GURU GHASIDAS VISHWAVIDYALAYA, BILASPUR (C.G.)
(A CENTRAL UNIVERSITY)

SCHOOL OF STUDIES OF ENGINEERING AND TECHNOLOGY
DEPARTMENT OF ELECTRONICS & COMMUNICATION ENGG.

Scheme of Teaching and Evaluation 2023-24 (As Per NEP-2020)
Choice Based Credit System (CBCS) and Outcome Based Education (OBE)
B. TECH. SECOND YEAR (Electronics and Communication Engineering)
(Effective from the Academic Year 2023-24)

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.

III-SEMESTER SCHEME OF TEACHING & EVALUATION 2023-24

S. N.	Course Type	Course Code	Course Title	Teaching Hours/week			Examination				Credits
				Theory lectures	Tutorial	Practical/Drawing	Examination in Hrs	CIA Marks	SEA Marks	Total Marks	
				L	T	P					
1	Ancient Science/Management/ Psychology	ECUCTE1	Engineering Economics	3	-	-	03	40	60	100	3
2	Department Core	ECUCTT1	Electronic Devices	3	-	-	03	40	60	100	3
3	Department Core	ECUCTT2	Digital Logic Design	3	-	-	03	40	60	100	3
4	Department Core	ECUCTT3	Networks, Signals and Systems	3	1	-	03	40	60	100	4
5	Department Elective	ECUCTK1	Transmission Line & Electromagnetic Waves	3	-	-	03	40	60	100	3
		ECUCTK2	Electronic Measurements and Instrumentation								
6	Institute Core/OE	EC UCTO1	Data Communication	3	-	-	03	40	60	100	3
		CSUCTO1	Data Structure with C++								
		ITUCTO1	Computer Organization & Architecture								
		CEUCTO1	Green Buildings								
		CHUCTO1	Engineering Materials								
		MEUCTO1	Introduction to Thermodynamics								
		IPUCTO1	I.C. Engine								
7	Practical	ECUCLT1	Electronics Devices Lab	-	-	2	03	25	25	50	1
8	Practical	ECUCLT2	Digital Logic Design Lab	-	-	2	03	25	25	50	1
Total				**18**	**1**	**04**	**24**	**290**	**410**	**700**	**21**

IV-SEMESTER SCHEME OF TEACHING & EVALUATION 2023-24

S. N.	Course Type	Course Code	Course Title	Teaching Hours/ week			Examination				Credits
				Theory lectures	Tutorial	Practical/Drawing	Examination in Hours	CIA Marks	SEA Marks	Total Marks	
				L	T	P					
1	Department Core	ECUDTT1	Analog Circuits	3	-	-	03	40	60	100	3
2	Department Core	ECUDTT2	Analog and Digital Communication	3	1	-	03	40	60	100	4
3	Department Core	ECUDTT3	Control Systems	3	-	-	03	40	60	100	3
4	Department Elective	ECUDTK1	Probability Theory & Random Process	3	-	-	03	40	60	100	3
		ECUDTK2	Sensors & Actuators								
		ECUDTK3	Antenna & Wave Propagation								
5	Institute Core/OE	ECUDTO1	Introduction to Electronics Devices and Circuits	3	-	-	03	40	60	100	3
		ITUDTO1	Computer Network								
		ITUDTO2	Fundamentals of Python Programming								
		CSUDTO1	Introduction to Information Science								
		CEUDTO1	Remote Sensing & GIS								
		CHUDTO1	Fluidization Engineering								
		MEUDTO1	Introduction to Fluid Mechanics								
		IPUDTO1	Automobile Engineering								
6	Practical	ECUDLT1	Analog Circuits Lab	-	-	2	03	25	25	50	1
7	Practical	ECUDLT2	Analog and Digital Communication Lab	-	-	2	03	25	25	50	1
8	Mini Project	ECUDPV1		-	-	4	03	50	50	100	2
Total				**15**	**1**	**08**	**24**	**300**	**400**	**700**	**20**

Credit Definition:

- ➢1-Hour lecture **(L)** per week per semester = **1Credit**
- ➢1-Hour tutorial **(T)** per week per semester = **1Credit**
- ➢2-Hour Practical/Drawing**(P)** per week per semester = **1 Credit**

- ➢**Four credit** courses are to be designed for **50** Hours of Teaching-Learning process.
- ➢**Three credit** courses are to be designed for **40** Hours of Teaching-Learning process.
- ➢**Two credit** courses are to be designed for **30** Hours of Teaching-Learning process.
- ➢**One credit** courses are to be designed for **15** Hours of Teaching-Learning process

Note: The above is applicable only to THEORY courses

B. TECH. II YEAR III SEMESTER SCHEME

Sub Code	L	T	P	Duration	IA	ESE	Total	Credits
ECUCTE1	3	-	-	3 Hours	40	60	100	3

ENGINEERING ECONOMICS

Course Objectives:

- To analyze cost/revenue data and carry out make economic analyses in the decision-making process
- To justify or reject alternatives/projects on an economic basis.

UNIT-I

Basic concepts and definitions, Methodology of economics, Demand and supply-elasticity, Theory of the firm and market structure, Price and output determinations in different types of market.

UNIT-II

Public sector economics, Welfare economics, Central and commercial marks and their functions, Industrial policies, Theory of localization, Weber & surgent florence theory, Investment analysis-NPV, ROI, IRR, Payback period, SWOT analysis.

UNIT-III

Monetary and fiscal Policy, Tools, Impact on the economy, Inflation, Business cycle, Cash flow- 2, 3, 4 model.

UNIT-IV

Business forecasting, Elementary techniques, Cost and revenue analysis, Capital budget, Break even analysis.

UNIT-V

Indian economy, Urbanization, Unemployment–poverty, Regional disparities, Unorganized sectors- roll of plans, Reforms-post independent period.

Text/Reference Books:

1. N. M. Gregory, "Principles of Economics", Thompson Asia, 2002.
2. V. Mote, S. Paul, and G. Gupta, "Managerial Economics", Tata McGraw Hill, 2004.
3. S. K. Misra and V. K. Puri, "Indian Economy", Himalaya, 2009.
4. P. Saroj, "Textbook of Business Economics", Sunrise Publishers, 2003.
5. U. Kapila, "Indian Economy Since Independence", Academic Foundation, New Delhi
6. R. Dutt and K. P. M. Sundharam, "Indian Economy", S. Chand & Company Ltd., New Delhi.

Course Outcomes:

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

CO1 Aware of the basic theoretical framework underlying the field of microeconomics, macroeconomics, Indian economy, public finance etc.

CO2 Understand the operations of money and banking and their interaction with the rest of the economy.

CO3 Realize how monetary forces operate through a multitude of channels-market, non- market, institutions and among others.

CO4 Understand the various issues/components of the Indian economy so that they are able to comprehend and critically appraise current Indian economic problems.

CO5 Understand the major developments in the Indian economy before independence, at the time of Independence and during the post-Independence period.

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		1	1	1		1			2		2	2	1		
CO2		1	1	1		1			2		2	2	1		
CO3		1	1	1		1			2		2	2	1		
CO4		1	1	1		1			2		2	2	1		
CO5		1	1	1		1			2		2	2	1		

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

Sub Code	L	T	P	Duration	IA	ESE	Total	Credits
ECUCTT1	3	-	-	3 Hours	40	60	100	3

ELECTRONIC DEVICES

Course Objectives:

- To develop basic concept of semiconductor materials and physics.
- To introduce different methods of DC analysis semiconductor devices.
- To develop the concept and analysis of transistor characteristics, biasing and thermal stabilization.
- To introduce the concept of special semiconductor devices.

UNIT-I

Semiconductor Concept: Review of semiconductor & energy band diagram, The k-space diagrams of Si and GaAs, Density of states function, The fermi–dirac probability function, The distribution function and the fermi energy, Semiconductor in equilibrium, Carrier transport phenomena, Carrier generation and recombination, Characteristics of excess carriers.

UNIT-II

Junction Diode Characteristics: Description of pn junction action, The abrupt & linearly graded junction, The ideal diode model, Temperature dependence of I-V characteristics, Breakdown mechanism, Diode resistance, Diode capacitance, Clipper, Clamper, Rectifier.

UNIT-III

Transistor Characteristics: NPN, PNP, Operations, Early effect, Input and output characteristics of CE, CB, CC, Transistor as a switch & amplifier, Transistor biasing and thermal stabilization.

UNIT-IV

Field Effect Transistor (FET): JFET construction, operation & device characteristics, Pinch off voltage and its significance, Classification of MOSFET, The two-terminal MOS structure, C-V characteristics, The Basic structure & operating principal of MOSFET, Threshold voltage, Current-voltage characteristics, Biasing of JFET & MOSFET.

UNIT-V

Special Semiconductor Devices: Tunnel diode, Photo diode, Photo voltaic effect, Solar cells, Schottky diode, Varactor diode, Heterojunctions, Dual gate MOSFET, FINFET.

Text/Reference Books:

1. M. S. Tyagi, "Introduction to Semiconductor Materials and Devices", Wiley, 1991.
2. D. A. Neaman, "Semiconductor Physics and Devices- Basic Principles", 4th ed., TMH, 2021.
3. J. Millman and C. C. Halkias, "Electronic Devices and Circuits", 6th ed., Tata McGraw Hill Publishing Limited, New Delhi, 2003.
4. A. Mottershead, "Electronic Devices and Circuits- An Introduction", Prentice Hall of India Private Limited, New Delhi, 2003
5. R. Boylestad and L. Nashelsky, "Electronic Device & Circuit Theory", 11th ed., Pearson, 2013.
6. B. G. Streetman and S. Banerjee, "Solid State Electronic Devices", Pearson Education, 2002.
7. S. M. Sze & K. N. Kwok, "Physics of Semiconductor Devices," 3rd ed., John Wiley & Sons, 2006.

Course Outcomes:

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

CO1 Illustrate the knowledge of semiconductor physics.
CO2 Comprehend the characteristics of the PN junction diode 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 operation & characteristics of special semiconductor devices.

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**

Sub Code	L	T	P	Duration	IA	ESE	Total	Credits
ECUCTT2	3	-	-	3 Hours	40	60	100	3

DIGITAL LOGIC DESIGN

Course Objectives:

- To understand number representation and conversion between different representation in digital electronic circuits.
- To analyze logic processes and implement logical operations using combinational logic circuits.
- To understand characteristics of memory and their classification.
- To understand concepts of sequential circuits & analyze sequential systems in terms of state machines.
- To understand concept of Programmable Devices, PLA, PAL, CPLD and FPGA and implement digital system using VHDL.

UNIT-I

Logic Simplification and Combinational Logic Design: Review of Boolean algebra and De-Morgan's theorem, SOP & POS forms, Canonical forms, Karnaugh maps up to 4 variables, Binary codes, Code conversion.

UNIT-II

Comparators, Multiplexers, Encoder, Decoder, Driver & Multiplexed Display, Half and Full Adders, Subtractors, Serial and parallel Adders, BCD Adder.

UNIT-III

Sequential Logic Design: Introduction, SR FF, JK FF and Master-Slave JK FF, Edge triggered FF, Ripple and synchronous counters, Shift registers, Finite state machines, Design of synchronous FSM, Algorothmic state machine charts, Designing finite synchronous circuits like pulse train generator, Pseudo random binary sequence generator, Clock generation.

UNIT-IV

Logic Families and Semiconductor Memories: TTL NAND gate, Specifications, Noise margin, Propagation delay, Fan-in, Fan-out, Tristate TTL, ECL, CMOS families and their interfacing, Memory elements, Concept of programmable logic devices, Logic implementation using programmable devices.

UNIT-V

VLSI Design Flow: Design entry, Schematic, FSM & HDL, Different modeling styles in VHDL, Data types and objects, Dataflow, Behavioral and Structural Modeling, Synthesis & simulation, VHDL constructs and codes for combinational and sequential circuits.

Text/Reference Books:

1. A. A. Kumar, "Fundamentals of Digital Circuits", 2nd ed., PHI, 2009
2. H. Taub and D. Schilling, "Digital Integrated Electronics", 1st ed., TMH, 2008
3. M. M. Mano," Digital Logic and Computer Design", 1st ed., PHI, 2004
4. A. P. Malvino and D. Leach, "Digital Principles and Application", 4th ed., TMH, 1986.
5. D. Perry, "VHDL", Tata McGraw Hill, 4th ed., 2002.
6. C. Roth, "Digital System Design using VHDL", Tata McGraw Hill 2nd ed., 201.

Course Outcomes:

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

CO1 Apply the knowledge of number systems and Boolean logic used in the development of digital circuits and analyze digital circuits using Boolean algebra and K-maps.
CO2 Design and implement a variety of logical devices using combinational circuits concepts.
CO3 Design and analyze sequential circuits
CO4 Analyze different circuits using different logic families.
CO5 Comprehend the concept of VHDL and design sequential & combinational circuits 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	2	2	2	2	1			1			3	3	1	1
CO2	3	3	3	2	2	1			1			3	3	1	1
CO3	3	3	3	2	2	1			1			3	3	1	1
CO4	3	3	3	2	2	1			1			3	3	1	1
CO5	3	3	3	2	2	1			1			3	3	1	1

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

Sub Code	L	T	P	Duration	IA	ESE	Total	Credits
ECUCTT3	3	1	-	4 Hours	40	60	100	4

NETWORKS, SIGNALS AND SYSTEMS

Course Objectives:

- Capable for analyzing any given electrical network and understand the significance and practical aspect of two port network.
- To make the students familiarize with the fundamental continuous and discrete signals and systems.
- To explore the concept of continuous to discrete conversion technique needed incommunication.
- To introduce different transformation methods used in time and frequency domains.
- Identify the behavior of the electrical network.

UNIT-I

Circuit Concept: Introduction to network elements and sources, Introduction to network theorems, Mutual inductance to magnetic coupled circuits, Series resonance and parallel resonance.

Two Port Networks: Short circuit, Open circuit, Transmission, Hybrid parameters, Relationship between parameter sets, Interconnection of two port networks, T and π section representation in parameter forms.

UNIT-II

Signals and Systems: Introduction to signals and systems, Test signals, Operations on signals, Classification of signals and systems.

Linear Time Invariant (LTI) Systems: Impulse response and step response, Convolution, properties of LTI systems, Eigen functions, System representation through differential and difference equations.

UNIT-III

Fourier Analysis of Continuous Time System: Fourier series representations, Fourier transform, Properties of Fourier transform, Magnitude and phase response.

Continuous to discrete conversion: Sampling, Sampling theorem and signal reconstruction.

Fourier analysis of discrete time system: The discrete-time Fourier transform (DTFT), Properties of DTFT, LTI system representation by DTFT.

UNIT-IV

Laplace transform: The Laplace transform, Region of convergence, Poles and zeros of system, Properties of Laplace transform, Inverse Laplace transform, Laplace domain analysis, Solution to differential equations and system behavior. Solution of network equations using Laplace transform.

Z transform: The Z-Transform, Region of convergence, Properties of Z-transform, Inverse Z-transform, Z-domain analysis, Solution to difference equations and system behavior.

UNIT-V

Transient and study state analysis: Network equation, Transient analysis of DC & AC circuits, Transient and steady state response of RL, RC, LC and RLC circuits in transient with or without stored energy – Solutions in t & s domains, Initial conditions in networks, Step and impulse response, Initial and final value theorem.

Text/Reference Books:

1. M. E. Van Valkenburg, "Network Analysis", 3rd ed., Prentice-Hall India, 201.0
2. F. F. Kuo., "Network Analysis and Synthesis", 2nd ed., Wiley India, 2008.
3. W. H. Hayt and J. E. Kemmerly, "Engineering Circuit Analysis", 8th ed., Tata McGraw-Hill, 2008.
4. Sudhakar and A. Shyammohan, "Circuits and Network", 3rd ed., Tata McGraw Hill, 2006.
5. C. L. Wadhwa, "Network analysis and synthesis", 2nd ed., New Age International, 2006.
6. B. P. Lathi, "Principles of Linear Systems and Signals", Oxford University Press, 2009.
7. H. P. Hsu, "Schaum's outline: Theory and Problem of Signal & Systems", TMH 1995.
8. S. Ghosh, "Signals & Systems", Pearson Education, 2006.
9. S. K. Mitra, "Signals & Systems", Oxford University Press, 2015.

A. V. Oppenheim, A.S. Willsky , and I.T. Young, "Signals and Systems", Prentice Hall, 1983.
10. J. Nagrath, S. N. Sharan, R. Ranjan, and S. Kumar, "Signals and Systems", TMH New Delhi, 2001.

Course Outcomes:

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

CO1 Analyze various electrical networks using advanced theorems and two-port network formulation.
CO2 Analyze and identify behavior & response of different types of continuous & discrete signals, systems & LTI system.
CO3 Represent any aperiodic signal in to a combination of sinusoids and obtain the continuous to discrete conversion using sampling.
CO4 Perform different continuous and discrete time domain transformation technique.
CO5 Obtain the transient and steady-state response of electrical networks.

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	2	2						3	3	2	2
CO2	3	3	2	2	2	1						3	3	2	2
CO3	3	3	2	3	3							3	3	2	2
CO4	3	3	2	3	3							3	3	2	2
CO5	3	3	2	3	2							2	3	2	3

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

Sub Code	L	T	P	Duration	IA	ESE	Total	Credits
ECUCTK1	3	-	-	3 Hours	40	60	100	3

TRANSMISSION LINE & ELECTROMAGNETIC WAVES

Course Objectives:

- To develop the concept of analysis of transmission line
- To develop the design concept 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.

UNIT-I

Transmission Lines: Equations of voltage and current on TX line, Propagation constant and characteristic impedance, Reflection coefficient and VSWR, Impedance transformation on lossless and low loss transmission line, Power transfer on TX line, Smith chart, Admittance smith chart.

Application of Transmission Lines: Applications of transmission lines: Impedance matching, Use of transmission line sections as circuit elements, Types of Transmission line.

UNIT-II

Maxwell's Equations: Basics of vectors, Vector calculus, Basic laws of electromagnetics, 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.

UNIT-IV

Waveguide: Reflection from a conducting boundary, Wave propagation in parallel plane waveguide, Analysis of waveguide general approach, Rectangular waveguide, Modal propagation in rectangular waveguide, Field visualization.

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 and K. G. Balmain, "Electromagnetic Waves & Radiating Systems, Prentice Hall, India
3. N. Narayana Rao, "Engineering Electromagnetics", 3rd ed., Prentice Hall, 1997.
4. David Cheng, Electromagnetics, Prentice Hall

Course Outcomes:

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

CO1 Impedance transformation on transmission line and evaluate sections of transmission line for realizing circuit elements.

CO2 Selection of transmission line for various applications as feed and impedance matching.

CO3 Apply the basic laws of electromagnetic in high frequency wave propagation.

CO4 Characterize uniform plane wave and to evaluate reflection and transmission of waves at media interface.

CO5 Analyse the wave propagation in metallic waveguides at microwave frequency.

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							1	3	2	
CO2	3	3	2	3								1	3		
CO3	3	3	2	3									3		
CO4	3	3	3	3	2								3	2	
CO5	3	3	1	2	2								3		

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

Sub Code	L	T	P	Duration	IA	ESE	Total	Credits
ECUCTK2	3	-	-	3 Hours	40	60	100	3

ELECTRONIC MEASUREMENTS AND INSTRUMENTATION

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, Methods, Instruments and measurement system: Mechanical, Electrical, Electronic instruments, Classification of instruments, Mode of operation, Applications, Characteristics of instrument and measurement system, Elements of a generalized measurement system, Accuracy and precision, Types of error, Probability of error, Limiting error.

UNIT-II

Electromechanical Indicating Instruments: Operating forces, Construction, Torque/weight ratio, Control system, Damping, D´Arsonaval galvanometer, Response of galvanometer, Ballistic galvanometer, PMMC-construction, Torque equation, Voltage/current measurement: Ammeter, Voltmeter, Ohmmeter, Multimeter (V.O.M.), Q-meter Measurement.

UNIT-III

AC Bridge: Introduction, Sources and detectors, General equation for bridge balance, General form, Maxwell´s bridge, Hay´s bridge, Anderson´s bridge, De-Sauty´s bridge, Schering bridge, Wien´sbridge. **Electronic Instruments:** Introduction, Advantage of electronic voltmeter, VTVM, Differential voltmeter, Electronic voltmeter using rectifier, True

RMS reading voltmeter, Calorimeter.

UNIT-IV

Transducer: Classification of transducer, Potentiometer, Loading effect, Strain Gauge, Thermistor, Thermocouple, 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.

UNIT-V

Instrumentation: Digital display method, Segmental display- 7segment & 14 segment display, dot matrix, LED, LCD, TFT, Plasma display, DLP. Digital voltmeter (DVM), Recorders, CRO: Introduction, Oscilloscope block diagram, CRT, Functional block diagram of sampling, Storage, Dual trace and dual beam oscilloscope.

Text/Reference Books:

1. W. D. Cooper & A. D. Helfrick, "Modern Electronic Instrumentation and Measurement Technique", PHI 2000.
2. A Course in Electrical and Electronic Measurements and Instrumentation, A K Sawhney, Dhanpat Rai & Sons, 2010
3. Eric Udd, Fiber Optics Sensors, Wiley Publishers
4. Krishna kumar, Sensors and instruments in Agriculture: Microprocessor based Instrumentation for Agriculture industry, PHI Publication

Course Outcomes:

At the end the course, student 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
ECUCLT1	-	-	2	2 Hours	25	25	50	1

ELECTRONIC DEVICES LAB

Course Objectives:

- To identify and test various electronic components.
- To use CRO/DSO & function generator for various measurements.
- To plot the characteristics of diode and transistor.
- To observe the waveform of rectifiers & filters.

LIST OF EXPERIMENTS:

1. To verify V-I characteristics of PN junction diode.
2. To verify V-I characteristics of zener diode.
3. To verify V-I characteristics of light emitting diode (LED).
4. To study half & full wave rectifier and evaluate the efficiency.
5. To study filter and evaluate the efficiency.
6. To verify V-I characteristics of BJT in CE–mode.

7. To verify V-I characteristics of BJT in CB–mode.
8. To verify V-I characteristics of BJT in CC–mode.
9. To verify V-I characteristics of JFET.
10. To verify V-I characteristics of MOSFET.

Course Outcomes:

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

CO1 Illustrate the characteristics of diode.
CO2 Implement rectifier circuits and evaluate the efficiency.
CO3 Implement the filter circuits and analyze the practical applications for filters.
CO4 Implement the different configuration of BJT and analyze their characteristics.
CO5 Design JFET & MOSFET and analyze their characteristics.

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	2	1
CO2	3	2	1	1	1	1			2			3	2	2	1
CO3	3	2	1	1	1	1			2			3	2	2	1
CO4	3	2	1	1	1	1			2			3	2	2	1
CO5	3	2	1	1	1	1			2			3	2	2	1

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

Sub Code	L	T	P	Duration	IA	ESE	Total	Credits
ECUCLT2	-	-	2	2 Hours	25	25	50	1

DIGITAL LOGIC DESIGN LAB

Course Objectives:

- To provide hand-on experience in designing and implementing digital/logic circuits.
- The laboratory exercises are designed to enhance students ability to design, build, and implement digital circuits and systems.
- To know the concepts of combinational circuits.
- To understand the concepts of flip flops, registers and counters
- To know the concepts of interfacing of logic family.

LIST OF EXPERIMENTS:

1. To study the 4-binary adder.
2. To study the verification of De-morgan theorem.
3. To study the realization of Boolean expression & law.
4. To study the half/full adder/subtractor.
5. To study the encoder/decoder.
6. To study the one input two output demultiplexer.
7. To study the BCD seven segment decoder.
8. To study the logic gate apparatus.
9. To study the decimal to excess-3 encoder.
10. To study the excess-3 to decimal decoder.
11. To study the 8:1 multiplexer & 1:8 demultiplexer.
12. To study the flip-flop trainer.
13. To study the logic gate using ICS.
14. CMOS: to study the interfacing of TTL & CMOS.
15. To study the johnson ring counter.

Course Outcomes:

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

CO1 Construct Boolean functions using logic gates.
CO2 Construct basic combinational circuits and verify their functionalities
CO3 Apply the design procedures to design basic sequential circuits.

CO4 Comprehend the basic gate ICs & digital circuits and to verify their operation
CO5 Learn & design about counters.

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**

INSTITUTE CORE (III SEMESTER)

Sub Code	L	T	P	Duration	IA	ESE	Total	Credits
ECUCTO1	3	-	-	3 Hours	40	60	100	3

DATA COMMUNICATION

Course Objectives:

- To learn the basic concepts of data communications.
- To learn the layered architecture of communication protocols.
- To learn digital signal transmission and encoding techniques.
- To learn multiplexing techniques.
- To learn the concepts and techniques in error detection and correction.

UNIT-I

Data and Signal: Analog and digital signals, Time and frequency domain, Composite signals, Bandwidth, Bit rate, Bit length, Baseband and broadband transmission, Attenuation, Distortion, Noise, Nyquist bit rate, Shannon capacity.

UNIT-II

Data Communication Concepts: Data transmission, Parallel and serial transmission, Synchronous and asynchronous transmission, Simplex, Half-duplex and full-duplex, Unipolar and polar line codes, Non return to zero codes, Return to zero codes, Bipolar line codes.

UNIT-III

Telephone network, Network topology, Multiplexing, Frequency division multiplexing, Time division multiplexing and wavelength division multiplexing, Pulse code modulation.

UNIT IV

Switching Techniques: Circuit, packet and hybrid switching, Types of error, Vertical redundancy check, Longitudinal redundancy check, Cyclic redundancy check, Error correction, Integrated services digital network.

UNIT-V

Transmission Media: Guided and unguided media, Twisted pair, Unshielded twisted pair and shielded twisted pair, Coaxial cable and fiber optic cable, Radio waves, Microwaves and infrared transmission RJ- 45, Network interface card, Rack, Cable standard-category 5, 6 and 7, Cross connection, Straight connection, Cable coding standards.

Text/Reference Books:

1. "Data communication and networking", Forouzan, TMH.
2. Data communication and Computer Networks, Prakash C Gupta, PHI Learning.
3. "Computer Networks", Tanenbaum, PHI Learning.
4. "Communication Networks-Fundamental concepts and key Architectures",Leon-Garcia,Widjaja,TMH.

5. "Computer Communications & Networking Technologies", Michael A. Gallo & William M. Hancock - Cengage pearsen publications.
6. "Network for computer scientists & engineers", Youlu zheng & shakil akhtar, Oxford pubcation.

Course Outcome:

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

CO1 Understand the basics of data communication, networking, internet and their importance.
CO2 Interpret the components, tools and techniques of communication systems.
CO3 Explain how information can be sent via communication interfaces and links.
CO4 Determine various modulation, error detection & correction techniques & their applications.
CO5 Identify the basic security threats of a network.

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							3	2	1	1
CO2	3	2	3	1	1							3	2	1	1
CO3	3	2	2	2	2							3	2	2	1
CO4	3	3	3	2	2							3	2	2	1
CO5	3	3	3	2	2							3	2	2	1

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

Sub Code	L	T	P	Duration	IA	ESE	Total	Credits
CSUCTO1	3	-	-	3 Hours	40	60	100	3

DATA STRUCTURE USING C++

Course Objectives:

- Introduce the concept of data structures through array, stack and queues.
- To design and implement various data structure algorithms.
- To introduce various techniques for representation of the data in the real world.
- To develop application using data structure algorithms.

UNIT-I

INTRODUCTION: Functions and parameter, Dynamic memory allocation, Recursion.
LINEAR LISTS: Data objects and structures, Linear list data structures, Array Representation, Vector Representation, Singly Linked lists and chains. L1, L2

UNIT-II

ARRAYS AND MATRICS: Arrays, Matrices, Special matrices, Sparse matrices.
STACKS: The abstract data types, Array Representation, Linked Representation, Applications- Parenthesis Matching & Towers of Hanoi. L1, L2, L3

UNIT-III

QUEUES: The abstract data types, Array Representation, Linked Representation, Applications- Railroad car arrangement.
HASHING: Dictionaries, Linear representation, Hash table representation. L1, L2, L3

UNIT-IV:

BINARY AND OTHER TREES

Trees, Binary trees, Properties and representation of binary trees, Common binary tree operations, Binary tree traversal the ADT binary tree, ADT binary tree and the class linked binary tree. L1, L2, L3

UNIT-V

PRIORITY QUEUES: Linear lists, Heaps, Applications-Heap Sorting.
SEARCH TREES: Binary search trees operations and implementation, Binary Search trees with duplicates. L1, L2, L3

Text/Reference Books:

1. Data structures, Algorithms, and applications in C++, Sartaj Sahni, Universities Press, 2nd Ed, 2005.
2. Data structures, Algorithms, and applications in C++, Sartaj Sahni, Mc. Graw Hill, 2000.

3. Object Oriented Programming with C++, E. Balaguruswamy, TMH, 6th Edition, 2013.
4. Programming in C++, E. Balaguruswamy. TMH, 4th, 2010.

Sub Code	L	T	P	Duration	IA	ESE	Total	Credits
ITUCTO1	3	-	-	3 Hours	40	60	100	3

COMPUTER ORGANIZATION & ARCHITECTURE

Course Objectives:

- Conceptualize the basics of organizational and architectural issues of a digital computer.
- Analyze processor performance improvement using instruction level parallelism.
- Learn the function of each element of a memory hierarchy.
- Study various data transfer techniques in digital computer.
- Articulate design issues in the development of processor or other components that satisfy design requirements and objectives.

UNIT-I

Basic of Computer Organization & Architecture: Introduction, Computer Organization vs. Computer architecture, Von Neumann Architecture vs. Harvard Architecture. Input & Output Organization: Introduction, Simple Bus Architecture, Types of Buses, I/O Communication Methodologies: Programmed I/O(Polling), Interruptdriven I/O & Direct Memory Access(DMA), I/O channel & I/O Processor, Accessing I/O device: Memory M apped I/O, Isolatedor I/O Mapped.

UNIT-II

Computer Arithmetic: Introduction, Addition & Subtraction: Addition & Subtraction with Signed – Magnitude Data, Hardware Implementation & Algorithm, Addition & Subtraction with Signed - 2's Complement Data, Multiplication Algorithm: Hardware Implementation for Signed – Magnitude Data, Hardware Algorithm, Booth Multiplication Algorithm, Array Multiplier, Division Algorithms: Hardware Implementation for Signed-Magnitude Data & Algorithm, Carry Look Ahead Adder.

UNIT-III

Memory Organization: Introduction, Types of Memory, Memory Hierarchy, Main Memory, Cache Memory, Virtual Memory, Associative Memory. Processor Organization: Introduction, Control Unit: Hardwired Control Unit, Micro programmed Control Unit, Instruction Set Computer: Reduced Instruction Set Computer (RISC) vs. Complex Instruction Set Computer (CISC).

UNIT-IV

Pipelining: Introduction, Concept of Instruction Pipeline, Design Problems with Pipeline: Structural Hazard, Data Hazard & Control Hazard, Extension in Pipeline Designed: Super Pipelining, Superscalar Processor, Very Long Instruction Width (VLIW) Architecture.

UNIT-V

Multiprocessor System: Introduction, Shared Memory Multiprocessor, Distributed Memory Multiprocessor, Flynn's Classification: Single Instruction Single Data (SISD), Single Instruction Multiple Data (SIMD), Multiple Instruction Single Data (MISD), Multiple Instruction Multiple Data (MIMD), Cache Coherence, Message Passing Model, Cluster Computing, Distributed Computing.

Text/Reference Books:

1. Computer System Architecture, M.Morris Mano, Pearson Education India.
2. Computer Organization & Architecture, W. Stalling, Pearson Education India.
3.Computer Architecture & Organization, J. P. Hayes, McGraw-Hill India.
4. Computer System Organization, Naresh Jotwani, Mc Graw Hill, India.
5. Computer System Architecture, P. V. S. Rao, PHI India.
6. Advanced Computer Architecture, Rajiv Chopra, S. Chand India.
7. Computer Organization & Architecture, Lalit K. Arora, Anjali Arora, S.K.Kataria & Sons, India.
8. Computer Fundamentals Architecture & Organization, B Ram, Sanjay Kumar, New Age International,

Course Outcomes:

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

CO1 Understand the computer architecture concepts. C
CO2 Understand and apply different number systems and codes.
CO3 Understand memory hierarchy and its impact on computer cost/performance.
CO4 Design a pipeline for consistent execution of instructions with minimum hazards.
CO5 Understand the concepts of multiprocessor

Sub Code	L	T	P	Duration	IA	ESE	Total	Credits
CEUCTO1	3	-	-	3 Hours	40	60	100	3

GREEN BUILDINGS

Course Objectives:

- To understand the basics of Green Buildings.
- To learn the concept of site selection and water conservation.
- To study the use of efficient energies.
- To learn about maintenance of Indoor environmental quality.
- To study various green building rating systems including their mandatory requirements and credit points.

UNIT-I

Green Buildings: Introduction, history and evolution, objectives, benefits, typical features of green buildings, sustainability and green buildings, global trends in green buildings, Examples of green buildings in India and the world (case studies to be presented by students).

UNIT-II

Site selection and building planning: Criteria for site selection, preservation of landscape, soil erosion control, understanding and minimizing urban heat island effect. Water conservation and efficiency: Rainwater harvesting methods for roof & non-roof, water demand, water efficient plumbing systems, water metering, waste water disposal, recycle and reuse systems.

UNIT-III

Energy Efficiency: Concepts of embodied energy, operational energy, demolition energy and life cycle energy. Methods to reduce operational energy: Energy efficient building envelopes, efficient lighting technologies, energy efficient appliances for heating and air conditioning systems in buildings, wind and solar energy harvesting, energy metering and monitoring, concept of net zero buildings.

UNIT-IV

Indoor Environmental Quality for Occupant Comfort: Daylighting, air ventilation, exhaust systems, materials, adhesives, building acoustics. **Environment Quality and Occupational Health:** Air conditioning, air quality, Sick building syndrome, minimum fresh air requirement, improved fresh air ventilation, Measure of Indoor air quality (IAQ), Reasons for poor IAQ, Measures to achieve Acceptable IAQ levels.

UNIT-V

Green Building Rating Systems: Introduction to various rating systems (LEED, GRIHA, IGBC etc.), mandatory requirements and credit points of various rating systems, study of green building rating criteria of IGBC, Understanding the green building measures in the areas of site preservation, energy efficiency, materials, water conservation and indoor air quality.

Text/Reference Books:

1) IGBC Green Homes Rating System, Version 2.0., Abridged reference guide, 2013, Indian Green Building Council Publishers.
2) GRIHA version 2015, GRIHA rating system, Green Rating for Integrated Habitat Assessment.
3) Alternative building materials and technologies by K.S. Jagadish, B.V. Venkatarama Reddy and K.S. Nanjunda Rao.

4) Non-Conventional Energy Resources by G. D. Rai, Khanna Publishers.
5) Sustainable Building Design Manual, Vol.1 and 2, TERI, New Delhi 2004.
6) Mike Montoya, Green Building Fundamentals, Pearson, USA, 2010.
7) Charles J. Kibert, Sustainable Construction Green Building Design and Delivery, John Wiley & Sons, New York, 2008.
8) Regina Leffers, Sustainable Construction and Design, Pearson / Prentice Hall, USA, 2009.

Course Outcomes:

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

CO1: Apply the concept and knowledge of Green Building in handling any physical projects.
CO2: Conduct a site selection process and apply water conservation techniques for green buildings.
CO3: Make use of technologies with efficient energies.
CO4: Apply the knowledge in maintaining the indoor environmental quality.
CO5: Revise essential parameters of green building rating 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	2	3	1		3	3					2	2	1	2
CO2	3	2	1	2		3	3					1	2	2	3
CO3	3	2	1	2		3	3					2	2	2	3
CO4	3	2	2	2		3	3					2	2	2	2
CO5	3	2	1	1		2	2					1	2	1	2

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

Sub Code	L	T	P	Duration	IA	ESE	Total	Credits
CHUCTO1	3	-	-	3 Hours	40	60	100	3

ENGINEERING MATERIALS

Course Objectives:

- To provide the understanding of material selections for construction to execute a task for a particular application, its properties and behaviour at different circumstances.
- Properties, behaviour and maintenance of various engineering materials.

UNIT-I

Crystalline and Non-Crystalline Materials: Crystalline state, Atomic bonding, Bravias lattices, Miller indices, Structure of some common inorganic compounds, Structural imperfections. Economic, environmental and social issues of material usage.

UNIT-II

Mechanical properties of materials and their variation with temperature, importance and limitations of these properties on material selection for a particular application. Failure of materials: Failure of materials under service conditions.

UNIT-III

Corrosion: Mechanism of corrosion, Types of corrosion, Factors influencing corrosion, Methods of corrosion control, Inhibition and other precautionary measures.

UNIT-IV

Non-Ferrous Metals: Copper, Brasses, Bronze, Aluminium, their mechanical properties, Workability and applications, Corrosion resistance. Non-metallic materials of construction.

UNIT-V

Phase diagram: Phase rules, Equilibrium phase diagram, cooling curves and their relations to properties of metals and alloys, Iron-carbon equilibrium diagram. Response of materials to chemical environment.

Text/Reference Books:

1. Introduction to Materials Science for Engineers by James F. Shackelford, Pearson.
2. Elements of Materials Science and Engineering by L.H.Van Vlack, Pearson.

3. Materials Science and Engineering by V. Raghavan, PHI Learning Private Limited.
4. Materials Science for Engineers by L. H. VanVlack, Addison-Wesley Publishing Co.
5. Chemistry of Engineering Materials by A. M. Sikkander and T. N. Balu, Raj Publications.
6. Corrosion, Prevention and Control by K.S. Rajagopalan, Scientific Surveys Limited.
7. Corrosion Engineering by M. G. Fontana, McGraw Hill Education.
8. Perry's Chemical Engineers' Handbook by D. W. Green and R. H. Perry, McGraw Hill Publication.

Course Outcomes:

At the end of the course students will be able to:
CO1 Explain different types of materials and their mechanical properties and limitations.
CO2 Explain types of corrosion and various methods to control them.
CO3 Describe phase diagram and its significance.

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		2			1						1	1	
CO2	2	1		2			1						1	1	
CO3	2	1		2			1						1	1	
CO4															
CO5															

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

Sub Code	L	T	P	Duration	IA	ESE	Total	Credits
MEUCTO1	3	-	-	3 Hours	40	60	100	3

INTRODUCTION TO THERMODYNAMICS

Course Objectives:

1. To understand the basic laws of thermodynamics and heat transfer
2. To understand the principle of operation of thermal systems like I C Engine, boilers, turbines, condensers etc.

UNIT-I

Fundamental Concepts System, surrounding and universe, Concept of continuum, Property, State, Path, process, Cyclic process, Energy and its form, Work and heat, Enthalpy.

UNIT-II

Laws of thermodynamics: Concepts of Temperature, Zeroth law. First law of thermodynamics. Concept of processes, Flow processes and control volume, Flow work, Steady flow energy equation, Mechanical work in a steady flow of process.
Second law: Essence of second law, Thermal reservoir, Heat engines, COP of heat pump and refrigerator. Statements of second law, Carnot cycle, Concept of Entropy.

UNIT-III

Thermal Power Plant Layout; Rankine Cycle, Major components of thermal power plant, Condensers, Cooling Towers.

UNIT-IV

Power producing machines: Internal combustion engines, basic cycles; Turbines: Basic cycle of turbines, Impulse and Reaction Turbines.

UNIT-V

Power consuming machines: Pumps, compressors; Basic of refrigeration cycles, Environmental- friendly refrigerants, and Air conditioners.

Text/Reference Books:

- Engineering Thermodynamics – P.K. Nag, McGraw Hill
- Basic and Applied Thermodynamics – P.K. Nag, McGraw Hill
- Fundamentals of Thermodynamics – Sonntag, Borgnakke, Van Wylen, Wiley

- Thermodynamics-An engineering approach – Cengel and Boles, McGraw Hill

Course Outcomes:

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

1. Explain the basic concepts of thermodynamics such as heat and work.
2. State and Describe the basic laws of thermodynamics
3. Describe working principle of thermal power plants
4. Understand various energy interactions between heat and work.
5. Understand and describe various thermal machines based on thermodynamics.

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										2	1	1
CO2	3	2	2										3	1	1
CO3	3	2	2										3	1	1
CO4	3	2	1										2	1	1
CO5	3	2	1										2	1	1

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

Sub Code	L	T	P	Duration	IA	ESE	Total	Credits
IPUCTO1	3	-	-	3 Hours	40	60	100	3

I.C. ENGINE

Course Objectives:

1. To study classifications of internal combustion engine.
2. To understand how and why actual cycles deviate from air standard cycle and fuel-air cycle.
3. To understand combustion in spark ignition engine and diesel engines.
4. To impart knowledge about carburetion, gasoline injection and diesel injection.
5. To impart knowledge about ignition, cooling, lubrication and governing systems.
6. To impart knowledge about various engine performance characteristics and its testing.

UNIT-I

Introduction of internal combustion engines, classification of I.C. engines, engines components, basic engine nomenclature, four stroke S.I. and C.I. engine, two stroke engines, comparison of two stroke and four stroke engines, comparison of S.I. and C.I. engines.

UNIT-II

Air Standard Cycle: Otto cycle, Diesel cycle, Dual cycle, comparison between Otto, diesel and dual cycles, fuel-air cycles and actual-cycles.

SI Engines: Combustion phenomenon in S.I. Engines,Flame development and its propagation, ignition lag, knocking in S.I. engines, Carburetor,Theory of carburetion.

UNIT-III

CI Engine: Combustion phenomenon in CI engines, p-v diagram and their study for various stage of combustion, delay period, detonation in C.I. engines, Fuel injection in CI engines

UNIT-IV

Engine Friction and Lubrication: Total engine friction, blow by losses, pumping losses, factors effecting engine friction, mechanism of lubrication, lubrication system.

UNIT-V

Cooling system: Piston and cylinder temperature distribution, principles and various methods of cooling.Measurement of performanceParameters.

Text/Reference Books:

1. A Course in IC Engines - M.L. Mathur and R.P. Sharma, Laxmi Publication.
2. Internal Combustion Engines –V. Ganesan, TMGH Publication.

3. Internal Combustion Engines: Theory and Practice - G.F. Taylor.
4. Introduction to IC Engine -Stone, Richard.
5. Fundamentals of I.C. Engine- Gupta, PHI.

Course Outcomes:

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

CO1: Demonstrate the components & combustion phenomenon of SI and CI engines.
CO2: Perform a thermodynamic analysis of Otto, Diesel, and Dual cycle models
CO3: Demonstrate the combustion phenomenon of SI engine and CI engine
CO4: Understand cooling, friction & lubrication systems in engines
CO5: Evaluate the performance parameters of IC engines.

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	3	1	-
CO2	3	2	-	-	-	-	-	-	-	-	-	1	2	-	-
CO3	3	2	-	-	-	-	-	-	-	-	-	2	3	1	1
CO4	3	1	-	-	-	-	-	-	-	-	-	1	3	1	-
CO5	3		-	-	-	-	-	-	-	-	-	-	3	-	-

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

B. TECH. II YEAR IV SEMESTER SCHEME

Sub Code	L	T	P	Duration	IA	ESE	Total	Credits
ECUDTT1	3	-	-	3 Hours	40	60	100	3

ANALOG CIRCUITS

Course Objectives:

- To introduce low & high frequency model of transistor amplifiers.
- To make students understand and analyze the design and working of amplifiers/oscillators and their configurations.
- To give understanding of power & tuned amplifier.

UNIT-I

Low Frequency Transistor Amplifier: h-parameter models for CB, CE, CC configurations and their inter relationship, Analysis and comparison of the three configurations, Approximate models and calculation of CE and CC amplifiers, CE with emitter resistance, Miller's theorem, Analysis of low frequency CS and CD FET amplifier.

UNIT-II

Multistage & High Frequency Transistor Amplifier: Need for cascading, n-stage cascaded amplifier, Methods of coupling multistage amplifiers, Darlington pair, Bootstrap principle, Cascode, CE hybrid pi model, Current gain with resistive load, Gain-bandwidth product.

UNIT-III

Feedback Amplifiers: Feedback concept, Classification, Properties of negative feedback amplifier, Voltage series feedback, Current series, Current shunt, Voltage shunt feedback, Effect of feedback on amplifier bandwidth and stability.

UNIT-IV

Oscillator: Introduction, Barkhausen criteria, Sinusoidal oscillator, Phase shift oscillator, Wien bridge oscillator, Resonant circuit oscillators: LC Collpit, LC Hartley, General form of oscillator configuration: Crystal oscillator.

UNIT-V

Large Signal/ Power Amplifier: Classification, Large signal amplifier characteristics, Class A, B, AB, C & D amplifiers, Class B push-pull amplifiers, Complementary symmetry push-pull class B amplifier, Harmonic distortion, Cross-over distortion.

Tuned Amplifiers: Classification of tuned amplifier, Analysis of single and double tuned amplifiers.

Text/Reference Books:

1. J. Millman and C. C. Halkias, "Integrated Electronics", 2nd edition, TMH 2001.
2. S. Sedra and K. C. Smith, "Microelectronic Circuits Theory and Applications", 6th ed., Oxford, 2015
3. D. Neamen, "Electronic Circuits-Analysis & Design", Cengage Learning, 2/e, 2011.
4. D. A. Bell, "Electronic Device & Circuits", 5th ed., Oxford Publication, PHI, 2008.
5. R. Boylestad and L. Nashelsky, "Electronic Device & Circuit Theory", 11th ed., Pearson, 2013.

Course Outcomes:

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

CO1 Illustrate and analyze low frequency single stage amplifier.
CO2 Elucidate and analyze multistage & high frequency transistor amplifier.
CO3 Discuss the concept of feedback and construct feedback amplifier.
CO4 Illustrate about oscillator and analyze the oscillating frequency and condition of oscillation for different oscillators.
CO5 Explain about power & tuned amplifier and its type along with characteristics.

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	2			2			2	3	1	2
CO2	3	3	2	2	1	2			2			2	3	1	2
CO3	3	3	2	2	1	2			2			2	3	1	2
CO4	3	3	2	2	1	2			2			2	3	1	2
CO5	3	3	2	2	1	2			2			2	3	1	2

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

Sub Code	L	T	P	Duration	IA	ESE	Total	Credits
ECUDTT2	3	1	-	4 Hours	40	60	100	4

ANALOG AND DIGITAL COMMUNICATIONS

Course Objectives:

- To develop ability to analyze system requirements of analog and digital communication systems.
- To understand the generation, detection of various analog and digital modulation techniques.
- To acquire theoretical knowledge of each block in AM, FM transmitters and receivers.
- To understand the concepts of baseband transmissions.

UNIT-I

Amplitude Modulation: Introduction, Block diagram of communication system, Need for modulation, Amplitude modulation, Generation of AM wave, Detection of AM Wave, DSB-SC modulation, Generation of DSB-SC wave, Detection of DSB-SC modulated waves, SSB-SC modulation, Generation of SSB-SC wave, Demodulation of SSB-SC wave, Principle of vestigial side band modulation.

UNIT-II

Angle Modulation: Principle of frequency modulation (FM) and phase modulation (PM), Relation between FM and PM , Frequency deviation, Bandwidth of FM , Narrow band and wide band FM, FM modulation and detectors.

UNIT-III

Transmitters: Classification of transmitters, AM transmitters, FM transmitters. **Receivers:** Radio receiver-Superhetrodyne receiver, Image frequency, AGC, FM receiver. **Noise in communication system**: Introduction, Receiver model, Significance of signal to noise ratio, Noise in DSB-SC, SSB-SC receivers, Noise in AM receivers (Envelope detector), Noise in FM receivers, Pre-emphasis and de-emphasis in FM.

UNIT-IV

Pulse Modulation Techniques: Pulse Analog Modulation: Introduction, Sampling**,** Nyquist criterion**,** Types of pulse modulation, TDM. **Pulse Digital Modulation:** Block diagram of digital communication system, PCM generation and reconstruction, Quantization: Uniform, Non uniform quantization, Companding, DPCM, Delta modulation and adaptive delta modulation, Noise in PCM and DM.

UNIT-V

Digital Carrier Modulation Schemes: Optimum receiver for AWGN channel, Matched filter and correlation receivers, Generation and detection of ASK, BPSK and BFSK, QPSK and DPSK, Probability of bit error computation for BPSK, BFSK, QPSK, QAM, Comparison of modulation techniques.

Text/Reference Books:

1. Taub H. and Schilling D.L., "Principles of Communication Systems", Tata McGraw Hill, 2001.
2. Haykin S., "Communications Systems", John Wiley and Sons, 2001.
3. Proakis J. G. and Salehi M., "Communication Systems Engineering", Pearson Education, 2002.
4. Digital Communications –Simon Haykin, Jon Whiley, 2005
5. Sam Shanmugam, "Digital and analog communication system", John Wiley, 2005.
6. Wozencraft J. M. and Jacobs I. M., ``Principles of Communication Engineering'',John Wiley, 1965.
7. Barry J. R., Lee E. A. and Messerschmitt D. G., ``Digital Communication'', Kluwer Academic Publishers, 2004.
8. Proakis J.G., ``Digital Communications'', 4th Edition, McGraw Hill, 2000.

Course Outcomes:

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

CO1 Analyze and design of various continuous wave and amplitude modulation and demodulation techniques.

CO2 Analyze and Design various continuous wave Angle modulation and demodulation techniques.
CO3 Analyze and design the various Pulse Modulation Techniques (Analog and Digital Pulse modulation).
CO4 Attain the knowledge about the functioning of different AM, FM Transmitters and Receivers and understand the effects of noise in AM and FM.
CO5 Understand the concepts of Digital Modulation Technique, Baseband transmission and Optimum Receiver.

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	2			2			2	3	1	2
CO2	3	3	2	2	1	2			2			2	3	1	2
CO3	3	3	2	2	1	2			2			2	3	1	2
CO4	3	3	2	2	1	2			2			2	3	1	2
CO5	3	3	2	2	1	2			2			2	3	1	2

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

Sub Code	L	T	P	Duration	IA	ESE	Total	Credits
ECUDTT3	3	-	-	3 Hours	40	60	100	3

CONTROL SYSTEMS

Course Objectives:

- To make the student familiarize with the fundamental concepts of different control systems.
- To help students develop an understanding the concept of transfer function and representing systems by block diagram, signal flow graph.
- To develop an understanding of transient and steady state behavior of different systems.
- To introduce the concept of absolute and relative stability of control system using Root locus, Bode plot, Polar plot and Nyquist plot.
- To inculcate state variable analysis approach for modern control systems i.e. MIMO systems.

UNIT-I

Introduction to Control Systems: Open & closed-loop systems, Industrial control examples, Transfer function, Block diagram and signal flow graph analysis, Mathematical modeling: Mechanical and electrical systems, Force-voltage and force-current analogy.

UNIT-II

Time Response Analysis: Standard signals, Order and type of system, Time response and performance specifications in transient response, Steady-state analysis, Error constants proportional, Integral and derivative.

UNIT-III

Stability Concept: Absolute and relative stability, Routh Hurwitz stability criterion, Root locus method of design, Stability analysis using root locus, Lead and lag compensation using root locus technique.

UNIT-IV

Frequency Response Analysis: Frequency-domain specifications, Polar plots, Bode plot, Stability in frequency domain, Nyquist plots, Nyquist stability criterion, Compensation Techniques: Lead, Lag and Lag-lead compensation.

UNIT-V

State Variable Analysis: Concepts of state, State variable, State model, State models for MIMO systems, Diagonalization, State transition matrix (STM), Solution of state equations, Concept of controllability & observability, Introduction to nonlinear system.

Text/Reference Books:

1. M. Gopal, "Control Systems: Principles and Design", Tata Mcgraw-Hill, 1997.

2. B. Manke, "Linear Control Systems", Khanna Publication, 2022.
3. B. C. Kuo, "Automatic Control System", 6th ed., Prentice Hall, 1993.
4. K. Ogata, "Modern Control Engineering", 2nd ed., Prentice Hall, 1991.
I. J. Nagrath and M. Gopal, "Modern Control Engineering", 5th ed., New Delhi: New Age International, 2017.

Course Outcomes:

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

CO1 Construct block diagrams, signal flow graphs and mathematical models of systems.
CO2 Analyze transient and steady state response specifications of systems
CO3 Perform stability analysis of linear time invariant system.
CO4 Design a compensator to meet specifications in time or frequency domains.
CO5 Analyze multiple input multiple output modern control 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	2	2	1				2			2	3	1	2
CO2	3	3	2	2	2				2			2	3	1	2
CO3	3	3	2	2	2				2			2	3	1	2
CO4	3	3	2	2	2				2			2	3	1	2
CO5	3	3	2	2	2				2			2	3	1	2

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

Sub Code	L	T	P	Duration	IA	ESE	Total	Credits
ECUDTK1	3	-	-	3 Hours	40	60	100	3

PROBABILITY THEORY 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 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 Outcome:

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

CO1 Understand 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	Credits
ECUDTK2	3	-	-	3 Hours	40	60	100	3

SENSORS & ACTUATORS

Course Objectives:

- The students will have an exposure to sensors and its importance in the real world.
- To understand basics of sensors, actuators and their operating principle.
- To educate the students on different types of micro fabrication techniques for designing and developing sensors.
- To explain working of various types of electrochemical sensors and actuators.
- To provide an understanding on characteristic parameters to evaluate sensor performance.

UNIT-I

Sensors: Difference between sensor, Transmitter and transducer, Primary measuring elements, Selection and characteristics: Range, Resolution, Sensitivity, Error, Repeatability, Linearity and accuracy, Impedance, Backlash, Response time, Dead band.

Signal transmission: Types of signal, Principle of operation, Construction details, Characteristics and applications of potentiometer, Proving rings, Strain gauges, Resistance thermometer, Thermistor, Hot-wire anemometer, Resistance hygrometer, Photo-resistive sensor.

UNIT-II

Inductive & Capacitive Transducer: Inductive transducers: Principle of operation, construction details, characteristics and applications of LVDT, Induction potentiometer, Variable reluctance transducer, Synchros, Microsyn. Capacitive transducers: Principle of operation, construction details, characteristics of capacitive transducers, Different types & signal conditioning, Applications: capacitor microphone, capacitive pressure sensor, proximity sensor.

UNIT-III

Actuators: Definition, Types and selection of actuators, Linear, Rotary, Logical and continuous actuators, Pneumatic actuator, Electro-pneumatic actuator, Cylinder, Rotary actuators, Mechanical actuating system: Hydraulic actuator, Control valves, Construction, characteristics and types, Selection criteria. Electrical actuating systems: Solid-state switches, Solenoids, Electric motors- Principle of operation and its application: D.C motors, AC motors, Single phase & 3 phase induction motor, Synchronous motor, Stepper motors, Piezoelectric actuator.

UNIT-IV

Micro Sensors and Micro Actuators Micro Sensors: Principles and examples, Force and pressure micro sensors, Position and speed micro sensors, Acceleration micro sensors, Chemical sensors, Biosensors, Temperature micro sensors and flow micro sensors. **Micro Actuators:** Actuation principle, Shape memory effects-one way, Two way and pseudo elasticity, Types of micro actuators.

UNIT-V

Sensor Materials and Processing Techniques: Materials for sensors: Silicon, Plastics, metals, Ceramics, Glasses, Nano materials, Processing techniques: vacuum deposition, sputtering, chemical vapour deposition, electro plating, photolithography, silicon micro machining, Bulk silicon micro machining, Surface silicon micro machining, LIGA process.

Text/Reference Books:

1. Patranabis.D, "Sensors and Transducers", Wheeler publisher, 1994.
2. Sergej Fatikow and Ulrich Rembold, " Microsystem Technology and Microbotics", First edition, Springer –Verlag NEwyork, Inc, 1997.
3. Jacob Fraden, "Hand Book of Modern Sensors: Physics, Designs and Application" Fourth edition, Springer, 2010.
4. Robert H Bishop, "The Mechatronics Hand Book", CRC Press, 2002.
5. Thomas. G. Bekwith and Lewis Buck.N, Mechanical Measurements, Oxford and IBH publishing Co. Pvt. Ltd.,
6. Massood Tabib and Azar, "Microactuators Electrical, Magnetic, thermal, optical, mechanical, chemical and smart structures", First edition, Kluwer academic publishers, Springer, 1997.

7. Manfred Kohl, "Shape Memory Actuators", first edition, Springer.

Course Outcome:

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

CO1 Describe fundamental physical and technical base of sensors and actuators,
CO2 Illustrate the concept of inductor & capacitor transducer.
CO3 Analyse various premises, approaches, procedures and results related to sensors and actuators.
CO4 Create analytical design and development solutions for microsensors and microactuators.
CO5 Comprehend the basics of sensor materials & processing 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	1	1	1	1			2			2	3	1	1
CO2	3	3	3	1	2	1			2			2	3	2	2
CO3	3	3	2	2	2	1			2			2	3	2	2
CO4	3	3	3	2	2	1			2			2	3	2	2
CO5	3	3	2	2	2	1			2			2	3	1	2

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

Sub Code	L	T	P	Duration	IA	ESE	Total	Credits
ECUDTK3	3	-	-	3 Hours	40	60	100	3

ANTENNA & WAVE PROPAGATION

Course Objectives:

- To learn the fundamental parameters of the Antenna.
- To understand the basic concepts of radiation from loop and wire antenna.
- To analyze the principle of aperture antennas and design it for some applications
- To learn about the working principle of modern antennas and design it for some applications.
- To learn about the latest technologies which employ the antenna.

UNIT-I

Fundamental Concepts: Physical concept of radiation, Radiation pattern, Near-and far-field regions, Reciprocity, Directivity and gain, Effective aperture, Polarization, Input impedance, Efficiency, Friis transmission equation, Radiation integrals and auxiliary potential functions.

UNIT-II

Radiation from Wires and Loops- Infinitesimal dipole, Finite-length dipole, Linear elements near conductors, Dipoles for mobile communication, Small circular loop.

UNIT-III

Aperture and Reflector Antennas-Huygens' principle, Radiation from rectangular and circular apertures, Design considerations, Babinet's principle, Radiation from sectoral and pyramidal horns, Design concepts, Prime-focus parabolic reflector and cassegrain antennas. Broadband antennas: Log-periodic and yagi-uda antennas, Frequency independent antennas, Broadcast antennas.

UNIT-IV

Micro strip Antennas: Basic characteristics of micro strip antennas, Feeding methods, Methods of analysis, Design of rectangular and circular patch antennas, Dielectric resonator antenna, Antenna arrays-analysis of uniformly spaced arrays with uniform and non-uniform excitation amplitudes.

UNIT-V

Planar arrays, Smart antennas-concept and benefits of smart antennas, Fixed weight beam forming basics, Adaptive beam forming, Different modes of radio wave propagation used in current practice.

Text/Reference Books:

1. J.D. Kraus, Antennas, McGraw Hill, 1988.
2. C.A. Balanis, Antenna Theory - Analysis and Design, John Wiley, 1982.
3. R.E. Collin, Antennas and Radio Wave Propagation, McGraw Hill, 1985.
4. R.C. Johnson and H. Jasik, Antenna Engineering Handbook, McGraw ill, 1984.
5. I.J. Bahl and P. Bhartia, Micro Strip Antennas, Artech House, 1980.
6. R.K. Shevgaonkar, Electromagnetic Waves, Tata McGraw Hill, 2005
7. R.E. Crompton, Adaptive Antennas, John Wiley

Course Outcome:

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

CO1 Conduct investigation of the antenna for different applications with an understanding of the fundamental parameters of antennas.
CO2 Design and principle of a dipole antenna.
CO3 Design and evaluate broadband and high gain antennas for various applications.
CO4 Analyze the properties of different types of modern antennas and their design.
CO5 Come up with the design of the antenna of the required specifications for the latest wireless technologies.

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	1	3							1	3	2	
CO2	3	3	2	1	3							1	3	2	
CO3	3	3	2	1								1	3		
CO4	3	3	3	2	3							1	3	2	1
CO5	3	3	1	2	3	3						1	3	2	1

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

Sub Code	L	T	P	Duration	IA	ESE	Total	Credits
ECUDLT1	-	-	2	2 Hours	25	25	50	1

ANALOG CIRCUITS LAB

Course Objectives:

- To identify and test various electronic components.
- To use DSO for various measurements.
- To plot the characteristics of diode and transistor.
- To design and implement feedback amplifier circuits.
- To measure the frequency of oscillators.

LIST OF EXPERIMENTS:

1. To study the h-parameters of transistor.
2. To study the single stage RC coupled CE, CB, CC amplifier.
3. To study the two stage RC coupled amplifier using transistor.
4. To study the different types of feedback amplifier.
5. To study the wien bridge oscillator.
6. To study the RC phase-shift oscillator.
7. To study the hartley & collpit oscillator.
8. To study the JFET as an amplifier.
9. To study the class A amplifier.
10. To study the class B amplifier.
11. To study the RF single & double tuned amplifier.
12. To study the push-pull amplifier.
13. To study the complementery symmetry push-pull amplifier.

Course Outcomes:

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

CO1 Implement the different configuration of BJT & FET amplifier at different frequencies.
CO2 Implement the RC coupled amplifier and analyze the characteristics at different frequencies.
CO3 Implement different types of feedback amplifier.

CO4 Implement different class of power amplifier with different loads and evaluate the efficiency.
CO5 Design audio & radio frequency oscillator and evaluate the frequency of oscillation.

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	1	2					3			3	2	2	1
CO2	3	3	1	2					3			3	2	2	1
CO3	3	3	1	2					3			3	2	2	1
CO4	3	3	1	2					3			3	2	2	1
CO5	3	3	1	2					3			3	2	2	1

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

Sub Code	L	T	P	Duration	IA	ESE	Total	Credits
ECUDLT2	-	-	2	2 Hours	25	25	50	1

ANALOG SND DIGITAL COMMUNICATION LAB

Course Objectives:

- To Study the basics of analog and digital modulation techniques.
- To get real-time and practical exposure of communication systems with detailed analysis of analog and digital communication techniques.

LIST OF EXPERIMENTS:

1. To study of amplitude modulation and demodulation.
2. To study of DSB-SC, 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 ASK, FSK and PSK modulation schemes.

Course Outcome:

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

CO1 Analyze the fundamental concepts of analog communication systems.
CO2 Perform the sampling process.
CO3 Implement the various pulse modulation schemes for digital communication
CO4 Examine the performance of coding in digital systems.
CO5 Demonstrate the various digital modulation technique

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	3				1			2	3	1	1
CO2	3	2	1	1	3				1			2	3	1	1
CO3	3	3	2	1	3				1			2	3	1	1
CO4	3	3	2	1	3				1			2	3	1	1
CO5	3	3	2	1	3				1			2	3	1	1

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

INSTITUTE CORE (IV SEMESTER)

Sub Code	L	T	P	Duration	IA	ESE	Total	Credits
ECUDTO1	3	-	-	3 Hours	40	60	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
- To analyze and perform the theoretical concepts through laboratory and simulation experiments.

UNIT-I

Semiconductor Concept: Review of semiconductor & energy band diagram, The k-space diagrams of Si and GaAs, Density of states function, The fermi–dirac probability function, The distribution function and the fermi energy, Semiconductor in equilibrium, Carrier transport phenomena, Carrier generation and recombination.

UNIT-II

Junction Diode Characteristics: Description of pn junction action, The abrupt junction, The ideal diode model, Temperature dependence of I-V characteristics, Breakdown mechanism, Diode resistance, Diode capacitance, Clipper, Clamper, Rectifier.

UNIT-III

Transistor Characteristics: NPN, PNP, Operations, Early effect, Current equations, Input and output characteristics of CE, CB, CC, Transistor as a switch & amplifier, Transistor biasing and thermal stabilization.

UNIT-IV

Field Effect Transistor (FET): JFET construction, operation & device characteristics, Pinch off voltage and its significance, Classification of MOSFET, The two-terminal MOS structure, C-V characteristics, The Basic structure & operating principal of MOSFET, Threshold voltage, Current-voltage characteristics, Biasing of JFET & MOSFET.

UNIT-V

Low Frequency Analysis: h-parameter models for CB, CE, CC configurations and their inter relationship, Analysis and comparison of the three configurations, Approximate models and calculation of CE and CC amplifiers, CE with emitter resistance, Analysis of low frequency CS and CD FET amplifier.

Text/Reference Books:

1. D. A. Neaman, "Semiconductor Physics and Devices- Basic Principles", 4th ed., TMH, 2021.
2. J. Millman and C. C. Halkias, "Electronic Devices and Circuits", 6th ed., Tata McGraw Hill Publishing Limited, New Delhi, 2003.

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.

Course Outcomes:

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

CO1 Illustrate the knowledge of semiconductor physics.
CO2 Comprehend the characteristics of the PN junction diode 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 Evaluate low frequency analysis of transistor.

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	1			3			2	3	1	2
CO2	3	3	2	3	2	1			3			2	3	2	2
CO3	3	3	2	3	2	1			3			2	3	2	2
CO4	3	3	2	3	2	1			3			2	3	2	2
CO5	3	3	2	3	2	1			3			2	3	2	2

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

Sub Code	L	T	P	Duration	IA	ESE	Total	Credits
ITUDTO1	3	-	-	3 Hours	40	60	100	3

COMPUTER NETWORK

Course Objectives:

- Discuss the basic taxonomy and terminology of the computer networking.
- Discuss the functionality of different layers of OSI Model.
- Discuss different protocols of TCP/IP protocol suite.
- Discuss the process of IP addressing and working of routing protocols.
- Discuss the different challenges of Internetworking, Congestion control and Quality of services

UNIT-I

Introduction: Data communications: Components, Data representation, Direction of data flow (simplex, half duplex, full duplex).

Networks: Distributed processing, Network criteria, Physical structure (type of connection, topology), categories of network (LAN, MAN,WAN); Internet: brief history, internet today, Protocols and standard.

Reference models: OSI reference model, TCP/IP reference model, their comparative study.

Physical Layer: Transmission technology.

UNIT-II

Data Link Layer: Types of errors, Error detection & correction methods, Framing (character and bit stuffing), Flow control, Protocols: Stop & wait ARQ Go – Back – N ARQ, Selective repeat ARQ.

Medium access sub layer: Point to point protocol, Multiple Access Protocols: Pure ALOHA, Slotted ALOHA, CSMA, CSMA/CD, Token ring, Reservation, Polling, FDMA, TDMA, CDMA.

UNIT-III

Network Layer:

Internetworking devices: Repeaters, Hubs, Bridges, Switches, Router, Gateway.

Addressing: IP addressing, classful addressing, subnetting.

Routing: Techniques, Static vs. Dynamic routing, Routing table for classful address, Flooding, Shortest path algorithm, Distance vector routing, Link state routing.

Protocols: ARP, RARP, IP, ICMP, IPV6.

UNIT-IV

Transport Layer: Process to process delivery, UDP: Services and applications, TCP: Stream Oriented Service, Segment, Timers, Congestion control techniques: Avoidance and Detection.

UNIT-V

Application Layer: DNS, SMTP, FTP, HTTP & WWW.

Security: Cryptography, User authentication, Security protocols in internet, Firewalls. Recent research topic on networking.

Text/Reference Books:

1. Data Communications and Networking by B.A.Forouzan – TMH Publication.
2. Computer Networks by S. Tanenbaum – Pearson Education / PHI Publication.
3. Internetworking with TCP/IP by Comer - Pearson Education/PHI by Publication.
4. Data and Computer Communications by W.Stallings – PHI Publication.

Course Outcome:

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

1. Upon completion of this course, the students will be able to
2. Understand the working of different internetworking devices.
3. Understand the working of Internet.
4. Understand the difference between OSI and TCP/IP.
5. Understand the security mechanism in Networking.
6. Understand core concept of IP addressing and routing.

Sub Code	L	T	P	Duration	IA	ESE	Total	Credits
ITUDTO2	3	-	-	3 Hours	40	60	100	3

FUNDAMENTALS OF PYTHON PROGRAMMING

Course Objectives:

- To read and write simple python programs.
- To develop python programs with conditionals and loops.
- To define python functions and call them.
- To use python data structures –- lists, tuples, dictionaries.
- To do input/output with files in python.

UNIT-I

Introduction to Python: Introduction to python and its historical background, Applications, Installation of python and development environments (IDLE, Jupyter), Writing and running python programs, Understanding python's syntax and code structure, Basic input and output operations.

UNIT-II

Data Types and Variables: Data types: integers, floats, strings and Booleans, Variables and variable naming conventions, Type conversion, and typecasting, Python Operators: arithmetic, comparison, logical and assignment operators.

UNIT-III

Python Control Flow and Loops: Python decision-making with if, elif, and else statements, Python loops: while and for loops, Break and continue statements, Python control statements (pass, assert), String operations: concatenation, replication, slicing, and indexing.

UNIT-IV

Python Data Structures and Functions: Python sequences, lists, tuples, and range, Python collections, sets, dictionaries, Functions in python: defining, calling, parameters, return, Work with various data structures and create functions for different tasks.

UNIT-V

Advanced Topics and Modules: File handling in python, Exception handling, Introduction to modules and libraries, Built-in modules in python, Overview of python libraries (e.g., math, random), Explore packages.

Text/Reference Books:

1. Core Python Programming, Wesley J. Chun, Second Edition, Pearson.
2. Think Python, Allen Downey, Green Tea Press.
3. Introduction to Python, Kenneth A. Lambert, Cengage.
4. Python Programming: A Modern Approach, Vamsi Kurama, Pearson.
5. Learning Python, Mark Lutz, O'Really.

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

CO1 Introduce students to Python's history, installation, and basic usage, enabling them to write and execute simple Python programs.

CO2 Familiarize students with Python syntax, data types, variables, and fundamental operators to build a solid programming foundation.

CO3 Teach students how to make decisions and control program flow using conditional statements and loops in Python.

CO4 Enable students to work with various data structures like lists, tuples, sets, dictionaries, and

functions to manipulate data effectively.
CO5 Equip students with essential skills for file handling, and exception handling, and introduce them to modules and libraries in Python for more advanced programming tasks.

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	2							3	3	3	2
CO2	3	3	2	2	2							3	3	3	2
CO3	3	3	2	2	2							3	3	3	2
CO4	3	3	2	2	2							3	3	3	2
CO5	3	3	2	2	3							3	3	3	3

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

Sub Code	L	T	P	Duration	IA	ESE	Total	Credits
CSUDTO1	3	-	-	3 Hours	40	60	100	3

INTRODUCTION TO INFORMATION SCIENCE

Course Objectives:

1. To understand basic concepts about Coding Theorem.
2. To understand basic concepts about error detection and correction methods.
3. To understand basic concepts about compression techniques.
4. To understand basic concepts about video image compression techniques.
5. To understand basic concepts about cryptography.

UNIT-I

Uncertainty, Information and Entropy Information Measures: Characteristics on information measure, Shannon's concept of information, Shannon's measure of information, Model for source coding theorem, Communication system, Source coding and line/channel coding, channel models, channel mutual information capacity (Bandwidth).

UNIT-II

Channel coding, Theorem for discrete memory less channel, Information capacity theorem, Error detecting and error correcting codes, Types of codes, Block codes, Tree codes, Hamming codes, Description of linear block codes by matrices, Description of linear tree code by matrices, Parity check codes, Parity check polynomials.

UNIT-III

Compression: Lossless and lossy, Huffman codes, Binary Image compression schemes, Runlength Encoding, CCITT group-3 1D compression, CCITT group-3 2D compression, CCITT group-42D compression.

UNIT-IV

Video Image Compression: Requirement of full motion video compression, CCITT H 261video coding algorithm, MPEG compression methodology: MPEG-2 compression, Audio (Speech) compression.

UNIT-V

Cryptography: Encryption, Decryption, Cryptogram (cipher text), Concept of cipher, Cryptanalysis, Keys: Single key (Secret key), Cryptography, two-key (Public key) cryptography, Single key cryptography, Ciphers, Block Cipher code, Stream ciphers, Requirements for secrecy, The data Encryption Standard, Public Key Cryptography, Diffie-Hellmann public key distribution, The Rivest-Shamin Adelman (R-S-A) system for public key cryptography, Digital Signature.

Text/Reference Books:

1. Digital Communication by Das, Mullick & Chatterjee, New Age Pub.
2. Digital Communication by Proakis, TMH.
3. Digital Image Processing by Gonzales & Woods, Pearson.
4. Local Area Network by G. Keiser, TMH.

Course Outcome:

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

1. Student will be able to know about Coding Theorems.
2. Student will be able to know about error detection and correction methods.
3. Student will be able to know about compression techniques.
4. Student will be able to know about video image compression techniques.
5. Student will be able to know about cryptography.

Sub Code	L	T	P	Duration	IA	ESE	Total	Credits
CEUDTO1	3	-	-	3 Hours	40	60	100	3

REMOTE SENSING & GIS

Course Objectives:

- Apply the concepts of Photogrametry and its applications such as determination of heights of objects on terrain.
- Understand the basic concept of Remote Sensing and know about different types of satellite and sensors.
- Illustrate Energy interactions with atmosphere and with earth surface features, Interpretation of satellite and top sheet maps.
- Understand different components of GIS and Learning about map projection and coordinate system.
- Develop knowledge on conversion of data from analogue to digital and working with GIS software.

UNIT-I

INTRODUCTION TO PHOTOGRAMMETRY Principles and types of aerial photographs, geometry of vertical and aerial photograph, Scale and Height measurement on single and vertical aerial photograph, Height measurement based on relief displacement, Fundamentals of Stereoscopy, fiducial points, parallax measurement using fiducial line.

UNIT-II

REMOTE SENSING Basic concepts and foundation of Remote Sensing elements, Data information, Remote sensing data collection, Remote sensing advantages and Limitations, Remote sensing process. Electromagnetic spectrum, Energy interaction with atmosphere and with earth surface features (soil, water, and vegetation) Indian Satellites and Sensors characteristics, Map and Image false color composite, introduction to digital data, elements of visual interpretations techniques.

UNIT-III

GEOGRAPHIC INFORMATION SYSTEMS Introduction to GIS, Components of GIS, Geospatial data: Spatial Data – Attribute Data- Joining Spatial and Attribute Data, GIS Operations: Spatial Data input- Attribute Data Management-Data Display-Data Exploration-Data Analysis. **COORDINATE SYSTEMS:** Geographic Coordinate system; Approximation of Earth, Datum: Map Projections; Types of Map Projections-Map Projection Parameters-Commonly used Map Projections – Projected Coordinate Systems.

UNIT-IV

VECTOR DATA MODEL Representation of simple features- Topology and its importance: coverage and its data structure, shape file:, data models for composite features Object Based Vector Data Model; Classes and their Relationships: The geo-based data model: Geometric representation of Spatial feature and data structure: Topology rules.

UNIT-V

RASTER DATA MODEL Elements of Raster data model: Types of Raster data: Raster data structure: Data conversion, Integration of Raster and Vector data. Data Input: Metadata: Conversion of Existing data, Creating new data, Remote sensing data, Field data, Digitizing, Scanning, on screen digitizing, importance of source map, Data Editing.

Text/Reference Books:

1. Bhatta B (2008), Remote sensing and GIS“, Oxford University Press
2. Lillesand, T.M, R.W. Kiefer and J.W. Chipman (2013) Remote Sensing and Image Interpretation“, Wiley India Pvt. Ltd., New Delhi

3. Schowenger, R. A (2006) Remote Sensing, Elsevier publishers.
4. Parkinson,B. W., Spilker, J. J. (Jr.) (1996). Global Positioning System: Theory & Applications (Volume-I). AIAA, USA
5. Remote Sensing of the environment- An earth resource perspective- 2nd edition- by John R. Jensen, Pearson Education.
6. Introduction to geographic information system- kang – Tsung Chang, Tata McGraw- Hill Education Private Limited.
7. Concepts & Techniques of GIS by C.P.Lo Albert, K.W. Yonng, Prentice Hall (India) Publications. Remote Sensing and Geographical Information systems by M.Anji Reddy JNTU Hyderabad 2001, B.S. Publications.
8. Principals of Geo physical Information System- Peter A Burragh and Rachael A. Mc Donnell, Oxford Publishers 2004
9. Basics of Remote Sensing and GIS by S. Kumar, laxmi Publications.
10. Fundamentals of Remote Sensing by George Joseph, Universities Press, 2013.

Course Outcome:

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

CO1 Understand the principles of aerial and satellite remote sensing, Able to comprehend the energy interactions with earth surface features, spectral properties of water bodies.

CO2 Understand the basic concept of GIS and its applications, know different types of data representation in GIS.

CO3 Understand and Develop models for GIS spatial Analysis and will be able to know what the questions that GIS can answer are.

CO4 Apply knowledge of GIS software and able to work with GIS software in various application fields.

CO5 Illustrate spatial and non spatial data features in GIS and understand the map projections and coordinates systems.

CO6 Apply knowledge of GIS and understand the integration of Remote Sensing and GIS.

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	3											3		2
CO2	3	2											3	2	
CO3				3			2						3	2	
CO4											2		2	3	
CO5			3	2						2			2	3	2

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

Sub Code	L	T	P	Duration	IA	ESE	Total	Credits
CHUDTO1	3	-	-	3 Hours	40	60	100	3

FLUIDIZATION ENGINEERING

Course Objectives:

To impart the fundamental knowledge of Fluidization and understand the different aspects of fluidized bed systems applied in various industries.

UNIT-I

Phenomenon of Fluidization, Advantages and disadvantages of fluidization compared to conventional processes, Classification of various industrial beds, Industrial applications of fluidized beds in mineral processing, coal and biomass gasification & combustion FCC petroleum refining, pharmaceuticals, cement and other solid handling systems, Fluidized Bed Drying.

UNIT-II

Gross behavior of fluidized beds-Minimum fluidizing velocity and pressure drops; Voidage, Design of distributors, Effect of temperature and pressure on fluidized bed, Elutriation and entrainment Transport disengaging height.

UNIT-III
Bubbles in dense beds-Davidson Model, stream of bubbles, Bubbling bed models, Geldart classification, Different regimes of Fluidization, Davidson's model, Variation of Bubbling bed and Circulating Fluidized beds.

UNIT-IV
Emulsion phase, Turn-over rate of solids, Residence Time Distribution of Solids, Diffusion model of solids movement, Interchange coefficient of solid into and out of wake.

UNIT-V
Flow Pattern of Gas through fluidized beds, diffusion model for gas flow; two region models, evaluation of interchange coefficients, Heat and Mass transfer in Fluidized Beds.

Text/Reference Books:

1. Fluidization Engineering by D. Kunii and O. Levenpiel, Butterworth-Heinemann, Elsevier.
2. Fluidization by J. F. Davidson and D. Harrison, Academic Press.
3. Fluidization and Fluid Particles Systems by F.A. Zenz and D. F. Othmer, Reinhold Publishing.
4. Handbook of Fluidization and Fluid-Particle Systems, by W. C. Yang, CRC Press. Course

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

1. Describe fluidization and its recommendation in various industries exploiting its various advantages evaluating the heat and mass transfer aspects.
2. Apply model equations for fluidized beds for application in various industries.
3. Able to understand various fluidization characteristics like minimum fluidization velocity, complete fluidization velocity and transport disengage height.

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	3	3	--	--	--	--	--	--	--	3	3	--
CO2	3	3	3	3	3	--	--	--	--	--	--	--	3	3	--
CO3	3	3	3	3	3	--	--	--	--	--	--	--	3	3	--
CO4															
CO5															

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

Sub Code	L	T	P	Duration	IA	ESE	Total	Credits
MEUDTO1	3	-	-	3 Hours	40	60	100	3

INTRODUCTION TO FLUID MECHANICS

Course Objectives:
1. To familiarize with the properties of fluids and the applications of fluid mechanics.
2. To formulate and analyze problems related to calculation of forces in fluid structure interaction.
3. To understand the concept of fluid measurement, types of flows and dimensional analysis.
4. To understand boundary layer concepts.

UNIT-I
Fundamentals of Fluid Mechanics: Introduction; Applications; Concept of fluid; Difference between solids, liquids and gases; Concept of continuum; Ideal and real fluids; Fluid properties

UNIT-II
Fluid Statics: Concept of static fluid pressure; Pascal's law and its engineering applications; Hydrostatic paradox; Pressure distribution in a liquids

UNIT-III
Fluid Kinematics: Classification of fluid flows; Lagrangian and Euler flow descriptions;
Velocity and acceleration of fluid particle; Local and convective acceleration; Normal and tangential acceleration; Flow rate and discharge mean velocity; One dimensional continuity equation; Continuity equation

UNIT-IV

Fluid Dynamics: Euler's equation of motion; Bernoulli's equation using principle of conservation of energy; equation of motion and its applications to steady state ideal and real fluid flows

UNIT-V

Fluid devices; Conversion of mechanical to fluid energy - applications

Text/Reference Books:

1. S.K. Som, G. Biswas and S. Chakraborty, "Introduction to Fluid Mechanics and Fluid Machines", Tata McGraw Hill Publications, 3rd edition, 2011.
2. D.S. Kumar, "Fluid Mechanics and Fluid Power Engineering", S.K. Kataria and Sons Publishers, 1st Edition, 2009.
3. Y.A. Cengel and J.M. Cimbala, "Fluid Mechanics - Fundamentals and Applications", Tata McGraw Hill Publications, 3rd Edition, 2013.
4. V.L. Streeter, E.B. Wylie and K.W. Bedford, "Fluid Mechanics", McGraw Hill BookCompany, New York, 9th Edition, 1998.
5. Frank M. White, "Fluid Mechanics", Tata Mc Graw Hill Publications, 5th Edition, 2012.

Course Outcome:

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

1. Understand the concept of fluids and their properties.
2. Distinguish various types of flows and learn flow measurement methods.
3. Apply the concept to solve the problems related to fluid statics.
4. Apply concepts to solve problems on fluid kinematics.
5. Demonstrate working principle of various fluid-based devices.

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										2	1	3
CO2	3	2	2										3	1	3
CO3	3	2	2										3	1	3
CO4	3	2	1										2	1	3
CO5	3	2	1										2	1	3

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

Sub Code	L	T	P	Duration	IA	ESE	Total	Credits
IPUDTO1	3	-	-	3 Hours	40	60	100	3

AUTOMOBILE ENGINEERING

Course Objectives:

1. To provide the knowledge of basic structure of an automobile.
2. To provide the knowledge of transmission system and its various elements.
3. To provide the knowledge of clutches and suspension system
4. To provide the knowledge of braking system.
5. To provide the knowledge of steering system and engine emissions.

UNIT-I

Introduction of an automobile: Component and basis structure of automobile, classification, difference between automobile and automotive, the chassis construction & classification, defect in frames, frameless construction & specifications. Wheel and tyres: Types of wheel, wheel dimension, desirable tyres properties, types of tyres, tyre material, tyre dimension, factors affecting tyre life.

UNIT-II

Transmission system: Function of transmission types, sliding mesh gear box, constant mesh gear box, synchro mesh gear box, torque converter, propeller shaft, universal joint, hook joint, final drive, differential, performance of gear box.

UNIT-III

Clutches: Requirement, function & type of clutch, dry friction clutch, wet friction clutch, clutch plate, single plate & multiple plate clutch, centrifugal clutch and fluid fly wheel.
Suspension system function and requirement, leaf spring, torsion bar, telescopic shock absorber.

UNIT-IV

Brakes: Function and requirement, brake efficiency, wheel skidding, types of brake, electrical, mechanical and hydraulic & pneumatic brakes, master cylinder, wheel cylinder, self-actualizing brakes, brake drum, brake liners, brake shoe, trouble shooting.

UNIT-V

Front axle and suspension wheel alignment purpose: Factor of front wheel alignment, steering geometry, correct steering angle, steering mechanism, under steer and over steer, steering gear, power steering, reversibility of steering gears, steering gear ratio, calculation of turning radius.

Engine emission: Emission standard of vehicle in India, Euro norms, emission, testing. Principle of multipoint fuel injection (MPFI), component of MPFI, different sensors of MPFI system, vehicle air conditioning.

Text/Reference Books:

1. Automobile Engineering - Kripal Singh Vol. I, II.
2. Automobile Mechanics - Joseph Heitner.
3. Automobile Engineering - N.K Giri
4. Automobile Engineering - Shrinivasan T.M.H.
5. Automobile Engineering - K.K. Jain, R.B. Asthana T.M.H.
6. Automobile Engineering - R.B. Gupta Tech India Publication Series.

Course Outcome:

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

CO1: Graduates will gain a strong foundation in core automobile engineering, both in theoretical and applied concepts.
CO2: Acquire knowledge and hands-on competence in the design and development of automobile.
CO3: Graduates will develop an ability to identify and solve automobile engineering maintenance problems.

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	-	-	-	-	-	-	-	1	3	1	1
CO2	3	3	3	3	2	1	-	-	-	-	-	2	3	1	1
CO3	3	3	2	1	-	-	-	-	-	-	-	1	3	1	2
CO4															
CO5															

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