacitance using Schering's bridge.
7. To determine the sensitivity of LVDT and hence to show linear range of operation of LVDT.
8. To study the input/output characteristics of LVDT.
9. To study the characteristics of the thermocouple.
10. To study Galvanometer.

Course Outcomes:

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

CO1 Identify different measuring instruments for the measurement of various electrical and non-electrical parameters.

CO2 Design different bridges to find unknown values of self-inductance.

CO3 Design different bridges to find unknown values of capacitance.

CO4 Analyze the sensitivity and characteristics of LVDT

CO5 Analyze the characteristics of thermocouple.

Course Outcomes and their mapping with Program Outcomes & Program Specific Outcomes:

CO	PO												PSO		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	1	2	2					2			2	3	2	1
CO2	3	1	2	2					2			2	3	2	1
CO3	3	1	2	2					2			2	3	2	1
CO4	3	1	2	2					2			2	3	2	1
CO5	3	1	2	2					2			2	3	2	1

Weightage: **1-Sightly; 2-Moderately; 3-Strongly**

PROGRAM ELECTIVE

Sub Code	L	T	P	Duration	IA	ESE	Total	Credits
EC206TPE01	3	-	-	3 Hours	30	70	100	3

INFORMATION THEORY & CODING

Course Objectives:

- To study the concept of information and entropy
- To study Shannon's theorem for coding
- To analyze channel capacity
- To study various channel coding techniques for error correction and detection

UNIT-I

Source Coding: Introduction to information theory, Uncertainty and information, Average mutual information and entropy, Information measures for continuous random variables, Source coding theorem, Huffman coding.

UNIT-II

Channel Capacity Coding: Channel models, Channel capacity, Channel coding, Information capacity theorem, Shannon limit, Markov sources.

UNIT-III

Error Control Coding (Channel Coding) Linear Block Codes for Error Correction & Cyclic Codes: Introduction to error correcting codes, Basic definitions, Matrix description of linear block codes, Equivalent codes, Parity check matrix, Decoding of a linear block code, Syndrome decoding, Hamming codes. Cyclic Codes: Polynomials, The division algorithm for polynomials, A method for generating cyclic codes, Matrix description of cyclic codes, Burst error correction.

UNIT-IV

Convolution Codes: Introduction to convolution codes, Tree codes and Trellis codes, Polynomial description of convolution codes (analytical representation), Distance notions for convolution codes, The generating function, Matrix description of convolution codes, Viterbi decoding, Distance bounds for convolution codes.

UNIT-V

Turbo Codes: Turbo codes, Turbo decoding, Distance properties of turbo codes, Convergence of turbo codes.

Text/Reference Books:

1. R. Bose, "Information Theory, Coding and Cryptography," Tata McGraw-Hill Education, 2008.
2. S. Haykin, "Digital Communications," Wiley India Edition, 2009.
3. N. Abramson, "Information and Coding," McGraw Hill, 1963.
4. M. Mansurpur, "Introduction to Information Theory," McGraw Hill, 1987.
5. R.B. Ash, "Information Theory," Prentice Hall, 1970.

6. S. Lin and D.J. Costello Jr., "Error Control Coding," Prentice Hall, 1983.

Course Outcomes:

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

CO1 Analyze the self and mutual information and apply the concept of information theory.

CO2 Evaluate the information capacity of discrete memory-less channels and determine possible code rates achievable on such channels.

CO3 Apply linear block and cyclic codes for error detection and correction.

CO4 Apply convolution codes for error detection and correction.

CO5 Apply turbo coding and decoding for error detection and correction.

Course Outcomes and their mapping with Program Outcomes & Program Specific Outcomes:

CO	PO												PSO		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	2	2	1							3	3	1	2
CO2	3	3	2	2	2							3	3	2	2
CO3	3	3	2	3	2							3	3	1	2
CO4	3	3	2	3	2							3	3	1	2
CO5	3	3	2	3	2							3	3	1	2

Weightage: **1-Sightly; 2-Moderately; 3-Strongly**

Sub Code	L	T	P	Duration	IA	ESE	Total	Credits
EC206TPE02	3	-	-	3 Hours	30	70	100	3

ADVANCE SIGNAL PROCESSING

Course Objectives:

1. To develop basic idea of multi rate filter bank design
2. To develop the understanding the concept of prediction of future signals
3. To introduce the fundamental concepts for adaptive filter designs.
4. To analyze the concept of estimation theory for signal analysis
5. To explore the concept of multi-resolution transformation.

UNIT-I

Multirate Digital Signal Processing: Decimation and interpolation, Multistage implementation of sampling rate conversion, Applications of multirate signal processing, Digital filter banks, Two channel quadrature mirror filter banks.

UNIT-II

Linear Prediction and Optimum Linear Filters: Random signals, Correlation functions and power spectra, Innovations representation of a stationary random process, Forward and backward linear prediction, Solution of the normal equations, The Levinson-Durbin algorithm, Properties of the linear prediction-error filters.

UNIT-III

Adaptive Filters: Applications of adaptive filters, Adaptive channel equalization, Adaptive noise cancellation, Linear predictive coding of speech signals, Adaptive direct form FIR filters, The LMS algorithm, Properties of LMS algorithm, Adaptive direct form filters, RLS algorithm.

UNIT-IV

Power Spectrum Estimation: Parametric and non parametric methods for power spectrum estimation, Methods for the AR model parameters, ARMA model for power spectrum estimation.

UNIT-V

Wavelet Transform: Origin of wavelets, Wavelets and other reality transforms, History and future of wavelets, Short time Fourier transform, Continuous wavelet, Discrete wavelet transform.

Text/Reference Books:

1. J. G. Proakis and D. G. Manolakis, “Digital Signal Processing, Principles, Algorithms and Applications”, 4th ed., Pearson, 2007.
2. S. Haykin, “Adaptive Filter Theory”, Prentice Hall, Englewood Cliffs, NJ, 1991.
3. K. P. Soman, Ramachandran, Resmi, “Insight into Wavelets- from Theory to Practice”, 3rd ed., PHI, 2010.
4. P. P. Vaidyanathan, “Multi Rate Systems and Filter Banks”, Prentice Hall, 1993.
5. S. Mallet, “A Wavelet Tour of Signal Processing”, Academic Press, 1998.

Course Outcomes:

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

CO1 Apply knowledge of multi-rate signal processing and concept of decimators and interpolators.

CO2 Analyze the signals using prediction based filtering.

CO3 Design adaptive filters for a given application.

CO4 Implement various estimation algorithm for signal analysis.

CO5 Develop advanced signal processing tools, including wavelet transform.

Course Outcomes and their mapping with Program Outcomes & Program Specific Outcomes:

CO	PO												PSO		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	1	1	1						1	2	3	3
CO2	3	3	3	3								1	2	3	3
CO3	3	3	2	1		1						1	2	2	3
CO4	3	3	3	2								1	2	3	3
CO5	3	3	3	2	1	1						1	2	3	3

Weightage: **1-Sightly; 2-Moderately; 3-Strongly**

Sub Code	L	T	P	Duration	IA	ESE	Total	Credits
EC206TPE03	3	-	-	3 Hours	30	70	100	3

RENEWABLE ENERGY SOURCES

Course Objectives:

- Awareness about renewable Energy Sources and technologies.
- Adequate inputs on wind power plants
- To learn basics of solar energy and its extraction
- To learn power generation process using biomass and hydroelectric system
- To know details of other renewable energy sources and their storage.

UNIT-I

Renewable Energy (RE) Sources: Environmental consequences of fossil fuel use, Importance of renewable sources of energy, Sustainable design and development, Types of RE sources, Limitations of RE sources, Present Indian and International energy scenario of conventional and RE sources

UNIT-II

Wind Energy: Power in the wind, Types of wind power plants (WPPs), Components of WPPs, Working of WPPs, Siting of WPPs, Grid integration issues of WPPs.

UNIT-III

Solar PV and Thermal Systems: Solar radiation, Radiation measurement, Solar thermal power plant, Central receiver power plants, Solar ponds, Thermal energy storage system with PCM, Solar photovoltaic systems, Basic principle of SPV conversion, Types of PV systems, Types of solar cells, Photovoltaic cell concepts: cell, module, array, PV module, I-V characteristics, Efficiency & quality of the cell, Series and parallel connections, Maximum power point tracking, Applications.

UNIT-IV

Biomass Energy: Introduction, Bio mass resources, Energy from bio mass: conversion processes, Biomass cogeneration, Environmental benefits, Geothermal energy: Basics, Direct use, Geothermal electricity, Mini/micro hydro power: Classification of hydropower schemes, Classification of water turbine, Turbine theory, Essential components of hydroelectric system.

UNIT-V

Other Energy Sources: Tidal Energy: Energy from the tides, Barrage and non barrage Tidal power systems, Wave energy: Energy from waves, Wave power devices, Ocean thermal energy conversion (OTEC), Hydrogen production and storage, Fuel cell: Principle of working, Various types, Construction and applications, Energy storage system, Hybrid energy systems.

Text/ Reference Books:

1. J. Earnest and T. Wizeliu, "Wind Power Plants and Project Development", PHI Learning Pvt.Ltd, New Delhi, 2011.
2. D. P. Kothari, K.C Singal, and R. Ranjan, "Renewable Energy Sources and Emerging Technologies", PHI Learning Pvt.Ltd, New Delhi, 2013.
3. S. Grinnell, "Renewable Energy & Sustainable Design", Cengage Learning, USA, 2016.
4. B. A. Striebig, A. A. Ogundipe, and M. Papadakis, "Engineering Applications in Sustainable Design and Development", Cengage Learning India Private Limited, Delhi, 2016.
5. S. N. Singh, "Non-conventional Energy Resources", Pearson Education, 2015

Course Outcomes:

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

CO1 Create awareness about renewable energy Sources and technologies.

CO2 Comprehend basics of wind energy and grid integration issues

CO3 Acquire knowledge about solar energy extraction and their usage

CO4 Comprehend basics about biomass energy and hydroelectric systems

CO5 Illustrates the various renewable other energy resources and technologies and their applications.

Course Outcomes and their mapping with Program Outcomes & Program Specific Outcomes:

CO	PO												PSO		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	1	2	1		2	3					2	1		2
CO2	3	1	2	2		2	3					2	1		2
CO3	3	2	3	2		2	3					2	1		2
CO4	3	2	3	2		2	3					2	1		2
CO5	3	2	3	2		2	3					2	1		2

Weightage: **1-Sightly; 2-Moderately; 3-Strongly**

Sub Code	L	T	P	Duration	IA	ESE	Total	Credits
EC206TPE04	3	-	-	3 Hours	30	70	100	3

INTRODUCTION TO MEMS

Course Objectives:

- To provide knowledge of semiconductors and solid mechanics to fabricate MEMS devices.
- To educate on the rudiments of micro fabrication techniques.
- To introduce various sensors and actuators.
- To introduce different materials used for MEMS.
- To educate on the applications of MEMS to disciplines beyond electrical and mechanical engineering.

UNIT-I

Introduction: Intrinsic characteristics of MEMS, Energy domains and transducers, Sensors & actuators, Introduction to micro-fabrication, Silicon based MEMS processes, New materials, Review of electrical and mechanical concepts of MEMS, Semiconductor devices, Stress and strain analysis, Flexural beam bending, Torsional deflection.

UNIT-II

Sensors and Actuators-I: Electrostatic sensors, Parallel plate capacitors, Applications interdigitated finger capacitor, Comb drive devices, Micro grippers, Micro motors, Thermal sensing and actuation, Thermal expansion, Thermocouples, Thermal resistors, Thermal bimorph, Applications, Magnetic actuators, Micromagnetic components, Case studies of MEMS in magnetic actuators, Actuation using shape memory alloys.

UNIT-III

Sensors and Actuators-II: Piezoresistive sensors, Piezoresistive sensor materials, Stress analysis of mechanical elements, Applications to inertia, Pressure, Tactile and flow sensors, Piezoelectric sensors and actuators, Piezoelectric effects, Piezoelectric materials, Applications to inertia, Acoustic, Tactile and flow sensors.

UNIT-IV

Micromachining: Silicon anisotropic etching, Anisotropic wet etching, Dry etching of silicon, Plasma etching, Deep reaction ion etching (DRIE), Isotropic wet etching, Gas phase etchants, Case studies, Basic surface micro machining processes, Structural and sacrificial materials, Acceleration of sacrificial etch, Striction and antistriction methods, LIGA process, Assembly of 3D MEMS, Foundry process.

UNIT-V

Polymer and Optical MEMS: Polymer in MEMS, Polimide, SU-8, Liquid crystal polymer (LCP), PDMS, PMMA, Parylene, Fluorocarbon, Applications to acceleration, Pressure, Flow and tactile sensors, Optical MEMS, Lenses and mirrors, Actuators for active optical MEMS.

Text/Reference Books:

1. C. Liu, "Foundations of MEMS", Pearson Education Inc., 2012.
2. S. D. Senturia, "Microsystem Design", Springer publication, 2000.
3. T. R. Hsu, "MEMS & Micro Systems Design and Manufacture", Tata McGraw Hill, New Delhi, 2002.
4. N. P. Mahalik, "MEMS", Tata McGraw-Hill Companies, 2011.
5. N. Maluf, " An Introduction to Micro Electro Mechanical System Design", Artech House, 2000.
6. M. Gad-el-Hak, editor, "The MEMS Handbook", CRC Press, 2001.
7. J. W. Gardner, V. K. Varadan, and O. O. Awadelkarim, "Micro sensors MEMS and Smart Devices", John Wiley & Sons Ltd., 2002.

Course Outcomes:

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

CO1 Understand the operation of micro devices, micro systems and their applications.

CO2 Design the micro devices, micro systems using the MEMS fabrication process.

CO3 Gain knowledge of basics approaches for various sensor and actuator design.

CO4 Choose micromachining techniques for a specific MEMS fabrication.

CO5 Develop experience on micro/nano systems for polymer and photonics.

Course Outcomes and their mapping with Program Outcomes & Program Specific Outcomes:

CO	PO												PSO		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	1	2	3	3	3			3	1		2	3	1	3
CO2	3	2	3	3	3	3			3	1		2	3	3	3
CO3	3	2	3	1	3	3			3	1		2	3	3	3
CO4	3	1	2	1	3	3			3	1		2	3	3	3
CO5	3	3	3	1	3	3			3	1		2	3	3	3

Weightage: **1-Sightly; 2-Moderately; 3-Strongly**

OPEN ELECTIVE-1

Sub Code	L	T	P	Duration	IA	ESE	Total	Credits
EC206TOE01	3	-	-	3 Hours	30	70	100	3

INTRODUCTION TO ELECTRONIC DEVICES & CIRCUITS

Course Objectives:

- To develop basic concept of semiconductor materials and physics.
- To introduce different methods of DC analysis and AC models of semiconductor devices.
- To develop the concept and analysis of transistor characteristics, biasing and thermal stabilization.
- To help students develop various designs of amplifiers and its applications.

UNIT-I

Semiconductor Concept: Atomic structure, Bohr's atom model, Energy band theory of crystals, Energy band structures in metals, Semiconductors and insulators, Forbidden energy gap, Electrical properties of Ge and Si, Conductivity equation, Mobility and conductivity, Electron and holes in intrinsic and extrinsic semiconductors, P type and N type semiconductors– majority and minority carriers, Mass action law, Hall effect, Carrier generation and recombination, Carrier transport: diffusion and drift process, Variation of semiconductor conductivity, Resistance and bandgap with temperature and doping.

UNIT-II

PN Junction Diode: Properties of P-N junction, Open circuited P-N junction, Behaviour of P-N junction under forward and reverse bias, Current component of PN diode, V-I characteristics, Temperature dependence of V-I characteristics, Ideal diode, Breakdown phenomenon: Zener and avalanche breakdown, Diode resistance: Static and dynamic resistance, Diode capacitance: transition and diffusion capacitance, Switching characteristics.

UNIT-III

Special Purpose Diodes: Zener diode, Varactor diode, Tunnel diode, Photodiode, Light emitting diodes- construction, working and characteristics, Applications of diodes: Half-wave diode rectifier, Full-wave rectifier, Clippers and Clampers.

UNIT-IV

Transistors: Definition, Formation of transistor- PNP and NPN, Symbols, Working principle, Regions of operation, Transistor current components, Transistor construction, Common base, Common emitter & Common collector configurations and their characteristics, Early effect, Current gains: α, β, and γ relation between them, Simple problems, Comparison of CB, CE and CC modes, Transistor as a switch, Transistor as an amplifier, Thermal runaway, Thermal stability.

UNIT-V

Field Effect Transistor: JFET construction, Operation, V-I characteristics, Transfer characteristics, Drain characteristics, FET as voltage variable resistor, Metal oxide semiconductor field effect transistor (MOSFET): construction and working of enhancement and depletion modes, Drain and transfer characteristics, Application of MOSFET as a switch, Comparison of JFET & MOSFET.

Text/Reference Books:

1. J. Millman and C. C. Halkias, "Electronic Devices and Circuits", Tata McGraw Hill Publishing Limited, New Delhi, 2003.
2. A. Mottershead, "Electronic Devices and Circuits- An Introduction", Prentice Hall of India Private Limited, New Delhi, 2003
3. R. Boylestad and L. Nashelsky, "Electronic Device & Circuit Theory", 11th ed., Pearson, 2013.
4. B. G. Streetman and S. Banerjee, "Solid State Electronic Devices", Pearson Education, 2002 / PHI
5. S. M. Sze and K. N. Kwok, "Physics of Semiconductor Devices," 3rd ed., John Wiley & Sons, 2006.
6. T. F. Boghert, "Electronic Devices & Circuits", Pearson Education, 6th ed., 2003.

Course Outcomes:

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

CO1: Illustrate the knowledge of semiconductor physics.

CO2: Understand the characteristics of the PN junction diode, special diodes and its application in electronic circuits.

CO3: Elucidate and analyze the characteristics and performance of transistors.

CO4: Analyze the concept of load line and design biasing circuits of transistor.

CO5: Comprehend the understanding of power electronic devices for industrial application.

Course Outcomes and their mapping with Program Outcomes & Program Specific Outcomes:

CO	PO												PSO		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	2	1					3	1		2	3		2
CO2	3	3	2	3	3	3			3	1		2	3	2	3
CO3	3	3	2	3	3	3			3	1		2	3	3	3
CO4	3	3	2	3	3	3			3	1		2	3	3	3
CO5	3	3	2	3	3	3			3	1		2	3	3	3

Weightage: **1-Sightly; 2-Moderately; 3-Strongly**