



Marathwada Shikshan Prasarak Mandal's

DEOGIRI INSTITUTE OF ENGINEERING AND MANAGEMENT STUDIES

(An Autonomous Institute)

Affiliated to Dr. Babasaheb Ambedkar Technological University, Lonere, Raigad |B.Tech | M. Tech

Affiliated to Dr. Babasaheb Ambedkar Marathwada University, CSN| MBA

Approved by AICTE/UGC- Govt. of India & DTE- Govt. of Maharashtra

Deogiri College Campus, Railway Station Road, Chhatrapati Sambhajnagar-431005 (MS)

DTE CODE : 2114

0240-2367567, 2367577

www.dietms.org

director@dietms.org

Department of Electronics and Telecommunications

Engineering

MTech (ETC) PROGRAM STRUCTURE (2025-27)

Course Category		I	II	III	IV	Total Credits
Program Courses	Program Core Course (PCC)	12	04	04		24
	MOOC		04			
	Program Elective Course (PEC)	06	06			12
Vocational and Skill Enhancement Courses (VSE)	Seminar	01				02
	PG Lab	01				
Humanities Social Science and Management (HSSM)	Indian Knowledge System (IKS)		02			02
Experiential Learning Courses (EL)	Research Methodology		03			34
	Mini Project		01			
	Project			10	20	
Open Elective Courses (OE)	Open Elective (OE)			03		03
Multi-Disciplinary Minor Courses (MDM)	Multi-Disciplinary Minor (MDM)			03		03
Liberal Learning Courses (LLC)	Co-Curricular Courses (CC)	-	-	-	AU	AU
Total Credits		20	20	20	20	80

MASTER COPY

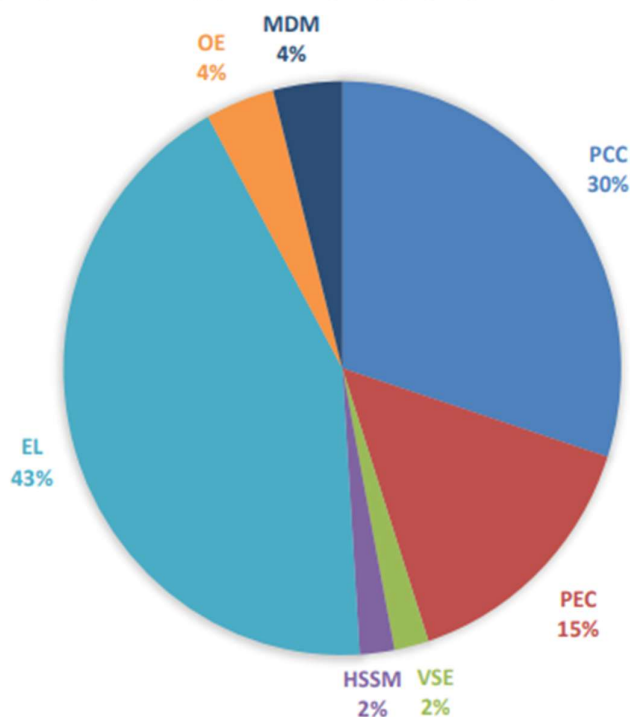
Chairman, BoS

Dean Academics

Chairman, Academic Council

M Tech in (E&TC)		
Course Category	Credits	% Credits
Program Core Courses (PCC)	24	30
Program Elective Courses (PEC)	12	15
Vocational & Skill Enhancement (VSE)	02	2
Humanity, Social Science & Management (AEC, EM, IKS, VEC) HSSM	02	2
Experiential Learning (EL)	34	43
Open Electives (OE)	03	4
Multi-Disciplinary Minor (MDM)	03	4
Total Credits	80	100%

COURSE CATERGOTY WISE COURSE DISTRIBUTION



MASTER COPY

[Signature]

Chairman, BoS

[Signature]

Dean Academics

[Signature]

Chairman, Academic Council

SEMESTER I												
Category	Course Code	Name of the Course	Teaching Scheme				Evaluation Scheme					Credits
			L	T	PR	Total	CA-I	CA-II	MSE	ESE	Total	
PCC	PE251001	Advanced Signal Theory	4	-	-	4	10	10	20	60	100	4
PCC	PE251002	Microwave and Radar Techniques	4	-	-	4	10	10	20	60	100	4
PCC	PE251003	Advanced Industrial Automation	4	-	-	4	10	10	20	60	100	4
PEC	PE2511--	PECI	3	-	-	3	10	10	20	60	100	3
PEC	PE2511--	PEC II	3	-	-	3	10	10	20	60	100	3
SC-SEC	PE251401	Seminar	-	-	2	2	15	15	-	20	50	1
SC-SEC	PE251402	PG Lab	-	-	2	2	15	15	-	20	50	1
Total			18	-	4	22					600	20
SEMESTER II												
Category	Course Code	Name of the Course	Teaching Scheme				Evaluation Scheme					Credits
			L	T	PR	Total	CA-I	CA-II	MSE	ESE	Total	
PCC	PE252004	Advanced Digital Communication Systems	4	-	-	4	10	10	20	60	100	4
PCC	PE252005	MOOC/SWAYAM	4	-	-	4	10	10	20	60	100	4
PEC	PE2521--	PECIII	3	-	-	3	10	10	20	60	100	3
PEC	PE2521--	PECIV	3	-	-	3	10	10	20	60	100	3
ELC	PG252601	Research Methodology	3	-	-	3	10	10	20	60	100	3
# HSSM-IKS	PG252501	Interdisciplinary Perspective on Indian Science and Technology	2	-	-	2	10	10	20	60	100	2
ELC	PE252602	Mini Project	-	-	2	2	15	15	-	20	50	1
Total			19		2	21					650	20
SEMESTER III												
Category	Course Code	Name of the Course	Teaching Scheme				Evaluation Scheme					Credits
			L	T	PR	Total	CA-I	CA-II	MSE	ESE	Total	
PCC	PE253006	Robotics	4	-	-	4	10	10	20	60	100	4
OE	PE253301	Open Elective	3	-	-	3	10	10	20	60	100	3
MDM	PE253201	Multi-Disciplinary Minor	3	-	-	3	10	10	20	60	100	3
ELC	PE253603	Project I	-	-	10	10	25	25	-	50	100	10
Total			10		10	20					400	20
SEMESTER IV												
Category	Course Code	Name of the Course	Teaching Scheme				Evaluation Scheme					Credits
			L	T	PR	Total	CA-I	CA-II	MSE	ESE	Total	
ELC	PE254604	Project II	-	-	20	20	50	50	-	100	200	20
CC	PE254701	Communication Skills and Technical Writing	2	-	-	2	25	25	-	-	50	AU
Total			2		20	22					250	20
Note: # End-of-semester evaluation will be done at the department level												

MASTER COPY

Chairman, BoS

Dean Academics

Chairman, Academic Council

OE and MDM courses

Note: OE and MDM Minor courses shall be offered through the SWAYAM/NPTEL online learning platform. The Board of Studies (BoS) shall identify, approve, and recommend the course based on its relevance to the program curriculum, academic quality, and prevailing industry standards.

Program Elective Courses (PEC)

SEM I	Program Elective I	3	Course Code	PE251101	PE251102	PE251103
			Course	Wireless Mobile Communication	Artificial Neural Networks and Applications	Signal Processing Algorithms & Applications
	Program Elective II	3	Course Code	PE251104	PE251105	PE251106
			Course	Advanced Optical Fiber Communication	Microelectronics	Digital Image Processing & Application
SEM II	Program Elective III	3	Course Code	PE252107	PE252108	PE252109
			Course	Wireless Sensor Network Design	Advanced Embedded System Design	Biomedical Signal Processing
	Program Elective IV	3	Course Code	PE252110	PE252111	PE252112
			Course	IOT and Systems	Analog VLSI Design	Pattern Recognition

MASTER COPY


Chairman, BoS


Dean Academics


Chairman, Academic Council



Title of the Course: Advanced Signal Theory		Course Category: PCC
Course Code: PE251001		
Teaching Scheme	Examination Scheme	
Lectures: 04 hrs/week	CA-I	10 Marks
Tutorial: --	CA-II	10 Marks
Credits: 04	MSE	20 Marks
Semester: First Year (Semester-I)	ESE	60 Marks
Course Prerequisite: Course Prerequisite: Basic knowledge of signals and systems, linear algebra, calculus, probability, and digital signal processing.		
Course Description: This course provides a comprehensive understanding of advanced concepts and analytical techniques in signal theory. It focuses on the mathematical foundations of probability, random variables, and stochastic processes, emphasizing their application in modern signal representation, transformation, and processing. The course will cover the theoretical underpinnings necessary for advanced research and practical applications in fields such as communication systems, estimation theory, and statistical signal processing.		
Course Objectives: 1. To equip students with a solid foundation in probability theory relevant to signal processing. 2. To enable students to analyze and characterize random variables and their statistical properties. 3. To develop the ability to apply joint distributions and conditional expectations for multiple random variables. 4. To introduce the concepts of stochastic processes and their applications in communication and signal estimation. 5. To prepare students for advanced study and research in signal processing by developing strong analytical skills.		

Course Outcomes:		
CO	After the completion of the course, the student should be able to	Bloom's Level
CO1	Explain the fundamental concepts of probability theory, random variables, probability distributions, and random processes used in engineering applications.	L2 Understand
CO2	Apply probability laws, Bayes' theorem, distribution functions, and statistical measures to solve problems involving random variables and stochastic systems.	L3 Apply
CO3	Determine the characteristics of single and multiple random variables, including moments, characteristic functions, joint distributions, and conditional expectations for engineering analysis.	L3 Apply
CO4	Analyze sequences of random variables and random processes using stochastic convergence, correlation functions, spectral density concepts, and their applications in communication and signal processing systems.	L4 Analyze

CO-PO Mapping													
COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	2	-	-	1	-	-	-	-	-	1	2	3
CO2	3	3	2	1	2	-	-	-	-	-	1	2	3
CO3	3	2	2	2	2	-	-	-	-	-	1	2	3
CO4	3	3	2	3	3	-	-	-	-	-	2	2	3

MASTER COPY

Arul
Chairman. BoS

Assessment:	
CA-I (a) (10M)	Assignment / Subjective Test / Open book test
CA-II (b) (10M)	Assignment / Presentation / Case Study
MSE (c) (20M)	Descriptive Test

Course Contents:		
Unit 1	Probability Theory Introduction to probability: The meaning and axioms of probability, repeated trials and sequences of events, Conditional probability and independence of events, Bayes' theorem, and its applications.	8 Hrs.
Unit2	Random Variables Introduction to the concept of a random variable, Distribution and density functions (PDF and CDF), Specific random variables (e.g., Gaussian, Uniform, Exponential), Conditional distributions and asymptotic approximations for Binomial random variables.	8 Hrs.
Unit3	Functions of One Random Variable The random variable and its distribution, calculating mean and variance of Moments and characteristic functions, Application of characteristic functions in statistical analysis.	8 Hrs.
Unit 4	Multiple Random Variables Joint and marginal distributions, Functions of multiple random variables, Joint moments and joint characteristic functions, Conditional distributions and conditional expected values, Statistical independence of multiple random variables.	8 Hrs..
Unit 5	Sequences of Random Variables General concepts and properties of sequences of random variables, Mean square estimation, Stochastic convergence and limit theorems, Random Number Generation: Methods and importance.	8 Hrs.
Unit 6	Random Processes and Applications Introduction to random processes: Characterization and classification, Stationary and non-stationary processes, Autocorrelation and power spectral density, Cross-correlation and cross-spectral density, Analysis of linear systems with random inputs, Gaussian and Markov processes, White noise and colored noise models, Applications in communication systems and statistical signal estimation.	8 Hrs.

Textbooks	
1.	Papoulis, A., & Pillai, S. U. (2002). Probability, Random Variables and Stochastic Processes (4 th ed.). McGraw Hill.
2.	Stark, H., & Woods, J. W. (2011). Probability and Random Processes with Applications to Signal Processing (4th ed.). Pearson Education.
3.	Peebles, P. Z. (2001). Probability, Random Variables and Random Signal Principles (4th ed.). McGraw Hill.
Reference Books	
1.	Gallager, R. G. (2013). Stochastic Processes: Theory for Applications. Cambridge University

MASTER COPY

Abul
Chairman. BoS

	Press.
2.	Grimmett, G., & Stirzaker, D. (2001). Probability and Random Processes (3rd ed.). Oxford University Press.

Web Resources	
1.	https://nptel.ac.in/courses/117104117 — <i>NOC: Probability and Random Variables/ Processes for Wireless Communications</i> (covers probability, random variables, distributions, etc.)
2.	https://onlinecourses.nptel.ac.in/noc22_ee123/preview — <i>Probability and Random Processes</i> by IIT Guwahati (intro to probability, random variables, and random processes)

MASTER COPY

Arubol
Chairman. BoS

Course Title: Microwave and Radar Techniques		
Course Code: PE251002		Course Category: PCC
Teaching Scheme	Examination Scheme	
Lectures: 04hrs/week	CA-1	10 Marks
Tutorial:-----	CA-2	10 Marks
Credits:04	MSE	20 Marks
Semester: First Year (Semester I)	ESE	60 Marks
Course Prerequisite: Basic knowledge electromagnetic theory, transmission lines, and Communication systems.		
Course Description: This course includes the study of microwave principles, components, and radar techniques for high-frequency communication and detection systems.		
Course Objectives: To equip students with fundamental concepts and practical skills in microwave engineering and radar system design and analysis.		

Course Outcomes:		
COs	After completion of the course, students will be able to	Bloom's Level
CO1	Recall the fundamental concepts, terminology, components, operating principles, and applications of microwave and radar engineering systems.	L1 Remember
CO2	Explain the characteristics, functions, measurement techniques, and performance parameters of microwave devices, radar systems, and their applications.	L2 Understand
CO3	Apply microwave and radar engineering principles, analytical methods, and system parameters to solve engineering problems related to communication, measurement, and detection systems.	L3 Apply
CO4	Analyze the performance, behavior, and suitability of microwave and radar systems, components, and emerging technologies for diverse engineering applications.	L4 Analyze

CO-PO Mapping													
COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	2	-	-	1	-	-	-	-	-	1	2	2
CO2	3	2	1	1	2	-	-	-	-	-	1	3	2
CO3	3	3	2	2	3	1	-	-	-	-	1	3	3
CO4	3	3	3	3	3	2	-	-	-	-	2	2	3

Course Contents:		
Unit 1	Microwave Fundamentals Microwave frequency spectrum and applications, Guided wave concepts: Mode design of rectangular and circular waveguides, scattering matrix and impedance transformation, Microwave matching techniques, transmission lines, and Smith chart basics.	8 Hrs.
Unit2	Microwave Components and Devices Directional couplers, power dividers, hybrid junctions, circulators, isolators, Microwave filters and resonators, Microwave sources: Klystron, Reflex Klystron, Magnetron, TWT, Gunn diode, Solid-state Microwave devices: IMPATT, PIN	8 Hrs.

MASTER COPY

Abul
Chairman. BoS

	diodes, mixers, detectors.	
Unit 3	Microwave Measurement Techniques Measurement of power, frequency, impedance, VSWR, Q-factor, S-parameter measurements using network analyzers, High-power measurement methods and error analysis principles.	8 Hrs.
Unit 4	Radar Basics Radar block diagram and operating principles, Radar range equation, PRF, duty cycle, and system losses, CW, FM-CW radar and Doppler Effect, basics MTI radar, pulse radar, radar cross-section,	8 Hrs..
Unit 5	Advanced Radar Systems Tracking radars: mono pulse, conical scan, sequential lobing, Phased array radars and electronically steered arrays, Synthetic Aperture Radar (SAR) and Inverse SAR (ISAR), Low probability of intercept (LPI), Radars and stealth techniques.	8 Hrs.
Unit 6	Applications and Emerging Trends Microwave links and line-of-sight systems, Airborne and space-borne radar applications, Automotive radar and collision avoidance systems, Millimeter-wave radar and microwave imaging.	8 Hrs.

Textbooks	
1.	R.E.Collin – Foundations for Microwave Engineering
2.	S.Y.Liao – Microwave Devices and Circuits
3.	M.I.Skolnik – Introduction to Radar Systems
Reference Books	
1.	D.M.Pozar – Microwave Engineering
2.	KaiChang – RF and Microwave Wireless Systems
3.	Dr. M. Kulkarni – Microwave and Radar Engineering

Web Resources	
1.	NPTEL Microwave Engineering Course: https://nptel.ac.in/courses/108/106/108106119/
2.	Electronics Stack Exchange: https://electronics.stackexchange.com
3.	MIT OpenCourseWare - Radar Systems: https://ocw.mit.edu/courses/aeronautics-and-astronautics/16-650j-digital-radar-signals-and-systems-fall-2008

MASTER COPY

Ashok
Chairman. BoS

Course Title: Advanced Industrial Automation		
Course Code: PE251003		Course Category: PCC
Teaching Scheme	Examination Scheme	
Lectures: 04 hrs/ week	CA-1	10 Marks
Tutorial: -----	CA-2	10 Marks
Credits: 04	MSE	20 Marks
Semester: First Year (Semester -I)	ESE	60 Marks
Course Prerequisite: Fundamentals of control systems, process instrumentation, and basic industrial automation concepts.		
Course Description: This course explores advanced concepts of industrial automation including process control, distributed and supervisory control systems, industrial communication protocols, and intelligent control techniques for modern industrial applications.		
Course Objectives: The objective of this course is to provide in-depth knowledge of advanced automation systems, control strategies, and communication technologies for efficient monitoring and control of industrial processes.		

Course Outcomes:		
COs	After completion of the course, students will be able to	Bloom's Level
CO1	Recall the fundamental concepts, terminology, architectures, and components used in industrial process control, distributed control systems, communication networks, and intelligent control systems.	L1 Remember
CO2	Explain the operation, characteristics, and functionalities of controllers, DCS, SCADA systems, industrial communication protocols, and fuzzy logic control techniques.	L2 Understand
CO3	Apply process control principles, industrial communication methods, and control strategies to solve engineering problems in industrial automation and process industries.	L3 Apply
CO4	Analyze the performance, suitability, and implementation of industrial control systems, communication networks, and intelligent control techniques for diverse industrial applications.	L4 Analyze

CO-PO Mapping													
COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	2	-	-	1	-	-	-	-	-	1	2	2
CO2	3	2	1	1	2	-	-	-	-	-	1	3	2
CO3	3	3	2	2	3	-	-	-	-	-	1	3	3
CO4	3	3	3	3	3	-	-	-	-	-	2	2	3

Assessment	
CA-1 (a) (10M)	Assignment / Subjective Test / Open book test / etc
CA-2 (b) (10M)	Model Making / Assignment / Presentation / etc
MSE (c) (20M)	Mid Sem Examination

MASTER COPY

Abul
Chairman. BoS

Course Contents:		
Unit 1	Controllers and Basics of DCS Basic concepts of process control, Mathematical modeling of controllers, ON/OFF, P, PI, PD, PID controllers: characteristics and tuning methods, Distributed Control Systems (DCS): definition, need, architecture overview	8 Hrs.
Unit 2	Distributed Control System Architecture Local Control Units (LCU): architecture and communication facilities, Configuration of DCS and display features, Case studies of DCS applications in industries.	8 Hrs.
Unit 3	Industrial Control Systems and SCADA Data loggers and Data Acquisition Systems (DAS), Direct Digital Control (DDC): concept and implementation, Supervisory Control and Data Acquisition Systems (SCADA), Functional block diagram of computer control systems, alarms, interrupts, digital controller modes	8 Hrs.
Unit 4	Industrial Communication Protocols Fieldbus in industrial plants: functions, performance, and standards, Ethernet networks in process control, Fieldbus design, installation, sensor networks, HART and Foundation Fieldbus networks, Advantages and limitations of open networks	8 Hrs..
Unit 5	Process and Plant Control NC, CNC, and DNC machines: concepts and control, Process simulation and control, Plant/sub-plant study and instrumentation processes used in Thermal power stations Sugar, cement, paper industries, Pharmaceutical industries	8 Hrs.
Unit 6	Fuzzy Logic Control Fuzzy sets, fuzzy relations, and calculations, Membership functions and indices of fuzziness, Comparison of fuzzy quantities and methods to determine membership functions, Fuzzy logic-based controllers and industrial case studies.	8 Hrs.

Text Books	
1.	D. N. Considine – Process Instruments and Controls Handbook – McGraw-Hill
2	B. G. Lipták – Process Control: Instrument Engineers' Handbook – CRC Press
3	Wayne W. Bequette – Process Control: Modeling, Design and Simulation – Prentice Hall
4	Gopal M. Nair – Distributed Control Systems: Principles and Applications – I.K. International

Reference Books	
1.	Stuart A. Boyer – SCADA: Supervisory Control and Data Acquisition – ISA / International Society of Automation
2.	Jon Stenerson & Debra Swanson – Industrial Automation and Process Control – Pearson
3.	William Bolton – Programmable Logic Controllers and Industrial Control – Elsevier / Newnes
4.	D. Driankov, H. Hellendoorn, M. Reinfrank – An Introduction to Fuzzy Control – Springer

Web Resources	
1.	Introductory chapter on <i>New Trends in Industrial Automation</i> (IntechOpen – open access)

MASTER COPY

Arul
Chairman. BoS

	https://www.intechopen.com/chapters/66195 (IntechOpen)
2.	"Advanced Applications of Industrial Robotics: New Trends and Possibilities" (MDPI, open access) https://www.mdpi.com/2076-3417/12/1/135 (MDPI)

MASTER COPY

Arubal
Chairman. BoS

Course Title: Wireless Mobile Communication		
Course Code: PE251101		Course Category: PEC I
Teaching Scheme	Examination Scheme	
Lectures: 03 hrs/ week	CA-1	10 Marks
Tutorial: -----	CA-2	10 Marks
Credits: 03	MSE	20 Marks
Semester: First Year (Semester I)	ESE	60 Marks
Course Prerequisite: Basic Knowledge of communication theory, digital modulation, electromagnetic theory, signal processing, networking, probability, and simulation tools (MATLAB, Python).		
Course Description: Wireless Mobile Communication focuses on mobile communication principles, cellular systems, wireless network design, and protocols. It covers technologies like 4G/5G, handoff, channel allocation, and mobile IP for efficient mobile connectivity and data transfer.		
Course Objectives: 1. To Understand mobile communication basics and cellular concepts. 2. To Learn wireless protocols and standards (4G/5G). 3. To Study signal propagation and interference. 4. To Analyze handoff and resource management. 5. To Design efficient mobile communication systems.		

Course Outcomes:		
COs	After completion of the course: Student should be able to	Bloom's Level
CO1	Recall the fundamental concepts, terminology, channel characteristics, and technologies used in modern wireless communication systems.	L1 Remember
CO2	Explain the principles, models, and performance parameters of wireless channels, cellular systems, OFDM, MIMO, and broadband wireless standards.	L2 Understand
CO3	Apply wireless communication techniques, channel models, diversity methods, and multicarrier transmission concepts to analyze communication system performance.	L3 Apply
CO4	Analyze the behavior and performance of advanced wireless communication systems using fading channel models, MIMO techniques, OFDM systems, and emerging wireless standards.	L4 Analyze

CO-PO Mapping													
COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	2	-	-	1	-	-	-	-	-	1	2	2
CO2	3	2	1	1	2	-	-	-	-	-	1	3	2
CO3	3	3	2	2	3	-	-	-	-	-	1	3	3
CO4	3	3	3	3	3	-	-	-	-	-	2	2	3

Assessment	
CA-1 (a) (10M)	Assignment
CA-2 (b) (10M)	Assignment
MSE (c) (20M)	Mid Sem Examination

MASTER COPY

Arul
Chairman, BoS

Course Contents		
Unit 1	Wireless Channels and Diversity Fast fading wireless channel modelling, Rayleigh and Ricean fading channels, BER performance in fading channels, Diversity techniques for wireless communications (frequency, time, space), BER improvement with diversity methods	6 Hrs
Unit 2	Broadband Wireless Channel Modeling WSSUS channel modeling and parameters, RMS delay spread and Doppler fading, Jakes model, autocorrelation, and Jakes spectrum, Impact of Doppler fading on system performance,	6 Hrs
Unit 3	Cellular Communications Introduction to cellular systems and frequency reuse, Multiple access technologies (FDMA, TDMA, CDMA, OFDMA), Cellular processes: call setup, handover procedures, roaming, Teletraffic theory fundamentals for wireless networks	6 Hrs
Unit 4	OFDM Systems Introduction to OFDM and multicarrier modulation, Cyclic prefix, channel models, and SNR performance, PAPR issues and mitigation techniques, Frequency and timing offset issues in OFDM.	6 Hrs
Unit 5	MIMO Wireless Systems MIMO fundamentals and channel capacity, SVD and eigenmodes of MIMO channels, Spatial multiplexing techniques (BLAST) and diversity methods (Alamouti, OSTBC, MRT), MIMO-OFDM concepts and applications.	6 Hrs
Unit 6	UWB and Wireless Standards UWB definition, features, and wireless channels, UWB modulation techniques and BER performance, Overview of 3G and 4G standards: GSM, GPRS, WCDMA, LTE, WiMAX, Key differences and applications of modern broadband wireless systems.	6 Hrs

Sr. No.	Text Books
1.	T. S. Rappaport, Wireless Communications: Principles and Practice, 2nd Edition, Pearson.
2.	A. Goldsmith – Wireless Communications, Cambridge University Press, 2005.
3.	David Tse and Pramod Viswanath – Fundamentals of Wireless Communication, Cambridge University Press, 2005.
4.	Andreas F. Molisch – Wireless Communications, Wiley, 2nd Edition, 2011.
5.	A. F. Molisch, Wireless Communications, Wiley.

Reference Books	
1.	Simon Haykin & Michael Moher, Modern Wireless Communications, Pearson.
2.	Andrea Goldsmith, Broadband Wireless Communications, Springer.
3.	William Stallings, Wireless Communications and Networks, Pearson.
4.	M. K. Simon and M. S. Alouini, Digital Communication over Fading Channels, Wiley.
5.	B. Sklar, Digital Communications: Fundamentals and Applications, Pearson.
Web Resources	
1.	A Comprehensive Review of 5G Wireless Communication: Spectrum Diversity with Technological Innovations and Current Challenges — <i>International Journal of Intelligent Systems and Applications in Engineering</i> . (IJISAE) Link → PDF / article (IJISAE)

MASTER COPY

Arul
Chairman. BoS

2.	6G Wireless Communication Systems: Applications, Requirements, Technologies, Challenges, and Research Directions — arXiv preprint. (arXiv) Link → arXiv (arXiv)
----	--

MASTER COPY

Arubal
Chairman. BoS

Course Title: Artificial Neural Networks & Applications		
Course Code: PE251102		Course Category: PEC-I
Teaching Scheme	Examination Scheme	
Lectures:03 hrs/week	CA-1	10 Marks
Tutorial:-----	CA-2	10 Marks
Credits:03	MSE	20 Marks
Semester: First Year (Semester I)	ESE	60 Marks
Course Prerequisite: Course typically requires a strong foundation in mathematics (especially linear algebra, calculus, and probability) and programming (preferably Python), along with a basic understanding of machine learning principles.		
Course Description: An Artificial Neural Networks (ANN) and Applications course describes how ANNs, inspired by the human brain, use interconnected nodes (neurons) in layers to learn from data, recognize complex patterns, and make predictions for tasks like image analysis, language processing, and forecasting.		
Course Objectives: 1. To introduce the neural networks for classification and regression 2. To give design methodologies for artificial neural networks 3. To demonstrate neural network applications on real-world tasks		

Course Outcomes:		
COs	After completion of the course, students will be able to	Bloom's Level
C01	Recall the fundamental concepts, terminology, architectures, learning paradigms, and computational principles of neural networks and machine learning techniques.	L1 Remember
C02	Explain the characteristics, learning mechanisms, architectures, and applications of neural network models, support vector machines, and self-organizing systems.	L2 Understand
C03	Apply neural network and machine learning algorithms for pattern classification, prediction, function approximation, feature extraction, and dimensionality reduction problems.	L3 Apply
C04	Analyze the performance, convergence behavior, generalization capability, and suitability of neural network and machine learning models for solving complex engineering problems.	L4 Analyze

CO-PO Mapping													
COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
C01	3	2	2	2	2	-	-	-	-	-	1	1	3
C02	3	2	2	2	2	-	-	-	-	-	1	1	2
C03	3	3	3	3	3	-	-	-	-	-	2	2	3
C04	3	3	3	3	3	-	-	-	-	-	2	2	3

MASTER COPY

Arul
Chairman. BoS

Assessment	
CA-1(a) (10M)	Subjective Test/Assignment/etc.
CA-2(b) (10M)	Model Making/Assignment/Presentation/etc.
MSE(c) (20M)	Mid Sem Examination

Course Contents		
Unit 1	Introduction: Neural networks characteristics, History of development in neural networks principles, Artificial neural net terminology, Model of a neuron, Topology, Learning, Types of learning, Supervised, Unsupervised, Reinforcement learning, knowledge representation and acquisition Learning Process: Competitive, Boltzmann learning, Credit Assignment Problem, Memory, Adaption, Statistical nature of the learning process.	6 Hrs
Unit 2	Single Layer Perceptions: Adaptive filtering problem, Unconstrained Organization Techniques, Linear least square filters, least mean square algorithm, learning curves, Learning rate annealing techniques, perception – convergence theorem, Relation between perception and Bayes classifier for a Gaussian Environment.	6 Hrs
Unit 3	Multilayer Perceptions: Back propagation algorithm XOR problem, Heuristics, Output representation and decision rule, Computer experiment, feature detection, Back propagation and differentiation, Hessian matrix, Generalization, Cross validation, Network pruning Techniques, Virtues and limitations of back propagation learning, accelerated convergence, supervised learning.	6 Hrs
Unit 4	Radial-Basis Function Networks: Cover's theorem on the separability of patterns, separability and interpolation, Posed surface reconstruction, Solution of regularization equation: Greens function, Use of Greens function in regularization networks, Regularization networks and generalized RBF.	6 Hrs
Unit 5	Support Vector Machines: Optimal hyperplane for linearly separable patterns, Optimal hyperplane for non-separable patterns, How to build a support vector machine for pattern recognition, Support vector machines for nonlinear regression.	6 Hrs
Unit 6	Principal Components Analysis: Some intuitive principles of self-organization, Principal components analysis, Hebbian-based principal components analysis, Dimensionality reduction using PCA. Self-Organizing Maps: Basic feature mapping models, Self-organizing map, Learning vector quantization, Hierarchical vector quantization.	6 Hrs

MASTER COPY

Arul
Chairman. BoS

Sr. No.	Text Books
1	B. Yegnanarayana - Artificial neural network PHI Publication.2005
2	S. Raj sekaran, Vijayalakshmi Pari - Neural networks, Fuzzy logic and Genetic Algorithms

Reference Books	
1	Kevin L. Priddy, Paul E. Keller – Artificial neural networks: An Introduction - SPIE Press, 2005
2	Mohammad H. Hassoun – Fundamentals of artificial neural networks - MIT Press ,1995
3	S. Haykin, "Neural networks and Learning Machines", Pearson Education, 3rd Edition, 2013.

Web Resources	
1	https://ocw.mit.edu/courses/9-641j-introduction-to-neural-networks-spring-2005/
2	https://nptel.ac.in/courses/117105084

MASTER COPY

Arul
Chairman. BoS

Course Title: Signal Processing Algorithms & Applications		
Course Code: PE251103	Course Category: PEC-I	
Teaching Scheme	Examination Scheme	
Lectures: 03 hrs/ week	CA-1	10 Marks
Tutorial: -----	CA-2	10 Marks
Credits: 03	MSE	20 Marks
Semester: First Year (Semester I)	ESE	60 Marks
Course Prerequisite: Basic knowledge of signals and systems, linear algebra, calculus, probability, and programming fundamentals.		
Course Description: This course introduces fundamental concepts and techniques of signal processing with emphasis on algorithms and applications in real-world systems.		
Course Objectives: The objective of this course is to develop an understanding of signal processing principles, design efficient algorithms, and explore their applications in practical domains.		

Course Outcomes:		
COs	After completion of the course, students will be able to	Bloom's Level
CO1	Recall the fundamental concepts, terminology, mathematical tools, and techniques used in digital signal processing, filter design, multirate systems, wavelets, and optimum filtering.	L1 Remember
CO2	Explain the principles, characteristics, and applications of transform methods, digital filters, multirate signal processing, signal representation techniques, and adaptive filtering systems.	L2 Understand
CO3	Apply digital signal processing techniques, filter design methods, transform-domain analysis, and adaptive algorithms to solve engineering problems related to signal analysis and processing.	L3 Apply
CO4	Analyze the performance, efficiency, and suitability of digital signal processing systems, filter structures, multirate techniques, wavelet methods, and optimum filtering approaches for practical applications.	L4 Analyze

CO-PO Mapping													
COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	2	2	2	1	-	-	-	-	-	1	2	2
CO2	3	2	1	1	2	-	-	-	-	-	1	3	2
CO3	3	3	2	2	3	-	-	-	-	-	1	3	3
CO4	3	3	3	3	3	-	-	-	-	-	2	2	3

Assessment	
CA-1 (a) (10M)	Assignment / Open book test / etc
CA-2 (b) (10M)	Model Making / Assignment / Presentation / etc
MSE (c) (20M)	Mid Sem Examination

MASTER COPY

Arul
Chairman. BoS

Course Contents		
Unit 1	Introduction and Transform Methods Review of discrete-time signals and systems, transforms for discrete-time signal analysis (DTFT, DFT, Z-transform), Use of DFT in linear filtering and long data sequence processing, Spectrum computation and algorithms for convolution using DFT.	6 Hrs
Unit 2	LTI Systems and Digital Filter Structures Properties of LTI discrete-time systems in the transform domain, Simple digital filters: All-pass, Linear phase, Minimum/Maximum phase, Complementary transfer functions, FIR and IIR basic structures, Linear phase structures, Lattice structures (IIR, FIR, All-pass).	6 Hrs
Unit 3	Digital Filter Design General design considerations for digital filters, FIR filter design techniques (window and frequency sampling), IIR filter design from analog prototypes (Butterworth, Chebyshev, Elliptic), Frequency and spectral transformations in IIR filters, Least-square method for filter design.	6 Hrs
Unit 4	Multirate Signal Processing Sampling rate conversion concepts, Interpolators and decimators, Poly-phase decomposition, Analysis and synthesis filter banks, Orthogonal and orthonormal filter bank concepts	6 Hrs
Unit 5	Signal Representation and Wavelets Orthogonal representation of deterministic signals, Dimensionality of signal spaces, orthogonal basis functions, Time-bandwidth relationship, RMS duration, uncertainty relations, Multiresolution analysis and Wavelet Transform fundamentals.	6 Hrs
Unit 6	Linear Prediction and Optimum Filter Design Least-squares methods for system modeling and linear prediction, Adaptive filter concepts and algorithms (LMS, RLS – overview), Optimum filtering principles, Power spectrum estimation techniques.	6 Hrs

Text Books	
1	John G. Proakis, Dimitris G. Manolakis – Digital Signal Processing: Principles, Algorithms, and Applications – Pearson (Covers transforms, filter design, adaptive filters, multirate, spectrum estimation — a standard text)
2	A. V. Oppenheim, R. W. Schaffer, J. R. Buck – Discrete-Time Signal Processing – Pearson (Strong on theory of DTFT, Z-transform, LTI systems, spectral analysis, filter design)
3	Sanjit K. Mitra – Digital Signal Processing: A Computer-Based Approach – McGraw-Hill (Practical approach with MATLAB examples, FIR/IIR design, multirate DSP)
4	P. P. Vaidyanathan – Multirate Systems and Filter Banks – Pearson (Authoritative text for Unit IV — interpolators, decimators, polyphase, filter banks, orthogonal/orthonormal basis)
Reference Books	
1	Simon Haykin, Barry Van Veen – Signals and Systems – Wiley (Good review of discrete-time signals, transforms, orthogonal basis, linear prediction fundamentals)
2	Monson H. Hayes – Statistical Digital Signal Processing and Modeling – Wiley (For optimum filters, spectrum estimation, linear prediction, LMS/RLS concepts)
3	K. P. Soman, K. I. Ramachandran – Insight into Wavelets: From Theory to Practice – Prentice Hall India (Dedicated wavelet treatment, multiresolution analysis, applications)

MASTER COPY

Ashok
Chairman. BoS

4	Andreas Antoniou – Digital Filters: Analysis, Design, and Applications – McGraw-Hill (Good advanced coverage of FIR/IIR structures, lattice structures, and filter design techniques)
Web Resources	
1	Signal Processing Algorithms and Architectures — NPTEL course by Prof. Anirban Dasgupta (IIT Guwahati) (NPTEL) https://onlinecourses.nptel.ac.in/noc25_ee176/preview
2	Digital Signal Processing and its Applications — NPTEL course by Prof. V. M. Gadre (IIT Bombay) (NPTEL) https://onlinecourses.nptel.ac.in/noc25_ee23/preview

MASTER COPY

Anirban
Chairman. BoS

Course Title: Advanced Optical Fiber Communication		
Course Code: PE251104		Course Category: PEC-II
Teaching Scheme	Examination Scheme	
Lectures: 03hrs/week	CA-1	10 Marks
Tutorial:-----	CA-2	10 Marks
Credits:03	MSE	20 Marks
Semester: First Year(Semester-I)	ESE	60 Marks
Course Prerequisite: 1. Basic knowledge of communication systems 2. Fundamentals of Optics: Understanding of light propagation, reflection, refraction, and basic properties of light 3. Basic Electronics and Semiconductor Physics		
Course Description: This course introduces the principles and practices of optical fiber communication systems. It covers fiber characteristics, light sources, detectors, switching systems, optical networks, and standards. Students will study optical amplifiers, WDM/DWDM technologies, access networks, and fiber protection techniques. Emphasis is placed on analyzing system performance, survivability, and applications in next-generation high-speed communication networks.		
Course Objectives: 1.To understand the fundamentals of optical fiber communication, including fiber characteristics, light sources, and detectors. 2.To gain knowledge of switching systems, optical networks, and standards used in communication systems. 3.To study optical amplifiers and their role in WDM communication systems. 4.To explore optical networking concepts, including SONET/SDH, WDM/DWDM, and performance evaluation. 5.To learn architectures of access networks and next-generation optical networking technologies. 6. To analyze fiber optic protection techniques for reliability, survivability, and safety of communication		

Course Outcomes:		
COs	After completion of the course, students will be able to	Bloom's Level
CO1	Define the concepts of optical fiber communication, including fiber characteristics, attenuation, dispersion, light sources, detectors, amplifiers, and protection techniques.	L1 Remember
CO2	Explain the principles of switching systems, optical networks, WDM/DWDM, access networks, and optical amplification in modern communication systems.	L2 Understand
CO3	Apply suitable optical communication techniques, amplification methods, and networking approaches to design and implement reliable high-speed communication systems.	L3 Apply
CO4	Analyze the performance, limitations, and survivability of optical fiber communication systems, recommending suitable technologies for next-generation applications.	L4 Analyze

MASTER COPY

Arul
Chairman. BoS

CO-PO Mapping													
COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	2	-	-	-	-	-	-	-	-	1	2	2
CO2	3	2	1	1	-	-	-	-	-	-	1	3	2
CO3	3	3	2	2	-	-	-	-	-	-	1	3	3
CO4	3	3	3	3	-	-	-	-	-	-	2	2	3

Assessment	
CA-1 (a) (10M)	Assignment /Open booktest/etc
CA-2 (b) (10M)	Model Making/Assignment/Presentation/etc
MSE (c) (20M)	Mid Sem Examination

Course Contents		
Unit 1	Introduction Optical fiber communication system, Attenuation, dispersion, Properties of light sources, detectors	6 Hrs
Unit 2	Switching systems and standards Services, circuit switching, packet switching, optical networks, second generation optical networks, introduction to optical networks: layered view of optical networks, transparency and all optical networks, optical packet switching, wavelength standards, chirping, dispersion shifted fibers, non-zero dispersion fibers.	6 Hrs
Unit 3	Optical Amplification Doped Fiber Amplifiers, Semiconductor Optical Amplifiers, Raman Amplifiers, Optical Parametric Amplifier, Optical amplification in WDM communication systems.	6 Hrs
Unit 4	Optical Networks Basic networks, SONET/ SDH, wavelength-routed networks, Nonlinear effects on network performance, performance of various systems (WDM, DWDM + SOA)	6 Hrs
Unit 5	Access Networks Network Architecture overview, Enhanced HFC, Fiber to the Curb (FTTC), Buffering, Architectural choices for next generation optical networks.	6 Hrs
Unit 6	Fiber optic protection techniques Optical Safety, Open fiber control protocol, Network survivability: Unidirectional and Bidirectional Protection, Point to point links protection, Self-healing rings, bidirectional line switched ring, Optical layer Protection schemes, Wave Length Conversion	6 Hrs

MASTER COPY

Arul
Chairman. BoS

Text Books	
1	Ramaswami, Rajiv; Sivarajan, Kumar; Sasaki, Galen, "Optical Networks: A Practical Perspective" Morgan Kaufmann (3rd edition), 2009
2	Biswanath Mukherjee, "Optical WDM Networks", springer, 2009
Reference Books	
1	G.P. Agarwal, Fiber optic communication systems, 2nd Ed., John Wiley & Sons, New York, 1997.
2	Franz & Jain, Optical Communication Systems, Narosa Publications, New Delhi, 1 995
3	G. Keiser, Optical fiber communication systems, McGraw-Hill, New York, 2000.
4	Franz & Jain, Optical communication, Systems and components, Narosa Publications, New Delhi, 2000.
Web Resources	
1.	Advanced Optical Communication, IIT Bombay — NPTEL course page https://nptel.ac.in/courses/117101002
2.	Fiber Optic Communication Technology, IIT Madras — NPTEL course page https://nptel.ac.in/courses/108106167

MASTER COPY

Arul
Chairman. BoS

Course Title: Microelectronics		
Course Code: PE251105		Course Category: PEC II
Teaching Scheme	Examination Scheme	
Lectures:03 hrs/week	CA-1	10 Marks
Tutorial:-----	CA-2	10 Marks
Credits:02	MSE	20 Marks
Semester: First Year (Semester I)	ESE	60 Marks
Course Prerequisite: Fundamentals of Semiconductor Devices (Diodes, BJTs, MOSFETs), Basics of Analog and Digital Electronic Circuits (UG level), Knowledge of Electronic Devices and Circuits Laboratory, Exposure to Signals & Systems and Basic Communication Principles.		
Course Description: This course provides an in-depth understanding of semiconductor devices, analog and digital circuit design, IC fabrication, and advanced microelectronics applications. It covers MOS and BJT device models, scaling effects, and modern device structures. The course introduces analog building blocks such as current mirrors, differential amplifiers, and operational amplifiers, as well as digital circuits including CMOS logic, memory design, and low-power devices.		
Course Objectives: Provide fundamental knowledge of semiconductor device operation and MOS/BJT modeling. Develop skills in designing analog circuits such as amplifiers, current mirrors, and op-amps. Enable students to design digital circuits and memory structures considering power and scaling issues. Familiarize students with IC fabrication technologies and process integration.		

Course Outcomes:		
COs	After completion of the course, students will be able to:	Bloom's Level
CO1	Illustrate the fundamental concepts of semiconductor physics, MOS and bipolar devices, analog and digital circuits, IC fabrication processes, and emerging microelectronic technologies.	L1 Remember
CO2	Explain the operating principles and characteristics of semiconductor devices, analog and digital building blocks, memory circuits, IC fabrication techniques, and mixed-signal and emerging microelectronic systems.	L2 Understand
CO3	Apply semiconductor device models, analog and digital circuit techniques, fabrication processes, and low-power design principles to develop microelectronic circuit solutions.	L3 Apply
CO4	Analyze the electrical characteristics, performance, power consumption, and design trade-offs of microelectronic devices and circuits, including advanced transistors, analog/digital ICs, memories, mixed-signal circuits, RF/microwave ICs, MEMS, and VLSI/ULSI systems.	L4 Analyze

CO-PO Mapping													
COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	2	2	2	2	2	-	-	-	-	-	1	2	2
CO2	2	3	2	2	2	-	-	-	-	-	2	3	2
CO3	3	3	3	3	3	-	-	-	-	-	2	2	3
CO4	3	3	3	2	3	-	-	-	-	-	3	3	3

MASTER COPY

Arul
Chairman. BoS

Assessment	
CA-1 (a) (10M)	Assignment /Open booktest/etc
CA-2 (b) (10M)	Model Making/Assignment/Presentation/etc
MSE (c) (20M)	Mid Sem Examination

Course Contents		
Unit 1	Introduction to microelectronics and its scope: Review of semiconductor physics: intrinsic and extrinsic semiconductors, carrier transport phenomena, p-n junction characteristics, small-signal and large-signal models, MOS capacitor: C–V characteristics, threshold voltage, charge distribution, Short-channel effects in MOS devices	6 Hrs
Unit 2	MOSFET and Bipolar Devices: MOSFET operation, I–V characteristics, sub threshold conduction, Scaling of Transistorize, hot-carrier effects, leakage currents, BJT fundamentals: operation, Ebers-Moll model, Gummel-Poon model, Comparison of MOSFETs and BJTs in integrated circuits, Advanced devices: Fin FETs, SOI MOSFETs, HEMTs.	6 Hrs
Unit 3	Analog Microelectronic Circuits: current mirrors, current sources, and active loads, Differential amplifiers: single-ended and differential operation, CMRR, Operational amplifiers: architecture, performance parameters, frequency compensation, Analog building blocks for signal processing, Low-power analog design considerations.	6 Hrs
Unit 4	Digital Microelectronic Circuits: CMOS logic gates: static and dynamic operation, Sequential circuits: latches, flip-flops, registers, Memory design: SRAM, DRAM, non-volatile memories (Flash, MRAM), Low-power digital design techniques.	6 Hrs
Unit 5	Overview of IC fabrication process: flow, Crystal growth, wafer preparation, oxidation, diffusion, ion implantation, Photolithography, etching, deposition (CVD, PVD),	6 Hrs
Unit 6	Applications and Emerging Trends: Mixed-signal ICs: ADCs, DACs, PLLs, RF and microwave integrated circuits, MEMS and sensors in microelectronics, VLSI and ULSI system design issues.	6 Hrs

Text Books	
1.	Sedra, A. S., and Smith, K. C. – Microelectronic Circuits – Oxford University Press (Comprehensive coverage of analog & digital circuits, op-amps, MOSFETs, BJTs)
2	Razavi, B. – Fundamentals of Microelectronics – Wiley (MOSFET, BJT operation, analog & digital design basics, excellent for undergraduates)
3	Millman, J., and Grabel, A. – Microelectronics – McGraw-Hill (Good for semiconductor physics, device models, fabrication process basics)
4	Streetman, B. G., and Banerjee, S. – Solid State Electronic Devices – Pearson (Covers semiconductor physics, MOS/BJT fundamentals, short-channel effects, advanced devices like Fin FETs, SOI)

MASTER COPY

Arul
Chairman. BoS

Reference Books	
1.	Razavi, B. – Design of Analog CMOS Integrated Circuits – McGraw-Hill (Analog IC design, current mirrors, op-amps, low-power design techniques)
2	Weste, N. H. E., and Harris, D. – CMOS VLSI Design: A Circuits and Systems Perspective – Pearson (Digital microelectronics, CMOS logic, sequential circuits, SRAM/DRAM, low-power design)
3	Sze, S. M., and Ng, K. K. – Physics of Semiconductor Devices – Wiley (In-depth device physics, MOSFET scaling, HEMTs, advanced transistor technologies)
4	Jaeger, R. C., and Blalock, T. N. – Microelectronic Circuit Design – McGraw-Hill (Balanced treatment of analog, digital, and fabrication, with practical IC design examples)
Web Resources	
1.	NPTEL – Microelectronics: Devices to Circuits (IIT Roorkee) https://onlinecourses.nptel.ac.in/noc21_ee86/preview (NPTEL)

MASTER COPY

Arubal
Chairman. BoS

Course Title: Digital Image Processing and Applications		
Course Code: PE251106		Course Category: PEC II
Teaching Scheme	Examination Scheme	
Lectures: 03 hrs/week	CA-1	10 Marks
Tutorial:-----	CA-2	10 Marks
Credits:03	MSE	20 Marks
Semester First Year (Semester I)	ESE	60 Marks
Course Prerequisite: Digital Signal Processing		
Course Description: Digital image processing deals with the processing of images which are digital in nature. The first application is in the improvement of pictorial information for human perception, i.e., enhancing the quality of the image so that the image will have a better look. The second is for autonomous machine applications, which have wider applications in industries, particularly for quality control in assembly automation and many similar applications. This course will introduce various image processing techniques, algorithms, and their applications.		
Course Objectives: 1. To understand the fundamentals of digital image representation, sampling, quantization, and basic pixel relationships. 2. To apply various image transforms (DFT, DCT, Wavelet, SVD, SIFT, Hough, etc.) for analysis and feature extraction. 3. To develop techniques for image enhancement, restoration, denoising, and super-resolution in both spatial and frequency domains. 4. To analyze image compression models, coding techniques, and international standards (JPEG, MPEG). 5. To implement segmentation and representation methods for object detection, boundary analysis, and feature description. 6. To utilize morphological image processing operations and explore applications in security, medical imaging, robotic surgery, and remote sensing.		

Course Outcomes:		
COs	After completion of the course, students will be able to	Bloom's Level
C01	Illustrate the fundamental concepts of digital image representation, image transforms, enhancement and restoration, compression, segmentation, morphological processing, and image-processing applications.	L1 Remember
C02	Explain image sampling and quantization, spatial and frequency-domain transforms, enhancement and denoising techniques, compression methods, segmentation approaches, morphological operations, and applications of digital image processing.	L2 Understand
C03	Apply image transforms, enhancement and restoration techniques, compression algorithms, segmentation methods, morphological operations, and image-processing techniques to solve practical image-processing problems.	L3 Apply
C04	Analyze the performance and suitability of image-processing techniques	L4 Analyze

MASTER COPY

Arul
Chairman. BoS

CO-PO Mapping													
COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	2	2	2	2	2	-	-	-	-	-	1	1	2
CO2	3	3	2	2	3	-	-	-	-	-	1	2	3
CO3	3	3	3	3	3	-	-	-	-	-	2	2	2
CO4	3	3	3	3	3	-	-	-	-	-	2	3	3

Assessment	
CA-1(a) (10M)	Assignment / Subjective Test/Open booktest/etc
CA-2(b) (10M)	Model Making/Assignment/Presentation/etc
MSE(c) (20M)	Mid Sem Examination

Course Contents		
Unit 1	Fundamentals of Digital Image Processing Digital image representation, Fundamental steps in DIP, sampling and quantization, Basic relationships between pixels, Image geometry and transformations	6 Hrs
Unit 2	Image Transforms Two-dimensional Discrete Fourier Transform, Discrete cosine transforms, Haar Transform, Discrete Wavelet Transform. Karhunen – Loeve transform. and SVD, Scale Invariant Feature Transform (SIFT), Hough Transform.	6 Hrs
Unit 3	Image Enhancement, Restoration and Denoising Image enhancement in spatial domain, enhancement through point processing, Histogram Processing, Basic grey level Transformations, Enhancement using arithmetic and logic operations. Image Enhancement in frequency domain, Image Smoothing, Image sharpening. Basics of Image Restoration and Classification Techniques, Classification on noise in image. Noise models, image denoising using linear filters, order statistics-based filters and wavelet shrinkage methods, Image super-resolution.	6 Hrs
Unit 4	Image Compression Image compression models, classification of image compression, Fundamentals of information theory, error-free compression, variable length coding, Huffman coding, Arithmetic coding, bit plane coding, Run length coding, predictive coding, transform coding, image compression standards- JPEG, MPEG	6 Hrs
Unit 5	Image Segmentation and Representation Point, Line and Edge detection, Edge linking and boundary detection, Thresholding, Region based segmentation, Segmentation Using Morphological Watersheds, Image representation- Chain codes, Boundary and Regional Descriptors. Graph-based techniques, Active Contours, Active Shape Models, Active Appearance Model.	6 Hrs
Unit 6	Morphological Image Processing & Applications of Image Processing Basic operations: dilation and erosion, opening and closing operations, basic morphological algorithms such as region filling, thinning, thickening, pruning, skeletons, numerical-based on the above. Applications: Security applications, Medical imaging , Robotic Surgery, Remote sensing	6 Hrs

MASTER COPY

Arul
Chairman. BoS

Text Books	
1.	Rafael C. Gonzalez & Richard E. Woods, "Digital Image Processing", 4th Edition, 2018, Pearson, USA
2	Digital Image Processing- S Jayaraman, S. Essakkirajan, T. Veerakumar-TMH,2010
Reference Books	
1.	A. K. Jain, Fundamentals of Digital Image Processing, 2015, 3rd Edition, Pearson Education, USA
2.	William K. Pratt, Digital Image Processing, 2013, John Wiley & Sons, USA.
3.	S.Sridhar, Digital Image Processing, Oxford University Press
4.	Digital Image Processing using Matlab, Rafeal C. Gonzalez, Richard E. Woods, Steven L. Eddins, Pearson Education.
5.	Digital Image Processing and computer Vision-Somka, Halavac, Boyle - Cengage learning (Indian edition)2008
6.	Introduction to Digital Image Processing with Matlab, Alasdair McAndrew, Thomson Course Technology
Web Resources	
1.	Digital Image Processing (SWAYAM free online course, IIT Kharagpur) https://www.getyoureducation.net/course/digital-image-processing (getyoureducation.net)
2.	Digital Image Processing Applications (Open-access book, IntechOpen) https://www.intechopen.com/books/10991 (IntechOpen)

MASTER COPY

Arul
Chairman. BoS

Course Title: Seminar		
Course Code: PE251401		Course Category: SC-SEC
Teaching Scheme	Examination Scheme (As Applicable)	
Practical's/Sessions: 02 Hours/Week	CA-I	15 Marks
	CA-II	15 Marks
Semester: First Year (Semester-I)	ESE	20 Marks
Course Prerequisite: 1. Basic understanding of core subjects in specialization, Ability access, and interpret scientific literature. 2. Exposure to technical report writing and presentation.		
Course Description: The M.Tech Seminar course is designed to enhance student ability to identify, analyze and present research-oriented or industry-relevant topics related to their field of specialization. It provides a platform to review recent literature, critically analyze methodologies, and effectively communicate technical concepts written and oral forms. The course emphasizes independent learning analytical thinking presentation and interaction with peers and faculty to prepare students for research and professional careers.		
Course Objectives: 1. To enhance the ability to conduct a comprehensive literature review on a selected research/technical topic. 2. To develop skills in critical analysis, organization, and synthesis of technical information. 3. To improve proficiency in technical report writing and formatting. 4. To strengthen communication skills through oral presentation and discussion. 5. To build confidence in defending technical ideas and responding to queries effectively.		

Course Outcomes:		
COs	After completion of the course, students will be able to	Bloom's Level
CO1	Identify the fundamental concepts, terminology, recent developments, and research trends related to the selected seminar topic through systematic literature study.	L1 Remember
CO2	Explain the principles, methodologies, technologies, and research findings associated with the selected seminar topic using relevant technical literature.	L2 Understand
CO3	Apply appropriate engineering concepts, research methodologies, analytical tools, and modern technologies to investigate and address a problem related to the selected seminar topic.	L3 Apply
CO4	Analyze research literature, methodologies, results, and emerging trends to identify challenges, research gaps, and potential directions in the selected seminar area.	L4 Analyze

CO-PO Mapping													
COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	2	3	-	1	1	-	1	-	1	-	2	2	2
CO2	2	3	1	2	2	1	1	1	2	-	2	2	3
CO3	1	2	2	3	3	2	1	2	3	1	3	3	3
CO4	1	1	3	3	3	3	2	2	3	1	3	3	3

MASTER COPY

Arul
Chairman. BoS

Course Content	
The seminar requires each candidate to prepare a report on a topic that they and their supervisor have mutually agreed upon. This topic must be a current problem in the field of Mechanical Engineering and should have a strong research orientation. The candidate is expected to demonstrate a thorough understanding of the recent developments related to their chosen topic. Once the report is complete, the candidate will present it to an examining committee, as well as to other faculty members from the department. The PG coordinator and the Head of the Mechanical Engineering Department will form this committee to evaluate the seminar.	
Assessment	
Evaluation and Examination The seminar will be evaluated out of a total of 50 marks, with 30 marks for internal assessment and 20 marks for the semester-end examination. The semester-end examination will be conducted by a committee of three faculty members. Students must submit their completed reports, which should be authenticated by both their guide and the Head of the Department. Each student will individually present their work to the committee, who will then evaluate them and award marks.	
CA-I (a) (15M)	Review-I: 15 Marks (Concept/knowledge in the topic:10 marks, Literature: 05 marks)
CA-II (b) (15M)	Review-II: 15 Marks (Report writing & Presentation: 15 Marks)
ESE (Practical/viva voce) (c) (20M)	20 Marks (Individual evaluation through viva voce/test:20 marks)
Total (d) (50M)	50 Marks

MASTER COPY

Abul
Chairman. BoS

Course Title: PG Lab		
Course Code: PE251402		Course Category: SC-SEC
Teaching Scheme	Examination Scheme (As Applicable)	
Practicals/Sessions: 02 Hours/Week	CA-I	15 Marks
	CA-II	15 Marks
Semester: First Year (Semester-I)	ESE	20 Marks
Course Prerequisite: Basic knowledge of Digital Signal Processing, Communication Systems, VLSI, Embedded Systems, and Image Processing.		
Course Description: This laboratory course focuses on simulation-based experiments in communication, biomedical, VLSI, sensor networks, and image processing using MATLAB and virtual lab platforms.		
Course Objectives: 1. To simulate and analyze advanced communication and signal processing systems. 2. To apply biomedical signal analysis for diagnostic feature extraction. 3. To design and evaluate digital filters for noise reduction. 4. To model and simulate VLSI logic circuits. 5. To compare routing protocols in wireless sensor networks. 6. To implement and analyze image processing algorithms for edge detection and segmentation.		

Course Outcomes:		
COs	After completion of the course, students will be able to	Bloom's Level
CO1	Identify the fundamental concepts, principles, parameters, algorithms, and tools relevant to advanced engineering laboratory experiments.	L1 Remember
CO2	Explain the operating principles, methodologies, experimental procedures, and performance parameters of advanced engineering systems and techniques.	L2 Understand
CO3	Apply appropriate engineering principles, computational methods, simulation tools, and experimental techniques to implement and investigate advanced engineering problems.	L3 Apply
CO4	Analyze experimental and simulation results using appropriate performance metrics, interpret the observations, and draw technically valid conclusions for engineering applications.	L4 Analyze

CO-PO Mapping													
COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	1	–	1	2	–	1	–	1	–	2	2	2
CO2	3	2	1	2	2	1	1	1	2	–	2	2	3
CO3	3	3	3	3	3	2	1	2	2	1	3	3	3
CO4	3	3	3	3	3	3	2	2	3	1	3	3	3

MASTER COPY

Arul
Chairman. BoS

Assessment	
CA-I (a) (15M)	Laboratory performance and attendance Lab records and technical reporting
CA-II (b) (15M)	Experiment conduction, observation, and data collection Marks Viva-voce (during lab sessions)
Practical (d) (20M)	Particular Experiment number

Sr. No.	List of Experiments/Activities	Hours
1	To simulate a MIMO-OFDM communication system and evaluate BER performance under different channel conditions.	2 Hr
2	To acquire and process ECG signals, filter noise, detect QRS complexes, and compute heart rate variability.	2 Hr
3	To design and analyze FIR filters using Window methods and IIR filters using Butterworth/Chebyshev	2 Hr
4	To model and simulate CMOS inverter, NAND, and NOR circuits; study transfer characteristics, power, and delay.	2 Hr
5	To simulate sensor node deployment and compare routing protocols for energy efficiency and network lifetime.	2 Hr
6	To apply and compare edge detection algorithms and segmentation techniques on digital/medical images.	2 Hr

Text Books	
1.	Lab Manuals and Recent Research Papers related to analog and digital communication, Various Authors, Various Publishers, Latest Editions.
Reference Books	
1.	Behzad Razavi – Design of Analog CMOS Integrated Circuits, McGraw Hill (Advanced CMOS/VLSI simulations)
2	John G. Proakis & Dimitris K. Manolakis – Digital Signal Processing: Principles, Algorithms, and Applications, Pearson
3	Rajkamal – Embedded Systems: Architecture, Programming and Design, Tata McGraw Hill
4	Andrea Goldsmith – Wireless Communications, Cambridge University Press
Web Resources	
1.	Digital Signal Processing (DSP) Virtual Lab — IIT Kharagpur, Hands-on experiments you can run online — including FIR/IIR filter design with window methods, FFT, convolution, etc.

MASTER COPY

Arul
Chairman. BoS

Course Title: Advanced Digital Communication Systems		
Course Code: PE252004		Course Category: PCC
Teaching Scheme	Examination Scheme	
Lectures: 04 hrs/ week	CA-1	10 Marks
Tutorial: -----	CA-2	10 Marks
Credits: 04	MSE	20 Marks
Semester: First Year (Semester II)	ESE	60 Marks
Course Prerequisite: Digital communication, Probability Theory, Signal Processing, Linear Algebra, and Basic Communication Systems.		
Course Description: Advanced Digital Communication System explores advanced modulation, coding, detection, and channel modeling techniques to design and analyze modern digital communication systems.		
Course Objectives: The course aims to help students learn advanced modulation and coding techniques, analyze detection and estimation methods, model and evaluate communication channels, assess error performance, explore spread spectrum and multicarrier systems, and design and optimize digital communication systems.		

Course Outcomes:		
COs	After completion of the course, students will be able to	Bloom's Level
CO1	Explain the principles of sampling, waveform coding, digital modulation, error control coding, spread spectrum techniques, and their role in modern digital communication systems.	L2 Understand
CO2	Apply the concepts of sampling, coding, modulation, synchronization, and error control techniques to analyze and solve digital communication problems using appropriate engineering tools.	L3 Apply
CO3	Analyze the performance of digital communication systems by evaluating bandwidth efficiency, noise effects, synchronization, error probabilities, coding techniques, and spread spectrum methods.	L4 Analyze
CO4	Evaluate reliable digital communication systems	L5 Evaluate

CO-PO Mapping													
COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	2	-	-	1	-	-	-	-	-	1	2	2
CO2	3	3	2	2	3	-	-	-	-	-	1	3	3
CO3	3	3	2	2	2	-	-	-	-	-	1	2	3
CO4	3	3	3	2	3	-	-	-	-	-	1	3	3

MASTER COPY

Chairman. BoS

Assessment	
CA-1 (a) (10M)	Assignment / Open book test / etc
CA-2 (b) (10M)	Case Study /Model Making / Assignment / Presentation / etc
MSE (c) (20M)	Mid Sem Examination

Course Contents		
Unit 1	Sampling Process Sampling theorem for low-pass and bandpass signals, Quadrature sampling and reconstruction of message signals from samples, Signal distortion in sampling and practical aspects of signal recovery, Pulse Amplitude Modulation (PAM) and Time Division Multiplexing (TDM)	8 Hrs
Unit 2	Waveform Coding Techniques Pulse Code Modulation (PCM): quantization noise and signal-to-noise ratio, Channel noise, error probability, and robust quantization, Differential PCM (DPCM), delta modulation, and adaptive techniques, Applications of waveform coding.	8 Hrs
Unit 3	Digital Modulation Fundamentals Digital modulation formats: coherent and non-coherent binary techniques, Coherent quadrature modulation and quaternary formats, Comparison of binary and quaternary techniques, Effect of intersymbol interference (ISI) on modulation schemes.	8 Hrs
Unit 4	M-ary Modulation and Synchronization M-ary modulation techniques and bandwidth efficiency, Power spectral properties and channel capacity considerations, Bit error vs. symbol error probabilities, Synchronization methods in digital communication.	8 Hrs
Unit 5	Error Control Coding Rationale and types of error control codes, Discrete memoryless channels, linear block codes, and cyclic codes, Convolutional codes: distance properties, maximum likelihood and sequential decoding, Trellis codes and coding applications	8 Hrs
Unit 6	Spread Spectrum Techniques Pseudo-noise (PN) sequences and principles of spread spectrum, Direct Sequence Spread Spectrum (DSSS) with coherent BPSK: signal space and processing gain, Frequency Hop Spread Spectrum (FHSS) and probability of error, Applications of spread spectrum systems.	8 Hrs

Text Books	
1.	Digital Communications by John G. Proakis
2	Principles of Digital Communication by Robert G. Gallager
3	Digital Communication Systems by Simon Haykin

MASTER COPY

Arul
Chairman. BoS

4	Digital and Analog Communication Systems by K. Sam Shanmugam
5	Error Control Coding: Fundamentals and Applications by S. Lin and D. J. Costello
Reference Books	
1.	Modern Digital and Analog Communication Systems B.P. Lathi & Zhi Ding
2.	Digital Communications: Bernard Sklar
Web Resources	
1	IIT Madras / IIT Kanpur / IIT Kharagpur (variants exist) Platform: NPTEL (SWAYAM)

MASTER COPY

Arul
Chairman. BoS

Course Title: MOOC/SWAYAM		
Course Code: PE252005		Course Category: PCC
Teaching Scheme	Examination Scheme	
Lectures: 04 hrs/ week	CA-1	10 Marks
Tutorial: -----	CA-2	10 Marks
Credits: 04	MSE	20 Marks
Semester: First Year (Semester II)	ESE	60 Marks
Course Description: This course is part of a curated set of MOOCs offered, with the specific courses selected and approved by the Board of Studies (BoS) to ensure alignment with current academic and industry standards.		

MASTER COPY

Arubol
Chairman. BoS

Course Title: Wireless Sensor Network Design		
Course Code: PE252107		Course Category: PEC -III
Teaching Scheme	Examination Scheme	
Lectures: 03 hrs/ week	CA-1	10 Marks
Tutorial: -----	CA-2	10 Marks
Credits: 03	MSE	20 Marks
Semester: First Year (Semester II)	ESE	60 Marks
Course Prerequisite: Students should have prior knowledge of computer networks, digital communication, and basic embedded systems concepts. Familiarity with wireless communication fundamentals and microcontroller programming is desirable.		
Course Description: This course provides an in-depth understanding of wireless sensor networks (WSNs), covering node architecture, communication protocols, operating systems, synchronization, power management, and security mechanisms. It emphasizes practical applications in domains such as healthcare, agriculture, environmental monitoring, and intelligent transportation systems.		
Course Objectives: The primary objective of this course is to introduce students to the principles, design challenges, and architectures of WSNs. It aims to develop the ability to analyze and apply energy-efficient protocols, synchronization, and security techniques for reliable sensor network operation. Students will also gain exposure to sensor network operating systems, physical layer design issues, and routing strategies for real-world applications.		

Course Outcomes:		
COs	After completion of the course, students will be able to	Bloom's Level
CO1	Explain the fundamentals of wireless sensor networks, sensor node architectures, operating systems, communication protocols, security mechanisms, and their applications in real-world engineering systems.	L2 Understand
CO2	Apply the principles of wireless sensor networks to design sensor nodes, implement communication protocols, power management strategies, and operating system concepts using modern engineering tools.	L3 Apply
CO3	Analyze the performance of wireless sensor networks by evaluating power consumption, synchronization, security, physical layer design, MAC protocols, and routing techniques for efficient network operation.	L4 Analyze
CO4	Evaluate energy-efficient, secure, and reliable wireless sensor network solutions for multidisciplinary applications.	L5 Evaluate

CO-PO Mapping													
COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	2	1	-	2	-	-	-	-	-	1	2	2
CO2	3	3	2	2	3	-	-	-	-	-	2	3	3
CO3	3	3	2	3	2	-	-	-	-	-	2	2	3
CO4	3	3	3	2	3	-	-	-	-	-	3	3	3

MASTER COPY

Arul
Chairman. BoS

Assessment	
CA-1 (a) (10M)	Assignment / Open book test / etc
CA-2 (b) (10M)	Case Study /Model Making / Assignment / Presentation / etc
MSE (c) (20M)	Mid Sem Examination

Course Contents		
Unit 1	Introduction and Applications Motivation for networks of wireless sensor nodes, sensing principles and sensor types, Wireless network fundamentals for WSN, Design challenges and resource constraints in sensor networks. Key applications: healthcare, agriculture, traffic monitoring, environmental systems.	6 Hrs
Unit 2	Architectures of Wireless Sensor Nodes Node architecture and design considerations, sensing subsystem, processor subsystem, and communication subsystem, Interface and energy efficiency aspects, Case studies of sensor node platforms: LMote, XYZ, Hogthrob architectures.	6 Hrs
Unit 3	Power Management, Synchronization, and Security Power management techniques: local power, processor and communication subsystems, Time synchronization: need, challenges, and ranging techniques overview, Security in WSN: fundamentals, major threats, and attacks, Protocol mechanisms and lightweight security approaches.	6 Hrs
Unit 4	Operating Systems for Sensor Networks Functional and non-functional aspects of WSN operating systems, Overview of popular sensor OS prototypes: Tiny OS, SOS, Contiki, Lite OS, Introduction to sensor grid concepts and distributed OS features.	6 Hrs
Unit 5	Physical Layer Design Physical layer components for WSN, Source encoding and channel encoding methods, Modulation schemes for low-power networks, Signal propagation challenges in wireless sensor deployments	6 Hrs
Unit 6	MAC and Network Layer Protocols Medium Access Control (MAC) types, protocols, standards, and performance metrics, Network layer routing metrics and protocol requirements, Overview of routing techniques for energy-efficient and reliable communication.	6 Hrs

Text Books	
1.	Feng Zhao, Leonidas J. Guibas – Wireless Sensor Networks: An Information Processing Approach – Morgan Kaufmann
2	Kazem Sohraby, Daniel Minoli, Taieb Znati – Wireless Sensor Networks: Technology, Protocols, and Applications – Wiley
3	C. S. Raghavendra, Krishna M. Sivalingam, Taieb Znati (Eds.) – Wireless Sensor Networks – Springer
4	Anna Hac – Wireless Sensor Network Designs – Wiley

MASTER COPY

Abul
Chairman. BoS

Reference Books	
1.	Holger Karl, Andreas Willig – Protocols and Architectures for Wireless Sensor Networks – Wiley
2	Edgar H. Callaway Jr. – Wireless Sensor Networks: Architectures and Protocols – CRC Press
3	Sergios Theodoridis, Rama Chellappa (Eds.) – Academic Press Library in Signal Processing: Sensor Networks – Elsevier
4	Philip Levis et al. – TinyOS Programming – Cambridge University Press
Web Resources	
1.	Wireless Ad Hoc and Sensor Networks (IIT Kharagpur) This is one of the primary NPTEL/SWAYAM courses covering ad-hoc & wireless sensor network fundamentals, architecture, MAC, routing, power, security, etc

MASTER COPY

Arul
Chairman. BoS

Course Title: Advanced Embedded System Design		
Course Code: PE252108		Course Category: PEC-III
Teaching Scheme	Examination Scheme	
Lectures: 03 hrs/ week	CA-1	10 Marks
Tutorial: -----	CA-2	10 Marks
Credits: 03	MSE	20 Marks
Semester: First Year (Semester II)	ESE	60 Marks
Course Prerequisite: Basic knowledge of microprocessors, digital electronics, computer architecture, and C/C++ programming.		
Course Description: Study of hardware-software co-design, architectures, and programming techniques for developing efficient embedded systems.		
Course Objectives: To equip students with the knowledge and skills to design, analyze, and implement reliable and efficient embedded systems.		

Course Outcomes:		
COs	After completion of the course, students will be able to	Bloom's Level
CO1	Explain the fundamentals of embedded systems, Cortex-M3/M4 architecture, embedded Linux, operating system concepts, and embedded system design methodologies.	L2 Understand
CO2	Apply embedded system design principles, Cortex-M3/M4 programming, CMSIS, Linux system programming, and development tools to develop embedded applications.	L3 Apply
CO3	Analyze the performance of embedded systems by evaluating processor architecture, exception handling, memory protection, Linux kernel mechanisms, process management, and communication techniques.	L4 Analyze
CO4	Evaluate reliable, secure, and efficient embedded system solutions by integrating hardware, software, real-time operating system concepts, and embedded Linux for real-world applications.	L5 Evaluate

CO-PO Mapping													
COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	2	2	2	2	-	-	-	-	-	1	2	2
CO2	3	3	3	2	3	-	-	-	-	-	1	3	3
CO3	3	3	2	3	2	-	-	-	-	-	1	2	3
CO4	3	3	3	2	3	-	-	-	-	-	1	3	3

Assessment	
CA-1 (a) (10M)	Assignment / Subjective Test / Open book test / etc
CA-2 (b) (10M)	Model Making / Assignment / Presentation / etc
MSE (c) (20M)	Mid Sem Examination

MASTER COPY

Arubol
Chairman. BoS

Course Contents		
Unit 1	Introduction to Embedded Systems: Architecture of Embedded System, Design Methodology, Design Metrics, General Purpose Processor, and System On chip. Embedded system design and development: Embedded system design, Life-Cycle Models, Problem solving, The design process, Requirement identification, Formulation of requirements specification. Development tools.	6 Hrs
Unit 2	Overview of Cortex-M3 Cortex-M3 Basics: Registers, General Purpose Registers, Stack Pointer, Link Register, Program Counter, Special Registers, Operation Mode, Exceptions and Interrupts, Vector Tables, Stack Memory Operations, Reset Sequence. Instruction Sets: Assembly Basics, Instruction List, Instruction Descriptions.	6 Hrs
Unit 3	Exceptions: Exception Types, Priority, Vector Tables, Interrupt Inputs and Pending Behavior, Fault Exceptions, Supervisor Call and Pendable Service Call, NVIC	6 Hrs
Unit 4	Cortex-M3/M4 Programming: Cortex-M3/M4 Programming: Overview, Typical Development Flow, Using C, CMSIS (Cortex Microcontroller Software Interface Standard), Using Assembly. Exception Programming: Using Interrupts, Exception/Interrupt Handlers, Software Interrupts, Vector Table Relocation. Memory Protection Unit and other Cortex-M3 features: MPU Registers, Setting Up the MPU, Power Management, Multiprocessor Communication.	6 Hrs
Unit 5	Linux OS Introduction & User Level Programming: User/Kernel Model, Processes, Daemons, Threads, System Calls, Shell, Virtual Memory. Executable file layout, Creating Processes, Linking/Loading, Signals, Shared Library, Threads and multithreaded program, semaphores, Mutex, IPC mechanism, Pipes, Shared memory.	6 Hrs
Unit 6	Kernel Internals Basics: Process Internal representation, Linux File System Abstraction, Virtual File System, iNodes, files, /proc, Kernel Queue Data Structure, Memory Allocation (buddy system, slab cache), Embedded File Systems	6 Hrs

Text Books	
1.	Raj Kamal – Embedded Systems: Architecture, Programming, and Design – McGraw Hill (Great for introductory concepts, architecture, design methodology, and tools)
2	Jonathan W. Valvano – Embedded Systems: Real-Time Interfacing to ARM Cortex-M Microcontrollers – CreateSpace (Strong coverage of Cortex-M3/M4 basics, registers, instruction set, interrupts, programming in C and Assembly)
3	Joseph Yiu – The Definitive Guide to ARM Cortex-M3 and Cortex-M4 Processors – Newnes/Elsevier (Best reference for ARM Cortex-M architecture, NVIC, MPU, programming details, and exceptions)
4	Christopher Hallinan – Embedded Linux Primer: A Practical Real-World Approach – Pearson (Covers Linux OS introduction, user/kernel programming, processes, threads, IPC, embedded file systems)

MASTER COPY

Arul
Chairman. BoS

Reference Books	
1.	David E. Simon – An Embedded Software Primer – Addison Wesley (Classic reference for embedded software design, life-cycle models, problem-solving approach)
2	Michael Barr, Anthony Massa – Programming Embedded Systems in C and C++ – O'Reilly (Hands-on focus on embedded programming with C, debugging, toolchains)
3	Kurt Wall, Mark Watson, Mark Whitis – Linux Programming by Example: The Fundamentals – Addison Wesley (Good for system calls, processes, threads, signals, IPC mechanisms in Linux)
4	Daniel P. Bovet, Marco Cesati – Understanding the Linux Kernel – O'Reilly (For kernel internals: process management, VFS, memory allocation, /proc, data structures)
Web Resources	
1	Embedded Systems Design – NPTEL Course https://nptel.ac.in/courses/108105156

MASTER COPY

Arubal
Chairman. BoS

Course Title: Biomedical Signal Processing		
Course Code: PE252109		Course Category: PEC-III
Teaching Scheme	Examination Scheme	
Lectures: 03 hrs/ week	CA-1	10 Marks
Tutorial: -----	CA-2	10 Marks
Credits: 03	MSE	20 Marks
Semester: First Year (Semester II)	ESE	60 Marks
Course Prerequisite: Fundamentals of signals and systems, basic digital signal processing, and linear algebra.		
Course Description: This course focuses on the analysis, processing, and interpretation of biomedical signals using advanced signal processing techniques for healthcare applications.		
Course Objectives: Students will be able: 1. To study different types of biomedical signals. 2. To analyze and identify different biomedical signals. 3. Exposure and applications related to biomedical signal processing		

Course Outcomes:		
COs	After completion of the course, students will be able to	Bloom's Level
CO1	Remember the fundamental concepts of biomedical signals, signal acquisition, electrodes, signal conditioning, digital filtering, and biomedical signal processing techniques.	L1 Remember
CO2	Explain biomedical signal analysis techniques including Fourier analysis, wavelet analysis, spectral analysis, noise classification, and statistical methods used for biomedical applications.	L2 Understand
CO3	Apply biomedical signal processing techniques, statistical methods, and modern engineering tools to acquire, process, analyze, and interpret biomedical signals for diagnostic applications.	L3 Apply
CO4	Analyze biomedical signals using advanced techniques such as PCA, ICA, multiresolution analysis, neural networks, support vector machines, and hidden Markov models for pattern recognition and clinical decision-making.	L4 Analyze

CO-PO Mapping													
COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	2	2	2	2	-	-	-	-	-	1	2	2
CO2	2	3	2	2	2	-	-	-	-	-	2	2	3
CO3	2	2	3	3	3	-	-	-	-	-	2	3	3
CO4	2	3	2	3	3	-	-	-	-	-	3	3	3

Assessment	
CA-1 (a) (10M)	Assignment / Subjective Test / etc
CA-2 (b) (10M)	Assignment / Model Making / Presentation / etc
MSE (c) (20M)	Mid Sem Examination

MASTER COPY

Arul
Chairman. BoS

Course Contents		
Unit 1	Acquisition, Generation of Bio-signals, Origin of bio-signals, Types of bio-signals, study of diagnostically significant bio-signal parameters	6 Hrs
Unit 2	Electrodes for bio-physiological sensing and conditioning, Electrode-electrolyte interface, polarization, electrode-skin interface and motion artefact, biomaterials used for electrodes, Types of electrodes (body surface, internal, array of electrodes, microelectrodes), Practical aspects of using electrodes, Acquisition of bio-signals (signal conditioning) and Signal conversion (ADCs, DACs) processing, Digital filtering	6 Hrs
Unit 3	Biomedical signal processing by Fourier analysis, Biomedical signal processing by wavelet (time-frequency) analysis, Analysis (Computation of signal parameters that are diagnostically significant)	6 Hrs
Unit 4	Classification of signals and noise, Spectral analysis of deterministic, stationary random signals and non-stationary signals, Coherent treatment of various biomedical signal processing methods and applications.	6 Hrs
Unit 5	Principal component analysis, Correlation and regression, Analysis of chaotic signals, application areas of bio-signal analysis, multiresolution analysis (MRA) and wavelets, Principal component analysis (PCA), Independent component analysis (ICA).	6 Hrs
Unit 6	Pattern classification-supervised and unsupervised classification, Neural networks, Support vector Machines, hidden Markov models. Examples of biomedical signal classification examples.	6 Hrs

Text Books	
1.	Rangayyan, R. M. – Biomedical Signal Analysis: A Case-Study Approach – Wiley/IEEE Press
2	D. C. Reddy – Biomedical Signal Processing: Principles and Techniques – McGraw-Hill
3	Metin Akay – Biomedical Signal Processing – Academic Press
4	Willis J. Tompkins (Ed.) – Biomedical Digital Signal Processing – Prentice Hall
Reference Books	
1.	S. Palani, A. Balasubramanian – Biomedical Signal Processing: Principles and Techniques – PHI Learning
Web Resources	
1.	https://onlinecourses.swayam2.ac.in/nptel20_bi16/preview

MASTER COPY

Arul
Chairman. BoS

Course Title: IoT and Systems		
Course Code: PE252110		Course Category: PEC IV
Teaching Scheme	Examination Scheme	
Lectures: 03 hrs/ week	CA-1	10 Marks
Tutorial: -----	CA-2	10 Marks
Credits: 03	MSE	20 Marks
Semester: First Year (Semester II)	ESE	60 Marks
Course Prerequisite: Students should have basic knowledge of digital electronics, computer networks, and microcontroller programming. Familiarity with embedded systems and automotive fundamentals will be an added advantage.		
Course Description: This course introduces the fundamentals of automotive systems along with the principles of IoT hardware and communication. It covers IoT architectures, protocols, networking basics, embedded communication interfaces, system design principles, and applications across various domains, including home automation, agriculture, industry, and transportation.		
Course Objectives: The course aims to provide students with an understanding of automotive subsystems and the role of IoT in modern connected vehicles and environments. It seeks to develop knowledge of IoT architectures, communication protocols, and hardware platforms, while fostering skills in prototyping, system integration, and application design using embedded platforms like Arduino and Raspberry Pi.		

Course Outcomes:		
COs	After completion of the course, students will be able to	Bloom's Level
CO1	Remember the fundamental concepts of Internet of Things, IoT architecture, sensors, actuators, communication technologies, protocols, and application domains.	L1 Remember
CO2	Explain IoT system architecture, communication protocols, wireless technologies, security requirements, and sensor interfacing for IoT applications.	L2 Understand
CO3	Apply IoT hardware, communication protocols, sensors, and development platforms to design and implement IoT-based engineering solutions for real-world applications.	L3 Apply
CO4	Analyze IoT architectures, communication technologies, industrial IoT systems, and smart applications to develop efficient, secure, and sustainable IoT solutions.	L4 Analyze

CO-PO Mapping													
COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	2	2	2	2	-	-	-	-	-	1	2	2
CO2	2	3	2	2	2	-	-	-	-	-	2	2	3
CO3	2	2	3	3	3	-	-	-	-	-	2	3	3
CO4	2	3	3	3	3	-	-	-	-	-	3	3	3

MASTER COPY

Arul
Chairman. BoS

Assessment		
CA-1 (a) (10M)	Assignment / Subjective Test / etc	
CA-2 (b) (10M)	Assignment / Model Making / Presentation / etc	
MSE (c) (20M)	Mid Sem Examination	
Course Contents		
Unit 1	IoT Introduction and Fundamentals: Deciphering the term IoT Applications, where IoT can be deployed, Benefits/Challenges of deploying an IoT, IoT components: Digital Signal Processing, Data transmission, Choice of channel (wired/wireless), back-end data analysis. Understanding packaging and power constraints for IoT implementation.	6 Hrs
Unit 2	Signals, Sensors, Actuators, Interfaces: Introduction to sensors, transducers and actuators, Introduction to electrodes & biosensors, Static and dynamic characteristics of sensors, Different types of sensors/ actuators, Selection criteria for sensors/transducers/ actuators, Signal conditioning modules of IoT system, Energy and power considerations, Wireless sensor node structure, positioning topologies for IoT infrastructure.	6 Hrs
Unit 3	The Architecture of IoT: Opportunities for IoT, some interesting IoT projects\ Architecture of IoT. The Web of Things: Linked data-value is greatest when linked, Enterprise data – shared v. public v. private, Importance of security, privacy and authenticity Standards, Web of Things layer – driver for IOT systems	6 Hrs
Unit 4	IoT protocols and software: MQTT, UDP, MQTT brokers, publish-subscribe modes, HTTP, COAP, XMPP and gateway protocols.	6 Hrs
Unit 5	IoT point-to-point communication technologies: IoT Communication Pattern, IoT protocol Architecture, Selection of Wireless technologies (6LoWPAN, Zigbee, WIFI, BT, BLE, SIG, NFC, LORA, LiFi, WiDi)	6 Hrs
Unit 6	IoT application and its Variants. Case studies: IoT for smart cities, health care, agriculture, smart meters.M2M, Web of Things, Cellular IoT, Industrial IoT, Industry 4.0, IoT standards, Interfacing sensors with target boards (Arduino/ESP32/Raspberry Pi).	6 Hrs

Text Books	
1.	Arshdeep Bahga, Vijay Madisetti – Internet of Things: A Hands-On Approach – Universities Press
2	Cuno Pfister – Getting Started with the Internet of Things – O'Reilly
3	Adrian McEwen, Hakim Cassimally – Designing the Internet of Things – Wiley
4	Daniel Minoli – Building the Internet of Things with IPv6 and MIPv6: The Evolving World of M2M Communications – Wiley
Reference Books	
1.	Olivier Hersent, David Boswarthick, Omar Elloumi – The Internet of Things: Key Applications and Protocols – Wiley
2	Pethuru Raj, Anupama C. Raman – The Internet of Things: Enabling Technologies, Platforms, and Use Cases – CRC Press

MASTER COPY

Arul
Chairman. BoS

3	Raj Kamal – Internet of Things: Architecture and Design Principles – McGraw Hill
4	Marco Giordano, Claudio Pastrone et al. – IoT Fundamentals: Networking Technologies, Protocols, and Use Cases for the Internet of Things – Cisco Press
Web Resources	
1.	https://onlinecourses.swayam2.ac.in/

MASTER COPY

Arubol
Chairman. BoS

Course Title: Analog VLSI Design		
Course Code: PE252111		Course Category: PEC-IV
Teaching Scheme	Examination Scheme	
Lectures: 03 hrs/ week	CA-1	10 Marks
Tutorial: -----	CA-2	10 Marks
Credits: 03	MSE	20 Marks
Semester: First Year (Semester II)	ESE	60 Marks
Course Prerequisite: Basic knowledge of Digital Circuits, Analog Electronics, and design concepts.		
Course Description: This course provides an in-depth study of analog VLSI design principles, focusing on MOS device physics, CMOS technology, and analog building blocks. It covers operational amplifier design, data converters, and analog layout techniques with an emphasis on performance optimization and reliability. Students will gain hands-on experience in designing low-power, high-performance analog circuits for modern VLSI applications.		
Course Objectives: 1. To introduce fundamental concepts of analog VLSI design, MOS device modeling, and CMOS technology. 2. To develop skills for designing key analog circuits such as current mirrors, differential amplifiers, and operational amplifiers. 3. To impart knowledge of analog layout techniques, matching strategies, and reliability considerations. 4. To provide understanding of data converters, analog signal processing circuits, and advanced low-power design techniques.		

Course Outcomes:		
COs	After completion of the course, students will be able to	Bloom's Level
CO1	Remember the fundamental concepts of analog VLSI design, CMOS technology, MOS device physics, analog building blocks, and analog circuit characteristics.	L1 Remember
CO2	Explain the operation and design principles of analog CMOS subcircuits, operational amplifiers, compensation techniques, and analog layout methodologies.	L2 Understand
CO3	Apply analog VLSI design principles, layout techniques, and data converter architectures using modern EDA tools to develop analog integrated circuits.	L3 Apply
CO4	Analyze the performance of analog integrated circuits, data converters, and low-power analog systems by evaluating design trade-offs, reliability, and advanced analog applications.	L4 Analyze

CO-PO Mapping													
COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	2	2	2	2	-	-	-	-	-	1	2	2
CO2	2	3	2	2	2	-	-	-	-	-	1	3	2
CO3	2	2	3	3	3	-	-	-	-	-	1	3	3
CO4	2	3	3	3	3	-	-	-	-	-	1	3	3

MASTER COPY

Arul
Chairman. BoS

Assessment	
CA-1 (a) (10M)	Assignment / Subjective Test / Open book test / etc
CA-2 (b) (10M)	Assignment / Presentation / etc
MSE (c) (20M)	Mid Sem Examination

Course Contents		
Unit 1	Introduction to Analog VLSI Design: Introduction to VLSI and its analog aspects, Differences between Analog and Digital VLSI, Basic MOS device physics and modeling, MOSFET as an analog device CMOS technology overview: scaling, fabrication basics Review of basic analog building blocks	6 Hrs
Unit 2	Analog CMOS Sub circuits: Current mirrors and biasing techniques, Differential amplifiers, Gain stages and output stages, Common-mode feedback (CMFB), Frequency response of analog circuits	6 Hrs
Unit 3	Operational Amplifier Design: One-stage and two-stage op-amps, Telescopic and folded cascode op-amps, Slew rate, power dissipation, gain-bandwidth product, Compensation techniques: Miller, pole-zero cancellation	6 Hrs
Unit 4	Analog Layout Techniques: Layout considerations for analog circuits, Matching techniques: common-centroid, interdigitated layouts, Parasitics and their impact, Latch-up and its prevention	6 Hrs
Unit 5	Data Converters: Overview of data conversion systems, Sample-and-hold circuits, Analog-to-Digital Converters (ADC): Flash, SAR, Pipeline, Digital-to-Analog Converters (DAC): R-2R, Current steering Performance metrics: INL, DNL, SNR, ENOB, SFDR	6 Hrs
Unit 6	Advanced Topics & Applications: Low-power and low-voltage analog design techniques, Design for reliability and yield, Analog signal processing: filters, multipliers, Phase-locked loops (PLL) and VCOs	6 Hrs

Text Books	
1.	Razavi, B. – Design of Analog CMOS Integrated Circuits
2	Gray, Meyer, Lewis, Hurst – Analysis and Design of Analog Integrated Circuits
3	Johns & Martin – Analog Integrated Circuit Design
Reference Books	
1	Allen & Holberg – CMOS Analog Circuit Design
Web Resources	

MASTER COPY

Arul
Chairman. BoS

1	Analog IC Design (NPTEL – IIT Madras / IIT Kanpur) Online NPTEL courses.
---	--

MASTER COPY


Chairman. BoS

Title of the Course: Pattern Recognition		
Course Code: PE252112		Course Category: PEC-IV
Teaching Scheme	Examination Scheme	
Lectures: 03 hrs / week	CA-I	10 Marks
Tutorial: --	CA-II	10 Marks
Credits: 03	MSE	20 Marks
Semester: First Year (Semester-II)	ESE	60 Marks
Course Prerequisite: Knowledge of linear algebra, calculus, probability, statistics, and programming (Python/MATLAB). Prior exposure to machine learning or digital signal processing is recommended.		
Course Description: This course covers fundamental and advanced techniques for automated pattern recognition, integrating statistical, geometric, and neural approaches. Topics include Bayesian decision theory, feature extraction, clustering, and deep learning architectures. Emphasis is placed on real-world applications in image analysis, bioinformatics, and speech recognition.		
Course Objectives: 1. To establish a mathematical foundation for pattern classification and feature analysis. 2. To develop proficiency in supervised/unsupervised learning algorithms. 3. To design and evaluate neural networks for complex pattern detection. 4. To apply pattern recognition techniques to interdisciplinary problems (e.g., computer vision, bioinformatics). 5. To prepare students for research in AI/ML through rigorous analytical training.		

Course Outcomes:		
CO	After the completion of the course, the student should be able to	Bloom's Level
CO1	Illustrate the fundamental concepts of pattern recognition, Bayesian decision theory, feature extraction techniques, clustering methods, and neural network architectures.	L1 Remember
CO2	Explain feature extraction, dimensionality reduction, clustering algorithms, neural networks, and advanced pattern recognition techniques for engineering applications.	L2 Understand
CO3	Apply machine learning algorithms, feature selection methods, clustering techniques, and neural network models using modern software tools to solve engineering problems.	L3 Apply
CO4	Analyze the performance of pattern recognition systems using advanced machine learning models, evaluate real-world applications, and interpret ethical and practical considerations.	L4 Analyze

CO-PO Mapping													
COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	2	2	2	2	-	-	-	-	-	1	3	2
CO2	2	3	2	2	3	-	-	-	-	-	2	3	2
CO3	3	3	3	3	3	-	-	-	-	-	2	3	3
CO4	2	3	3	3	3	-	-	-	-	-	2	3	3

MASTER COPY

Chairman. BoS

Assessment:	
CA-I (a) (10M)	Case Study (e.g., diagnosing diseases via medical image patterns)
CA-II (b) (10M)	Algorithmic Implementation (Python-based project)
MSE (c) (20M)	Descriptive Test

Course Contents:		
Unit 1	Introduction & Bayesian Decision Theory Bayes' theorem, ML/MAP estimation, ROC curves, Naive Bayes, Minimum Risk Classifiers, Hypothesis Testing	6 Hrs.
Unit2	Feature Extraction & Selection PCA, LDA, Kernel-PCA, Mutual Information, Chi-square, Wrapper/Filter methods	6 Hrs.
Unit3	Clustering & Unsupervised Learning K-means clustering, EM algorithm, spectral clustering; Validation metrics	6 Hrs.
Unit 4	Neural Networks for Patterns Introduction of Neural networks in Pattern recognition, CNNs for image recognition, RNNs for sequences; Transfer learning	6 Hrs.
Unit 5	Advanced Topics Support Vector Machines (SVMs), hidden Markov models; Applications in bioinformatics/speech.	6 Hrs.
Unit 6	Real-World Systems Case studies (e.g., facial recognition, fraud detection); Ethical considerations.	6 Hrs.

Text Books	
1.	Pattern Recognition by Anuj Bharadwaj and Parag Verma, Alpha science Intl. Ltd.
Reference Books	
1	Pattern Classification by Richard O. Duda, Peter E. Hart, and David G. Stork.
2	Pattern Recognition and Machine Learning by Christopher M. Bishop.
3	Deep Learning by Ian Goodfellow, Yoshua Bengio, and Aaron Courville.
4	The Elements of Statistical Learning by Trevor Hastie, Robert Tibshirani, and Jerome Friedman.
5	Computer Vision: Algorithms and Applications by Richard Szeliski.
Web Resources	
1	Coursera: https://www.coursera.org/
2	Swayam NPTEL: https://onlinecourses.nptel.ac.in/

MASTER COPY

Arul
Chairman. BoS

Course Title: Research Methodology		
Course Code: PG252601		Course Category: ELC
Teaching Scheme	Examination Scheme	
Lectures: 03 hrs/ week	CA-1	10 Marks
Tutorial: -----	CA-2	10 Marks
Credits: 03	MSE	20 Marks
Semester- PG First Year (Semester II)	ESE	60 Marks
Course Prerequisite: Basic Engineering Fundamentals, Technical Communication or Writing, Introductory Statistics -Engineering Mathematics		
Course Description: This course introduces engineering students to research methodology, focusing on practical skills for solving engineering problems. Students learn to formulate research questions, design experiments, analyze data using statistical tools, and communicate findings effectively. Tailored for early postgraduates in various disciplines of Engineering, the course emphasizes ethical and sustainable research practices. Through lectures, assignments, and a final project, students develop competencies for thesis work, industry R&D, or advanced studies.		
Course Objectives: 1. Understand research fundamentals, ethics, and their role in advancing sustainable engineering solutions. 2. Formulate research problems and hypotheses for engineering challenges. 3. Design experiments and apply data collection methods for engineering applications. 4. Analyse data using statistical and computational tools to optimize engineering systems. 5. Communicate research findings effectively through technical reports and presentations.		

Course Outcomes:		
COs	After completion of the course, students will be able to	Bloom's Level
CO1	Understand research basics and ethics.	L2- Understanding
CO2	Formulate research problems and hypotheses.	L6- Creating
CO3	Design experiments and collect/analyze data.	L3- Applying
CO4	Use statistical tools for engineering applications.	L4 -Analyzing

CO-PO Mapping													
COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PS01	PS02
CO1	2	2	2	2	-	2	2	-	-	-	1	1	2
CO2	2	2	2	2	-	2	2	-	-	-	1	1	2
CO3	2	2	3	3	-	2	2	-	-	-	1	1	2
CO4	2	2	2	2	-	2	2	-	-	-	1	1	2

MASTER COPY

Chairman. BoS

Assessment	
CA-1 (a) (10M)	Subjective Test / Assignment
CA-2 (b) (10M)	Subjective Test / Assignment
MSE (c) (20M)	Mid Sem Examination

Course Contents		
Unit 1	Module 1: Research Basic What is research? Types (scientific, engineering) and goals. Defining problems, forming hypotheses, and designing research. Data collection methods, questionnaire design, and result interpretation. Literature review and communicate findings (reports, presentations).	6 Hrs
Unit 2	Module 2: Descriptive Statistics & Probability Basics of statistics: mean, median, standard deviation. Probability concepts: addition/multiplication theorems. Distributions: Binomial, Poisson, Normal. Sampling: Random, simple, stratified; non-sampling errors.	6 Hrs
Unit 3	Module 3: Correlation Correlation: Product moment coefficient. Regression: Simple and multiple linear.	6 Hrs
Unit 4	Module 4: Hypothesis testing: Errors, significance, Chi-square, F-tests. Central limit theorem, tests for means/proportions, confidence intervals	6 Hrs
Unit 5	Module 5: Experimental Design Analysis of variance (ANOVA). Experiment types: Randomized, block, factorial. Data classification and Yates technique.	6 Hrs
Unit 6	Module 6: Multivariate Analysis Multivariate distributions: Mean, variance, correlation matrices. Stepwise regression, variable selection. Factor and principal component analysis. Data analysis using software (e.g., Excel, MATLAB, R).	6 Hrs

Text Books	
1.	kothari, C. R. – Research Methodology: Methods and Techniques – New Age International
2	Montgomery, D. C., & Runger, G. C. – Applied Statistics and Probability for Engineers – Wiley
3	Devore, J. L. – Probability and Statistics for Engineering and the Sciences – Cengage
4	Sharma, S. – Applied Multivariate Techniques – Wiley
Reference Books	
1.	Hair, J. F., Black, W. C., Babin, B. J., & Anderson, R. E. – Multivariate Data Analysis – Pearson
2	Box, G. E. P., Hunter, J. S., & Hunter, W. G. – Statistics for Experimenters: Design, Innovation, and Discovery – Wiley
3	Goon, A. M., Gupta, M. K., & Dasgupta, B. – Fundamentals of Statistics – Vol I & II – World Press
4	Walpole, R. E., Myers, R. H., Myers, S. L., & Ye, K. – Probability and Statistics for Engineers and Scientists – Pearson

MASTER COPY

Arul
Chairman. BoS

Course Title: Interdisciplinary Perspective on Indian Science and Technology
Course Code: PG252501 **Course Category: HSSM-IKS**

Teaching Scheme	Examination Scheme	
Lectures: 02 hrs/ week	CA-1	10 Marks
Tutorial: -----	CA-2	10 Marks
Credits: 02	MSE	20 Marks
Semester: Semester II	ESE	60 Marks

Course Prerequisite: None

Course Description:

The course Interdisciplinary Perspective on Indian Science and Technology introduces students to India's rich contributions in mathematics, astronomy, architecture, metallurgy, textiles, and agriculture. It emphasizes the scientific principles embedded in traditional practices, tracing their historical development and global impact. Students will explore how ancient Indian innovations such as the number system, astronomical instruments, town planning, metallurgy, and sustainable farming shaped modern science and engineering. The course bridges theoretical understanding with practical relevance, enabling appreciation of indigenous knowledge systems and their applications in contemporary contexts.

Course Objectives:

1. To understand the foundational concepts and necessity of the Indian Knowledge System.
2. To identify key historical contributions of Indian scholars in mathematics, astronomy, architecture, metallurgy, textiles, and agriculture.
3. To interpret the scientific principles and techniques underlying traditional Indian practices.
4. To analyze the relevance of IKS in modern scientific and technological contexts.
5. To appreciate the global influence and sustainability of Indian innovations throughout history.

Course Outcomes:

COs	After completion of the course, students will be able to	Bloom's Level
CO1	Recall key concepts, terminologies, historical developments, and contributions in Indian Mathematics, Astronomy, Architecture, Metallurgy, Textiles, and Agriculture.	L1 Remember
CO2	Explain the principles, methods, and scientific basis of Indian Knowledge Systems in various domains such as mathematics, astronomy, architecture, metallurgy, textiles, and agriculture.	L2 Understand
CO3	Apply traditional Indian scientific and technological methods to address contemporary or theoretical problems in relevant fields.	L3 Apply
CO4	Analyze the relevance, strengths, and limitations of Indian Knowledge Systems.	L4 Analyze

CO-PO Mapping

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	2	1	1	-	-	-	1	1	1	-	1	1	1
CO2	2	2	1	-	-	-	2	1	1	-	2	1	2
CO3	2	2	2	1	-	-	2	1	1	-	2	1	2
CO4	2	3	2	1	-	-	3	1	2	-	3	1	2

MASTER COPY

Arul
Chairman. BoS

Assessment	
CA-1 (a) (10M)	Assignment / Subjective Test / Open-book test / etc.
CA-2 (b) (10M)	Model Making / Assignment / Presentation / etc.
MSE (c) (20M)	Mid Sem Examination

Course Contents		
Unit 1	Indian Mathematics Necessity of Indian Knowledge System, Defining Indian Knowledge System, Contributions of Indian Mathematicians, Historical Evidence and features of Indian Numerical Number System, The Idea of Zero and Infinity, Decimal System, Representation of Large Numbers, Global Spread and Adoption of Indian Numericals, Arithmetic (Square of a Number, Square Root, Series and Propagation), Geometry (Simple Constructions from Sulba-Sutras, e.g., Right Angle Triangle, The Value of Pi), Trigonometry and Algebra in IKS, Modern Indian Contributions to Mathematics	4 Hrs
Unit 2	Indian Astronomy Historical Development of Indian Astronomy, Astronomy for Timekeeping, Solar and Lunar Motions, The Celestial Coordinate System, Various Regional Indian Calendar Systems, Planetary Model of Aryabhata and Nilakantha, Astronomical Instruments, Various Royal Endeavors for Astronomy (e.g., Jaisingh's Jantar Mantar), Modern Indian Contributions to Astronomy	4 Hrs
Unit 3	Indian Architecture and Town Planning Sthapatya-Veda and Vastu-Shastra, Historical Features of Indian Town Planning, Water Management and Drainage Systems, Town Town Planning of Harappan Cities, Temple Architecture, Features and Examples of Cave, Rock Cut, Nagara, Dravida, Kalinga, Vesara, Deccan, Rajput, Mughal, Indo-Saracenic Architecture Styles, Modern Indian Contributions to Architecture and Town Planning	4 Hrs
Unit 4	Indian Metallurgy Ancient Mining and Ore Extraction Technologies, Mining and Manufacture of Zinc, Copper and its Alloys, Silver, Gold, Mercury and Lead, Iron Extraction from Biotite, Steel Manufacturing, Global Influence of Wootz Steel, Wax Casting, Modern Indian Contributions to Metallurgy	4 Hrs
Unit 5	Indian Textile Textile Traditions in Ancient India, The Variety and Diversity of Indian Textiles, Types of Fabrics and Materials, Cotton and Silk, Weaving Techniques and Looms, Dyeing Process and Natural Colors, Major Textile Centers, Significance of Indian Textile in Historical Global Trade, Fall of Indian Textile in Colonial Era, Modern Indian Contributions to Textile	4 Hrs
Unit 6	Indian Agriculture Importance of Agriculture in Ancient India, Traditional Crops (Grains, Fruits, Vegetables Spices), Significance of Indian Agricultural Products in Historical Global Trade, Significance of Agriculture and Irrigation for the Indian Kings, The Ery System of South India, Traditional Farming Techniques (Land Preparation, Sowing Techniques, Weeding and Pest Management, Harvesting and Storage), Irrigation Techniques and Rainwater Harvesting, Modern Indian Contributions to Agriculture	4 Hrs

MASTER COPY

Arul
Chairman. BoS

Textbooks	
1.	D. M. Bose, S. N. Sen and B. V. Subbarayappa, Eds., A Concise History of Science in India, 2nd Ed., Universities Press, Hyderabad, 2010.
2.	B. Mahadevan, Nagendra Pavana, Vinayak Rajat Bhat, Introduction to Indian Knowledge System: Concepts and Applications, PHI Learning, 2022
3.	Kapil Kapoor, Awadhesh Kumar Singh, Indian Knowledge Systems, D.K. Print World Ltd; First Edition (15 October 2005)
4.	Bhag Chand Chauhan, IKS: The Knowledge system of Bharata, Garuda Prakashan (13 March 2023)
5.	Science in India: A Historical Perspective by B V Subbarayappa, Rupa & Co (2013)
Reference Books	
1.	G. G. Joseph, Indian Mathematics Engaging the World from Ancient to Modern Times, World Scientific, London, 2016
2.	History of Astronomy: A Handbook, Edited by K. Ramasubramanian, Aniket Sule, and Mayank Vahia, SandHI, IIT Bombay, and T.I.F.R. Mumbai, 2016.
3.	History of Science in India Volume-1, Part-I, Part-II, Volume VIII, by Sibaji Raha, et al. National Academy of Sciences, India and The Ramkrishna Mission Institute of Culture, Kolkata (2014).
4.	Christopher Tadgell, History of Architecture in India, Architecture Design and Technology Press (1990)
5.	Bindia Thapar, Introduction to Indian Architecture, Periplus Asian Architecture Series
Web Resources	
1.	Indian Knowledge System Division, Ministry of Education, Government of India, https://iksindia.org/lectures-and-videos.php

MASTER COPY

Arubol
Chairman. BoS

Course Title: Mini Project			Course Category: ELC		
Course Code: PE252602					
Teaching Scheme		Examination Scheme (As Applicable)			
Practicals/Sessions: 02 Hours/Week		CA-I	15 Marks		
		CA-II	15 Marks		
Semester: First Year (Semester-II)		ESE	20 Marks		
Course Prerequisite:					
1. Basic understanding of core subjects in specialization, Ability to access, and interpret scientific literature. 2. Exposure to technical report writing and presentation.					
Course Description:					
The Mini Project course provides students with an opportunity to apply theoretical knowledge gained during coursework to a small-scale practical problem in E & TC Engineering. It enables students to experience the process of identifying a problem, reviewing literature, formulating objectives, and developing solutions using experimental, analytical, or simulation-based approaches. The course emphasizes independent learning, teamwork, critical thinking, innovation, and technical communication.					
Course Objectives:					
1. Develop the ability to identify, analyze, and solve engineering problems using modern tools and techniques. 2. Encourage creativity, innovation, and research aptitude in addressing mechanical engineering challenges. 3. Provide hands-on exposure to design, modeling, analysis, and/or experimental work on a defined problem. 4. Strengthen teamwork, project management, and professional ethics in executing engineering tasks. 5. Enhance technical writing and oral presentation skills through project documentation and seminars.					

Course Outcomes:		
COs	After completion of the course, students will be able to	Bloom's Level
CO1	Identify a relevant engineering problem, review appropriate literature, and recognize the requirements, constraints, and available technologies related to the selected mini project.	L1 Remember
CO2	Explain the concepts, methodologies, design approaches, and tools relevant to the selected engineering problem and formulate suitable project objectives.	L2 Understand
CO3	Apply appropriate engineering principles, research methodologies, modern tools, and computational or experimental techniques to design and implement the proposed mini-project solution.	L3 Apply
CO4	Analyze the implemented mini-project solution using appropriate performance parameters, interpret the results, identify limitations, and draw valid engineering conclusions.	L4 Analyze

CO-PO Mapping													
COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	3	1	1	1	1	1	1	2	1	2	2	2
CO2	3	3	2	2	2	1	1	1	2	1	2	2	3
CO3	3	3	3	3	3	2	2	2	2	2	3	3	3
CO4	3	3	3	3	3	3	2	2	3	2	3	3	3

MASTER COPY

Arul
Chairman, BoS

Course Contents	
The mini project is designed to help students identify, analyze, and solve real-world problems in Mechanical Engineering and management. This project also aims to improve their overall skills and capabilities. Each student should choose a topic they are interested in. The project's content must be relevant to emerging areas within the field, address current issues with a research focus, or be based on industrial visits. Students can also select a practical problem from the field of Mechanical Engineering to work on. By the end of the semester, each student must submit a final report to the Head of the Department. The report must be authenticated by their guide.	
Assessment	
The mini project is worth a total of 50 marks, with 30 marks for the internal assessment and 20 marks for the semester-end examination. The semester-end examination will be conducted by a committee of three faculty members. Students must bring their completed reports, which should be duly authenticated by their guide and the Head of the Department. Each student will individually present their work to the committee, who will then evaluate them and award marks accordingly.	
CA-I (a)	Review-I: 15 Marks (Concept/knowledge in the topic = 10 marks, Literature-05 marks)
CA-II (b)	Review-II: 15 Marks (Report writing & Presentation =15 Marks)
Practical/ viva voce (c)	20 Marks (Individual evaluation through viva voce / test (20 marks)
Total (d)	50 Marks

MASTER COPY

Arul
Chairman. BoS

Course Title: Robotics		
Course Code: PE253006		Course Category: PCC
Teaching Scheme	Examination Scheme	
Lectures: 04 hrs/ week	CA-1	10 Marks
Tutorial: -----	CA-2	10 Marks
Credits: 04	MSE	20 Marks
Semester: Second Year (Semester III)	ESE	60 Marks
Course Prerequisite: Students are expected to have knowledge of Engineering Mathematics, Control Systems, Mechanics & Kinematics, Signals & Systems, Programming & Tools, Programming & Tools.		
Course Description: This course provides an in-depth study of the modeling, analysis, and control of robotic systems. It introduces the fundamentals of robot kinematics, dynamics, trajectory planning, and control strategies, followed by advanced topics such as intelligent robotics, machine vision, and artificial intelligence techniques for autonomous systems. Students will explore mobile and humanoid robotics along with emerging trends such as cloud robotics and Industry 4.0 applications. The course emphasizes both theoretical foundations and practical applications, preparing students to design and develop advanced robotic solutions for industrial, medical, and service domains.		
Course Objectives: The objectives of this course are to: 1. Provide a strong foundation in the kinematics, dynamics, and control of robotic systems. 2. Develop the ability to model, analyze, and simulate robotic manipulators and mobile robots using mathematical and computational tools. 3. Introduce advanced techniques in artificial intelligence, machine vision, and path planning for autonomous and intelligent robotic systems. 4. Prepare students to design and implement innovative robotic solutions for industrial, medical, and emerging applications in Industry 4.0.		

Course Outcomes:		
COs	After completion of the course, students will be able to	Bloom's Level
CO1	Explain the fundamental concepts of robotics, robot configurations, kinematics, dynamics, control systems, and their applications in industrial and service domains.	L2 Understand
CO2	Apply kinematic, dynamic, and control principles using appropriate mathematical models and modern engineering tools to analyze and develop robotic systems.	L3 Apply
CO3	Analyze robotic manipulators, motion planning, control strategies, artificial intelligence techniques, and human–robot interaction for efficient robotic system performance.	L4 Analyze
CO4	Evaluate advanced robotic systems and emerging technologies by assessing their performance, reliability, safety, and suitability for industrial, healthcare, and autonomous applications.	L5 Evaluate

MASTER COPY

Arul
Chairman. BoS

CO-PO Mapping													
COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	2	1	2	2	-	-	-	-	-	1	2	2
CO2	2	3	3	3	3	-	-	-	-	-	1	3	3
CO3	2	3	3	3	3	-	-	-	-	-	1	3	3
CO4	2	3	2	3	3	-	-	-	-	-	1	3	3

Assessment	
CA-1 (a) (10M)	Assignment / Subjective Test / Open book test / etc
CA-2 (b) (10M)	Model Making / Assignment / Presentation / etc
MSE (c) (20M)	Mid Sem Examination

Course Contents		
Unit 1	Introduction to Robotics: History and evolution of robotics, types and classification of robots, Specifications and applications in industries, healthcare, defense, and service sectors, Components of robotic systems: sensors, actuators, controllers, and end-effectors	8 Hrs
Unit 2	Kinematics of Robots: Direct (forward) and inverse kinematics, Denavit–Hartenberg (DH) representation, Homogeneous transformation matrices, Velocity kinematics and Jacobian formulation, Singularities and workspace analysis	8 Hrs
Unit 3	Dynamics of Robots: Euler–Lagrange formulation and Newton–Euler formulation, Dynamics of manipulators with multiple DOF, Trajectory planning and motion profiles (linear, polynomial, spline), Control of joint forces and torques	8 Hrs
Unit 4	Robot Control Systems: Control architectures: position control, force control, hybrid control, Linear and nonlinear control of robotic manipulators, Adaptive and robust control techniques, PID and model-based controllers for robots, Case Studies of industrial Robot Controller	8 Hrs
Unit 5	Artificial Intelligence in Robotics: Path planning and navigation (graph-based, sampling-based methods), Machine vision and image processing for robotics, Machine learning approaches in robotics (supervised, reinforcement learning), Human–robot interaction and collaborative robotics, Human–robot interaction and collaborative robotics.	8 Hrs
Unit 6	Advanced Topics & Applications: Mobile robots: kinematics, dynamics, and control, Autonomous robotic systems, Humanoid robotics fundamentals, Surgical and service robots,	8 Hrs

MASTER COPY

Abul
Chairman. BoS

	Recent trends: cloud robotics, IoT-enabled robots, Industry 4.0 applications	
--	--	--

Text Books	
1.	M.P. Groover, Industrial Robotics: Technology, Programming and Applications, McGraw Hill.
Reference Books	
1	John J. Craig, Introduction to Robotics: Mechanics and Control, Pearson.
2	Mark W. Spong, Seth Hutchinson, M. Vidyasagar, Robot Modeling and Control, Wiley.
3	Bruno Siciliano & Lorenzo Sciavicco, Robotics: Modelling, Planning and Control, Springer.
4	Roland Siegwart, Illah Nourbakhsh & Davide Scaramuzza, Introduction to Autonomous Mobile Robots, MIT Press.
Web Resources	
1.	https://nptel.ac.in/domains/discipline/115?course=115_9

MASTER COPY

Arubol
Chairman. BoS

Course Title: Project-I		
Course Code: PE253603		Course Category: ELC
Teaching Scheme	Examination Scheme (As Applicable)	
Practical's/Sessions:10Hours/Week	CA-I	25Marks
	CA-II	25Marks
Semester: Second Year (Semester-III)	ESE	50Marks
Course Prerequisite: 1. Basic understanding of core subjects in specialization, ability access and interpret scientific literature. 2. Exposure to technical report writing and presentation.		
Course Description: Project-I is an integral part of the final project work. In this, the student shall complete the partial work of the project, which will consist of a problem statement, literature review, project overview, scheme of implementation that may include mathematical model/SRS/UML/ERD/block diagram/ PERT chart, and layout and design of the proposed system/work. As part of the progress report for Project-I work, the candidate shall deliver a presentation on the progress of the selected dissertation topic. The student shall submit the duly certified progress report of Project-I in standard format for satisfactory completion of the work, duly signed by the concerned guide and head of the department/institute.		
Course Objectives: 1. To enable students to identify and define a research/industrial problem. 2. To develop skills for conducting a comprehensive literature review. 3. To formulate objectives, scope, and methodology for the proposed work. 4. To strengthen technical writing, presentation, and project planning skills. 5. To prepare a well-structured project synopsis in line with research/industry requirements		

Course Outcomes:		
COs	After the completion of the course, the student will be able to	Bloom's Level
CO1	Apply relevant engineering and domain knowledge to a research/engineering problem in the chosen specialization.	L3 Apply
CO2	Analyze relevant literature related to the selected research problem.	L4 Analyze
CO3	Evaluate the objectives, scope, and methodology of the proposed project.	L5 Evaluate
CO4	Evaluate experimental or simulation results using appropriate validation criteria.	L5 Evaluate

CO-PO Mapping													
COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	3	2	2	1	2	–	1	2	1	3	3	3
CO2	2	3	1	3	2	1	2	1	3	1	3	3	3
CO3	2	3	3	2	3	2	1	1	2	2	3	3	3
CO4	2	2	2	1	2	2	1	3	2	3	2	3	2

MASTER COPY

Arul
Chairman. BoS

Course Contents:	
1. Identification of Research Area / Problem Statement	Selection of topic based on current research trends, industrial problems, or societal needs.
2. Literature Survey	Review of recent and relevant literature from journals, conferences, patents, and standards.
3. Problem Formulation	Statement of objectives, scope, and significance of the problem.
4. Methodology and Approach:	Proposed methods, design, tools, software, experimental setup, or simulation plan.
5. Project Planning	Defining project milestones, deliverables, and timelines.
6. Preparation and Presentation Proposal	Writing of a structured synopsis/proposal, including references, and presenting before a review panel.

Assessment	
Project-I will have internal marks of 50 and a Semester-end examination of 50 marks. Semester-end examination will be conducted by a committee consisting of three faculty members. The students are required to bring the report completed in all respects, duly authenticated by the respective guide and head of the department, before the committee. Students individually will present their work before the committee. The committee will evaluate the students individually, and marks shall be awarded as follows.	
CA-I (a)	Review-I: 25 Marks (Concept/knowledge in the topic-10M, Literature- 5M)
CA-II (b)	Review-II: 25 Marks (Report writing & Presentation =25 M)
Practical / viva voce (c)	50 Marks (Individual evaluation through viva voce / test (50 M)
Total(d)	100 Marks

MASTER COPY

Arul
Chairman. BoS

Course Title: Project-II		
Course Code: PE254604		Course Category: ELC
Teaching Scheme	Examination Scheme(As Applicable)	
Practical's/Sessions:20Hours/Week	CA-I	50Marks
	CA-II	50Marks
Semester: Second Year (Semester-IV)	ESE	100Marks
Course Prerequisite: 1. Basic understanding of core subjects in specialization, ability access, and interpret scientific literature. 2. Exposure to technical report writing and presentation		
Course Description: M.Tech Project–II (Dissertation) is a culmination of the postgraduate program where students demonstrate their ability to independently identify, formulate, and solve research or industry-oriented engineering problems. The dissertation involves systematic literature review, problem definition, research methodology, experimentation/simulation, result analysis, and formulation of conclusions. The course aims to develop research aptitude, technical depth, and professional presentation skills aligned with the Program Outcomes (POs).		
Course Objectives: 1. To enable students to undertake independent research or applied problem-solving in their domain. 2. To develop analytical and experimental skills through design, simulation, or experimental validation. 3. To strengthen technical communication through research publications and dissertation writing. 4. To encourage innovative thinking, ethical research practices, and professional responsibility.		

Course Outcomes:		
COs	After the completion of the course, the student will be able to	Bloom's Level
CO1	Apply relevant engineering knowledge to a research problem within the defined scope.	L3 Apply
CO2	Analyze relevant literature related to the selected research problem.	L4 Analyze
CO3	Evaluate appropriate methodologies for the selected research problem.	L5 Evaluate
CO4	Evaluate experimental or simulation results using appropriate validation criteria.	L5 Evaluate

CO-PO Mapping													
COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	3	2	2	1	2	–	1	2	1	3	3	3
CO2	2	3	1	3	2	1	2	1	3	1	3	3	3
CO3	2	3	3	2	3	2	1	1	2	2	3	3	3
CO4	2	2	2	1	2	2	1	3	2	3	2	3	2

MASTER COPY

Arul
Chairman. BoS

Course Contents:

1. Problem Definition & Literature Review

Identification of research problem based on gap analysis.
Comprehensive literature survey from journals, patents, and technical reports.

2. Research Methodology & Design

Development of methodology/experimental setup/modeling/simulation framework.
Selection of tools, techniques, and optimization methods.

3. Implementation & Analysis

Data collection through experiments/simulations/field studies.
Analysis, validation, and comparison with existing methods.

4. Dissertation Documentation & Presentation

Dissertation writing as per standard guidelines.
Drafting technical papers from dissertation outcomes.
Final presentation and defense.

Assessment

Project-II will have internal marks of 100 and a Semester-end examination of 100 marks.

An internal examination will be conducted by a committee of five faculty members. The students are required to bring the report completed in all respects, duly authenticated by the respective guide and head of the department, before the committee. Students individually will present their work before the committee. The committee will evaluate the students individually, and internal marks shall be awarded as follows.

1. Review-I: 25 Marks, Review-II: 25 Marks
 2. Guide Evaluation-50 Marks
- Total-100 Marks

External Examination Marks:

1. Guide-50 Marks
 2. External examiner evaluation-20 Marks
- DPAC Evaluation-30 Marks
- Total-100 Marks

3. Assessment Criteria:

- Novelty and relevance of problem (10%)
- Depth of literature review and problem definition (15%)
- Methodology and implementation (25%)
- Analysis, validation, and discussion of results (25%)
- Quality of dissertation and presentation (25%)

MASTER COPY


Chairman, BoS

Course Title: Communication Skills and Technical Writing		
Course Code: PE254701		Course Category: CC
Teaching Scheme	Examination Scheme	
Lectures:02hrs/week	CA-1	25 Marks
Tutorial:-----	CA-2	25 Marks
Credits:02	MSE	-
Semester: Second Year (Semester-IV)	ESE	-
Course Prerequisite: Basic English composition or introductory technical communication; familiarity with engineering fundamentals		
Course Description: This course equips engineering students with essential communication skills for professional and academic success, focusing on technical writing and oral presentations. Students learn to craft clear, concise technical reports, research proposals, and documentation, as well as deliver effective presentations tailored to engineering. Topics include audience analysis, research document structure, visual aids, professional correspondence, and ethical communication. Through hands-on practice for drafting technical research papers, peer reviews, and research projects, students would be able to apply skills to real-world engineering contexts, such as presenting research. The course prepares students for thesis work, industry reports, and collaborative engineering environments.		
Course Objectives: 1. Understand the principles, structure, and ethical conventions of research writing to support effective documentation in engineering applications. 2. Formulate research problems and develop structured technical documents, including abstracts, introductions, and methodologies, for engineering contexts. 3. Apply data collection and analysis techniques, such as questionnaires and observation methods, to enhance research writing for engineering projects. 4. Produce professional correspondence and technical papers formatted for submission to engineering platforms		

Course Outcomes:		
COs	After the completion of the course, the student should be able to	Bloom's Level
C01	Apply fundamental research methods and principles of research writing in engineering contexts.	L3 Apply
C02	Analyze research literature and evidence-based arguments to understand research problems and gaps.	L4 Analyze
C03	Evaluate the quality, structure, language, formatting, and citation practices of technical research documents.	L5 Evaluate
C04	Evaluate professional communication practices for effective technical presentations, correspondence, and research dissemination.	L5 Evaluate

MASTER COPY

Arul
Chairman. BoS

CO-PO Mapping													
COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	2	3	–	2	2	–	1	–	2	–	2	2	2
CO2	1	3	–	3	1	–	1	–	2	–	3	2	2
CO3	1	2	–	2	2	–	2	–	3	–	3	2	1
CO4	–	1	–	–	1	1	2	2	3	1	2	2	2

Assessment	
CA-1 (a)	Paper writing/ Presentations
CA-2 (b)	Paper publication/ Paper submission

Course Contents		
Unit 1	Fundamentals of Research Writing Introduction to research writing - Knowing the details of research writing- Planning the purpose and material-Practicing for the audience and content delivery. Different Methods in Research Writing Nature and meaning of research methods-Types of research – pure and applied research - Types of communication research – Quantitative, Qualitative and Rhetorical - Questionnaire and observation methods - Data collection and data analysis - Thesis/Synopsis writing - Structure and importance	6 Hrs
Unit 2	Mechanics of Research Writing Research writing in a broader spectrum - The tone -The language - Conventions of research – Evidence-based arguments - Thesis-driven analysis – Complexity and higher- order thinking.	4 Hrs
Unit 3	Components of Research Writing: Formatting a research paper Title page – Abstract – Introduction – Methodology – Conclusion Proof reading – Citing sources	2 Hrs
Unit 4	Communication and Communication Processes: Introduction to Communication, Forms and functions of Communication, Barriers to Communication and overcoming them, Verbal and Non-verbal Communication Reading Skills: Introduction to Reading, Types of Readers and Reading, Barriers to Reading, Strategies for Reading, Comprehension. Listening Skills: Importance of Listening, Types of Listening, Barriers to Listening. Speaking & Verbal & Non-verbal Communication: Use of Language in Spoken Communication, Principles and Practice of Group Discussion, Public Speaking (Addressing Small Groups and Making Presentation), Interview Techniques, Appropriate Use of Non-Verbal Communication, Presentation Skills, extempore, Elocution.	6 Hrs

MASTER COPY

Arul
Chairman. BoS

Unit 5	Professional Correspondence: Writing emails, memos, and cover letters for engineering contexts	2 Hrs
Unit 6	Technical Paper Submission Platforms for Engineering: IEEE Xplore(Journals and Conferences), Elsevier Journals (Science Direct), Springer Journals etc.	2 Hrs

Textbooks	
1.	Hamlin, A., Rubio, C., & DeSilva, M.(2017). Technical Writing. Open Oregon Educational Resources.
2.	Last, S., Neveu, C., Smith, M., & Nielsen, D. (2019). Technical Writing Essentials: Introduction to Professional Communications in the Technical Fields. B C campus.
3.	Oshima, A., & Hogue, A.(2006). Writing Academic English (4thed.) Pearson Longman
4.	Introducing Research Methodology : A Beginner's Guide to Doing a Research Project - Uwe Flick
5.	Research Design: Qualitative, Quantitative and Mixed Methods Approaches-J. David Creswell and John W. Creswell
6.	The Craft of Research-Gregory G. Colomb, Joseph M. Williams, and Wayne C Booth
7.	Foundations of Behavioral Research-Fred N. Kerlinger
8.	Technical Writing Styleby Dan Jones, Sam Dragga
Reference Books	
1.	Workbook for Advanced Research and Writing by Dr. L. Kavitha Nair, EFL, SRMIST, KTR.
2.	Handbook of Technical Writing by Walter E. Oliu
3.	Technical Writing Process by Kieran Morgan and Sanja Spejic

MASTER COPY

Arubal
Chairman. BoS