UNIVERSITY OF JAMMU

(NAAC ACCREDITED A + GRADE UNIVERSITY)
Baba Sahib Ambedkar Road, Jammu-180006 (J&K)

NOTIFICATION
(23/Sept/Adp/86)

It is hereby notified for the information of all concerned that the Vice-Chancellor, in anticipation of the approval of the Competent Bodies, has been pleased to authorize the adoption of the revised Syllabi and Courses of Studies of **Master of Technology (M.Tech.) in Electronics and Communication Engineering for Semester I to IV** under Credit Based System (as given in the Annexure) for the Examinations to be held in the years indicated against each Semester as under:-

Branch	Semester	For the Examination to be held in the years
E&C	**Semester-I**	**December 2023, 2024, 2025**
	Semester-II	**May 2024, 2025, 2026**
	Semester-III	**December 2024, 2025, 2026**
	Semester-IV	**May 2025, 2026, 2027**

The Syllabi of the course are available on the University Website: www.jammuuniversity.ac.in.

Sd/-
DEAN ACADEMIC AFFAIRS

No. F.Acd/III/23/10047- 10053
Dated:14/09/2023
Copy for information & necessary action to:-

1. Dean Faculty of Engineering
2. Principal, GCET
3. C.A to the Controller of Examinations
4. Joint/Assistant Registrar (Exams Prof./Eval Prof./Confidential)
5. Incharge University Website

14/Sept/23
Assistant Registrar (Academic)
14/9/23 14/09/23

UNIVERSITY OF JAMMU, JAMMU

Course Scheme

M.Tech 1st Semester Electronics and Communication Engineering For Examinations to be held in December2023,2024,2025

Contact Hours/Week:23

S.No	Subject Code	Subject	Teaching Hours/Week			Credits	Marks		%change
			L	T	P		Internal	External	
1	MECE101	Advance Digital Communication	3	1	-	4	25	75	20%
2	MECE102	Digital System Design	3	1	-	4	25	75	25%
3	MECE103	Embedded System Design	3	1	-	4	25	75	20%
4	MHUM101	Research Methodology	3	1	-	4	25	75	00%
5	MOOC100	NPTEL	3	-	-	3	100	-	100%
6	MECE111	Embedded system laboratory	-	-	2	1	50	-	00%
7	MECE112	VHDL Programming Laboratory	-	-	2	1	50	-	00%
Total Credits						21	300	300	

UNIVERSITY OF JAMMU, JAMMU

Course Scheme

M.Tech 2nd Semester Electronics and Communication Engineering For Examinations to be held in May 2024,2025,2026

Contact Hours/Week:28hours.

S.No	Subject Code	Subject	Teaching Hours/Week			Credits	Marks		%Change
			L	T	P		Internal	External	
1	MECE201	IoT and its Industrial Applications	3	1	-	4	25	75	20%
2	MECE202	Advance Digital Signal Processing	3	1	-	4	25	75	20%
3	MECE203	Wireless and mobile communication	3	1		4	25	75	100%
4	**Elective-A**		3	1	-	4	25	75	
	MECE2A1	RF and Microwave circuit Design							0%
	MECE2A2	VLSI Process Technology							10%
	MECE2A3	Digital ASIC Design							5%
5	**Elective -B**		3	1	-	4	25	75	
	MECE2B1	Advance Computer Networks							100%
	MECE2B2	Digital VLSI Circuit Design							15%
	MECE2B3	Digital Image Processing							20%
6	**Elective –B laboratory**		-	-	2	1	50	-	
	MECE2BA	Advance Computer Networks laboratory							100%
	MECE2BB	Digital VLSI Circuit Design laboratory							0%
	MECE2BC	Digital Image Processing laboratory							100%
7	MECE211	IOT laboratory			2	1	50	-	20%
8	MECE212	Research Seminar-I	-	-	4	2	100	-	0%
Total Credits						24	325	375	

UNIVERSITY OF JAMMU, JAMMU

Course Scheme

M.Tech 3rd Semester Electronics and Communication Engineering For Examinations to be held in December 2024,2025,2026

Contact hours/week:28

S.No.	Subject Code	Subject	Teaching Hours/Week			Credits	Marks		% change
			L	T	P		Internal	External	
1	**Elective-C**		3	1	-	4	25	75	
	MECE3C1	Information Theory and Coding							0%
	MECE3C2	Analog VLSI Design							15%
	MECE3C3	Wireless Sensor Network							100%
	MECE3C4	Cryptography and Network Security							20%
2	**Elective-D**		3	1	-	4	25	75	
	~~MECE3D1~~	~~Advance Optical~~ Fiber Communication system							100%
	MECE3D2	MEMS							20%
	MECE3D3	Nano-Electronics							5%
	MECE3D4	Bio Medical Electronics							5%
3	MECE311	**Dissertation Phase I** (To be continued in 4thSem)	-	-	20	9	250	-	0%
Total Credits							300	150	

UNIVERSITY OF JAMMU, JAMMU

Course Scheme

M.Tech 4th Semester Electronics and Communication Engineering For Examinations to be held in May 2025,2026,2027

Contact Hours/Week:38

S.No	Subject code	Subject	Teaching Hours/Week			Credits	Marks	
			L	T	P		Internal	External
1	MECE411	Dissertation Phase II	-	-	38	18	300	150
Total Credits						18	300	150

M. Tech 1st Semester Electronics and Communication Engineering For Examinations to be held in December2023,2024,2025

Branch:ECE Semester:1st	L	T	P	C	External	Internal
Course Title: Advance Digital Communication	3	1	-	4	75	25
Course No.: MECE101						
Duration of Exam:3HRS						

Course Overview: This course aims to acquaint the students with the fundamentals of Advanced Digital communication system, various modulation and spread spectrum techniques. Discussion of AWGN channels, implementation of optimal receiver for AWGN along with carrier and symbol synchronization will also be a part of this course.

Course Outcomes: By the end of the course, students will be able to:

CO1	Explain the fundamental concept of digital communication, including modulation, demodulation, encoding and decoding.
CO2	AnalyzethepropertiesofbasicModulationtechniquesandapplythemtoDigitalCommunication
CO3	Analyze the impact of noise on digital communication system and its effect on signal quality.
CO4	FamiliarizestudentswithOptimumreceiverforAWGNandsymbolsynchronization

Detailed Syllabus

UNIT 1 Elements of a Digital communication system: Communication channels and their characteristics, mathematical models for communication channels, recent trends in digital communication, Deterministic and Random Signal Analysis,BandpassandLowpassSignalRepresentation, Signal spacerepresentation ofwaveforms, Vector Space Concepts, Signal Space Concepts, Orthogonal Expansions of Signals. **(10Hrs)**

UNIT2Digital modulation Schemes: Representations of digitally modulated signals, memoryless modulation methods, Linear Modulation with Memory, Non-linear Modulation Methods with Memory, Spectral Characteristics of Digitally Modulated Signals, Power Spectra of Linearly Modulated Signals, Power Spectra of CPFSK and CPM Signals, Power Spectra of Modulated Signals with Memory. **(15Hrs)**

UNIT 3 Optimum Receivers for Additive White Gaussian Noise Channels: Waveforms and vector channel models, Optimum detection for the Vector AWGN channel, Implementation of the optimal receiver for AWGN channels, the correlation receiver, matched filter receiver, frequency domain interpretation of the matched filter, Probability of Error for Binary PAM, Probability of Error for M-ary PAM, Probability of Error for M-ary PSK. **(14 Hrs)**

UNIT 4 Carrier and symbol synchronization: Signal parameter estimation, the likelihood function, carrier recovery and symbol synchronization in signal demodulation, carrier phase estimation, maximum likelihood carrier phase estimation,phaselockedloop, effect ofnoiseon thephaseestimation, Decision- Directed Loops, Non-Decision Directed Loops, symbol timingestimation, maximum-likelihood timing estimation, non–decision direct demagnetization. **(13Hrs)**

UNIT 5 Spread Spectrum Signals for Digital Communication: Model of spread spectrum digital communication system, direct sequence spread spectrum signals, Error Rate Performance of the Decoder, some applications of DS Spread Spectrum Signals, Effect of Pulsed Interference on DS Spread Spectrum Systems, Generation of PN Sequences, Frequency hopped spread spectrum signals, CDMA system based on FHSS signals, Synchronization of spread spectrum systems.**(8 Hrs)**

Note: The Question paper will comprise of 7questions of 15 marks each uniformly distributed over the entire syllabus based on teaching hours. The candidate shall have to attempt any 5 questions.

Suggested Books:

1. "Digital Communications", JGProakis&MSalehi,5thEditionMcGrawHill
2. "Digital Communication", Simon Haykins, John Wiley &Sons
3. "Principle of Communication systems", Taub & Schilling,Tata Mc GrawHill
4. "Digital Communications: Fundamentals and applications", Bernard Sklar, Prentice Hall Publications

M.Tech 1st Semester Electronics and Communication Engineering For Examinations to be held in December2023,2024,2025

Branch:ECE Semester:1st	L	T	P	C	External	Internal
Course Title: Digital System Design	3	-	1	4	75	25
CourseNo.: MECE102						
Durationof Exam:3HRS						

Course Overview

This course aims to understand optimize logic circuit designs using Karnaugh maps. This course also focuses on how to design of combinational and sequential digital logic circuits by using different types of modelling using VHDL Language.

Course Outcomes: By the end of the course, students will be able to:

CO1	Optimize logic circuits, using Karnaugh maps, Variable entered mapping and Tabulation method.
CO2	Understandthe critical andpracticalaspectsofallthe combinational&sequentialcircuits.
CO3	Analyze anddesignsequentialcircuitsbyusingthe conceptsof state table andstater education techniques.
CO4	Analyse and design of Asynchronous machines.

Detailed Syllabus

UNIT 1 Minimization and Design of Combinational Circuits: Minimization with theorems, Karnaugh Map, Variable-entered mapping and Tabulation method. MSI and LSI Circuits and Applications: Arithmetic circuits, Comparators, Multiplexers,Codeconverters, EXOR andAND-OR-INVERTGates,WiredLogic,Tri-StateBus System, FAN-IN FAN-OUT,PropagationDelay. **(12Hrs)**

UNIT 2 Sequential Machine Fundamentals: Need for sequential circuits, Distinction between Combinational and sequential circuits, Concept of Memory, Binary Cell, Fundamental of Sequential Machine Operation, Classification of Sequential Machines, Flip-Flop, Type of Traditional Clocked Flip-Flop, Design of Clocked Flop-Flops, Conversion of Flip- Flops. **(12Hrs)**

UNIT 3 Analysis and Design of Sequential Circuits: State Diagram,Analysis of Synchronous Sequential Circuits, Design of Synchronous sequential circuits, State Reduction, Minimizing the next state decoder, Design steps Leading to next State Decoders, Outputdecoderdesign, Counters,Designof SingleMode Counters,Multi-Mode Counters, Ripple Counters, Ring Counters, Shift Registers, Ring Counters using Shift Registers.**(14Hrs)**

UNIT 4 System Controllers Utilizing Combinational MSI/LSI Circuits: Introduction, Using MSI Decoder I System Controllers, Using MSI Multiplexers in system controllers, Read Only Memories, ROM'S PROMS and applications, Using the PROM for Random Logic, Programmed Logic arrays, Applications of PLA. **(12Hrs)**

UNIT 5 Asynchronous Finite-State Machines: Introduction, Asynchronous Analysis, The Design of Asynchronous Machines, Cyclesandraces, Hazards, Essential Hazards. **(8Hrs)**

Note: The Question paper will comprise of 7 questions of 15 marks each uniformly distributed over the entire syllabus based on teaching hours. The candidate shall have to attempt any 5questions.

Suggested Books:

1. "An Engineering Approach to Digital Design",Willian IFletcher,PHI.
2. "Logic and Computer Design Fundamentals" Morris Mano and CharlesR. Kima.

M.Tech 1st Semester Electronics and Communication Engineering For Examinations to be held in December2023,2024,2025

Branch:ECE Semester:1st	L	T	P	C	External	Internal
Course Title: Embedded System Design	3	1	-	4	75	25
CourseNo.: MECE103						
Duration of Exam:3HRS						

Course Overview: To understand the history & basicconcepts of embedded system, understandingof differenttypes of programming languages used for embedded systems. Study of PIC 16F8XX based processors: architecture, programming, and interfacing of ARM processor with memory &I/O devices. Study of RTOS.

Course Outcomes: By the end of the course, students will be able to:

CO1	Acquire a Basic knowledge about fundamentals of microcontrollers
CO2	To learn techniques and tools for programmable logic design
CO3	To understand memory and interfacingsensors with controllers
CO4	Acquire & implement the knowledge about Life cycle of embedded design and its testing.

Detailed Syllabus

UNIT 1: Definition of Embedded System. Embedded systems Vs Computing systems. Embedded system model. Major application areas. Purpose of embedded systems. Characteristics and quality attributes of embedded systems. Introduction to PIC 16F8XX Microcontroller, CPU architecture, register file structure, Instruction Set, Programs, Timers and Interrupts, Interrupt Service Routine, Features of Interrupts, Interrupt vector & Priority.**(12Hrs)**

UNIT 2: Interfacing: 16F8XX in PIC, I/O Interface, LCD interfacing, seven segment interfacing, I2CBus, DAC, ADC. **(8Hrs)**

UNIT3: Embedded Core Based Design: System on chip, Application specific Integrated circuit, Overview of Embedded Processors like LPC 2148 features and instruction set, interfacing of LPC2148 with LED, DC motor, buzzer, ultrasonic sensor, HC SR04, seven segment display, ADC, keypad, switches UART, etc., study of MIPS. Architecture. **(15Hrs)**

UNIT4: Data parallel issues e.g. SIMD, MIMD. Introduction to FPGA, Basics of FPGA, RTOS overview. Architecture of an RTOS, Important features of Linux, Locks and Semaphores, OperatingSystemTimers, andInterrupts.**(10 HRS)**

UNIT5: System Design using LPC2148: Applications of Embedded Systems in Embedded Networking Introduction to Wireless Sensor Networks, Architecture of Wireless Sensor Node, application of ultrasonic sensor **(15Hrs)**

Note: The Question paper will comprise of 7 questions of 15 marks each uniformly distributed over the entire syllabus based on teaching hours. The candidates Shall have to attempt any 5questions.

Suggested Books:

1. "Microcontrollers(TheoryandApplications)",AjayV.Deshmukh
2. "PIC Microcontroller", JohnB.Peatman
3. "ARM system architecture", Steve Furber, Addison Wesley
4. "Programming Embedded Systemin C/C++", M.Barr
5. ""Embedded Systems",RajKamal
6. "Embedded Systems",K.V.Shibu
7. "Embedded Systems Design, Elsevier Science(2003)",AndrewN.Sloss.
8. "ARM System Developer's Guide Designing and Optimizing System Software", MorganKaufmanPublication(2010).

M.Tech 1st Semester Electronics and Communication Engineering For Examinations to be held in December2023,2024,2025

Branch: ECE Semester:1st	L	T	P	C	External	Internal
Course Title: Research Methodology	3	1	-	4	75	25
Course No.: MHUM101						
Duration of Exam:3HRS						

Course Overview: Research Methodology is a hands-on course designed to impart education in the foundational methods and techniques of academic research in social sciences and business management context. Research scholars would examine and be practically exposed to the main components of a research framework i.e., problem definition, research design, data collection, ethical issues in research, report writing, and presentation. Once equipped with this knowledge, participants should be well-placed to conduct disciplined research under supervision in an area of their choosing. In addition to their application in an academic setting, many of the methodologies discussed in this course would be similar to those deployed in professional research environments.

Course Outcomes: By the end of the course, students shall be able to:

CO1	To develop understanding of the basic framework of research process by exploring various research designs and techniques.
CO2	To identify various data collection, processing and analysis methods.
CO3	To develop an understanding of the ethical dimensions of conducting applied research.
CO4	To develop and Practice the skills necessary to conduct, review and publish research.

Detailed Syllabus:

UNIT I Research Methodology: Introduction, Objectives of Research, Significance of Research, Research Methods versus Methodology, Types of Research-exploratory Research, Descriptive Research, Casual Research, Research process, Defining a Research Problem, Techniques involved in Defining a Problem. **(11 hrs)**

UNIT 2 Research Design: Need for Research Design, Features of Good Design, Different Research Designs, Sampling Design, Steps in Sampling Design, Types of Sampling Design, Sample size Determination, Questionnaire Design and Testing, Measurement and scaling, Scaling Techniques. **(12 hrs)**

UNIT 3 Methods of Data Collection and Presentation: Methods of Data Collection, Collection of Primary and Secondary Data, Selection of appropriate method, Data Processing Operations, Diagrammatic and Graphical representation of data with Pie chart, Bar Diagram, Line Chart, Histogram, frequency Polygon , Ogive curves and Spread sheets. **(14hrs)**

UNIT 4 Statistical Tools: Measure of central tendencies- airthematic mean(for individual observation, discrete series and continuous series) Median , mode, quartiles, Deciles and percentile; Measures of Dispersion- range, quartile deviation, standard deviation, variance and coefficient of variance. **(12 hrs)**

UNIT 5 Techniques of Hypotheses: Hypotheses meaning and basic concepts, Flow diagram, Power of Hypotheses Test, Types of Hypotheses, limitations of the tests of Hypotheses, Chi-square Test, Correlation and Regression, Conversion of Chi to Phi, Caution in using Chi-square test. **(11 hrs)**

Note: The Question paper will comprise of 7 questions of 15 marks each uniformly distributed over the entire syllabus based on teaching hours. The candidates shall have to attempt any 5 questions.

Suggested Books:

1. "Research Methodology", C.R. Kothari, Wiley Eastern.
2. "Formulation of Hypothesis", Wilkinson K.P, L Bhandarkar, Himalaya Publication, Bombay.
3. "Research in Education", John W Best and V. Kahn, PHI Publication
4."Intellectual Property in New Technological Age", A. Lemley, 2016.
5. Booth, Colombi and Williams. The Craft of Research, University of Chicago Press, Chicago & London, Second edition, 2003.
6 John W. Creswell. Research Design, Sage Publications, New Delhi, Third Edition, 2009.

M.Tech 1st Semester Electronics and Communication Engineering For Examinations to be held in December2023,2024,2025

Branch:ECE Semester:1st	L	T	P	C	External	Internal
Course Title NPTEL	3	-	-	3	-	100
Course No.: MOOC100						
Duration of Exam:3HRS						

The students shall register for a 12 week SWAYAM/NPTEL course offered by IIT ,out of the list of courses floated by SWAYAM around the time of commencement of the semester. However, the selected NPTEL course should not be similar to the regular courses offered as a part of the department curriculum. The choice of course needs to be duly endorsed by the Department Academic Committee.

The overall monitoring of the NPTEL course will be under the supervision of the teacher in charge of the department.

The NPTEL/SWAYAM certification course comprises of Assignments (25%) and Proctored Examination (Online examination MCQ's based =75%) conducted at the end of the semester by IIT as per the schedule.

The marks obtained by the students in the NPTEL/SWAYAM certification course will be tabulated by the concerned department.

NOTE: - *In case the student does not pass the certification exam or remains absent in the proctored examination, no certificate will be given to the candidate by NPTEL and the student will be deemed to have failed in that course. The student will have to register again for the next semester NPTEL course and pass the examination along with a certificate.*

M.Tech 1st Semester Electronics and Communication Engineering For Examinations to be held in December2023,2024,2025

Branch:ECE Semester:1st	L	T	P	C	External	Internal
Course Title Embedded System Laboratory	-	-	2	1	-	50
Course No.: MECE111						

Course Outcomes: By the end of the course, students will be able to:

CO1	Interface ARM controller with various applications.
CO2	Implement macros in any software.
CO3	Implement programmes on FPGA

List of Experiments:

1. Write a program to operate LED with the help of ARM controller
2. Write a program to control LED with a switch using ARM controller
3. Write a program to implement 8 bit binary counter using ARM
4. Write a program to interface seven segment display with ARM
5. Write a program to implement macros in any software
6. Write a program to implement ADC using ARM
7. Write a program to interface keypad with ARM
8. Write a program to use INT0 interrupt in ARM
9. Implementation on FPGA

NOTE: Additional Practical / Experiments will be performed based on the course content requirements.

M.Tech 1st Semester Electronics and Communication Engineering For Examinations to be held in December2023,2024,2025

Branch:ECE Semester:1st	L	T	P	C	External	Internal
CourseTitle: VHDL Programming Laboratory	-	-	2	1	-	50
Course No.: MECE112						

Course Overview: This course gives knowledge about the design, analysis, simulation of digital circuits used as building blocks in Very Large Scale Integration (VLSI) devices. This lab also provides hands-on experience on implementation of digital circuit designs using VHDL HDL language, which are required for development of various projects.

Course Outcomes: By the end of the course, students will be able to:

CO1	Design, simulate and verify with hardware description languages
CO2	Understand and the use of VHDL HDL - entities, architectures, processes, functions, common concurrent statements, and common sequential statements
CO3	Design of combinational and sequential digital logic circuits by using different types of modeling of VHDL HDL language.
CO4	Design and verification of basic digital components using VHDL.

List of Experiments:

1. Verification of combinational designs.
2. Verification of sequential designs.
3. Design and verification of full adder.
4. Design and verification of 4-bit adder.
5. Design and verification of 4-bit look ahead carry adder
6. Design and verification of 8-bit arithmetic circuit.
7. Design and verification of 8-bit ALU.
8. Design and verification of 1024x4 RAM.

NOTE: Additional Practical / Experiments will be performed based on the course content requirements.

M.Tech 2nd Semester Electronics and Communication Engineering For Examinations to be held in May 2024,2025,2026

Branch:ECE Semester:2nd	L	T	P	C	External	Internal
CourseTitle:IoT and its Industrial Applications	3	1		4	75	25
CourseNo.: MECE201						
Durationof Exam:3HRS						

Course Overview:
In this course, student will explore various components of Internet of things such as Sensors, internetworking and cyber space. In the end they will also be able to design and implement IIoT circuits and solutions.

Course Outcomes: By the end of the course, students will be able to:

CO1	Attain knowledge of IoT, design, Architecture, communication protocols and sensors.
CO2	Implement the concepts Python programming tools, Res-pi and Arduino.
CO3	Analyse challenges in Iot and its applications in real time scenario.
CO4	While the promise of the Industrial Internet of Things (IIoT) brings many new business prospects, it also presents significant challenges ranging from technology architectural choices to security concerns.

Detailed Syllabus

UNIT 1: Introduction to IoT:
IoT Definition, Characteristics. IoT Functional Blocks, Physical design of IoT, Logical design of IoT, IoT Architecture, Various architectural views of IoT such as Functional, Information, Operational and Deployment. **(8 Hours)**

UNIT 2: IoT to M2M:
IoT and M2M fundamentals, Devices and gate ways, Definitions, M2M Value Chains, IoT Value Chains, Difference between IoT and M2M. **(6 Hours)**

UNIT 3: Network and communication protocol:
IoT standards and protocol, Wireless medium access issues, MAC control survey, constrained application protocol (CoAP). Message queue Telemetry transport protocol (MQTT), AMQP, security ion IoT protocol, Sensor deployment and node discovery, Data handling and analyst, Cloud Platform for IoTs.**(8 Hours)**

UNIT 4 Sensors and Actuators Modules:
Concept, layout, working and different applications of sensors and actuators, Temperature Sensor, Pressure Sensor, Proximity Sensor, Accelerometer and Gyroscope Sensor, IR Sensor, Optical Sensor, Gas Sensor, Smoke Sensor. ultrasonic sensor, relay. **(8 Hours)**

UNIT 5 Developing IoT based systems:
Introduction to Python, Implementing IoT concepts with python, Introduction to Arduino and Raspberry Pi programming, Implementation of IoT sensors with Arduino and Raspberry, Smartphone (Cellular), Bluetooth, LoRaWAN, Zigbee and wifi interfacing with R-Pi and Arduino. Introduction to ESP8266. **(12 Hours)**

UNIT 6: Control & Supervisory Level of Automation
Programmable logic controller (PLC), Real-time control system, Supervisory Control & Data Acquisition (SCADA). HMI in an automation process, ERP & MES. **(8 Hours)**

UNIT 7: Application of IIOT
Health monitoring, IOT smart city, Smart irrigation, Robot surveillance. Home Appliances Control Using Blynk Application, IIoT based smart energy meter. **(10 Hours)**

Note: The Question paper will comprise of 7 questions of 15 marks each, uniformly distributed over the entire syllabus based on teaching hours. The candidate shall have to attempt any 5 questions.

Suggested Books:

1. "From Machine-to-Machine to the Internet of Things: Introduction to a New Age of Intelligence", Jan Holler, VlasiosTsiatsis, Catherine Mulligan, Stefan Avesand, StamatisKarnouskos, David Boyle, 1st Edition, Academic Press, 2014.
2. "Internet of Things (A Hands-onApproach)", Vijay Madisetti and ArshdeepBahga, 1st Edition, VPT, 2014
3. "Rethinking the Internet of Things: A Scalable Approach to Connecting Everything",Francis da Costa, 1st Edition, Apress Publications, 2013
4. "Getting Started with the Internet of Things", CunoPfister, O'Reilly Media, 2011, ISBN: 978-1-4493- 9357-1
5. Industrial IoT Challenges, Design Principles, Applications, and Security by Ismail Butun (editor)

M.Tech 2nd Semester Electronics and Communication Engineering For Examinations to be held in May 2024,2025,2026

Branch:ECE Semester:2nd	L	T	P	C	External	Internal
Course Title: Advanced Digital Signal Processing	3	1	-	4	75	25
CourseNo.: MECE202						
Duration of Exam:3 HRS						

Course Overview: This course aims to introduce fundamentals of discrete systems and digital signal processing. It will provide the advanced methods of designing and analyzing algorithms that will help the students in developing theabilitytoselect opportunealgorithms anduseitfor aspecific problem.

Course Outcomes: By the end of the course, students will be able to:

CO1	UnderstandtheprincipleofDFT,algorithmapproachesinFFT andits usein datareduction.
CO2	Demonstrate proficiency in designing and implementing advanced digital filters, including finite impulse response (FIR) infinite impulse response (IIR) filters using various design methods such as windowing, frequencysamplingmethod
CO3	Understand the effect of finite word length andapprehendmulti-rate signal processing and its application.
CO4	Recognize theconceptsofadaptivefiltersdesignanditsapplications.

Detailed Syllabus

UNIT1 Discrete and Fast Fourier Transform: Review of z-transform, Discrete Fourier Transform (DFT) and Discrete Time Fourier Transform (DTFT), Divide and Conquer approach, Introduction to FFT algorithms- Decimation in time and decimation in frequency algorithms. **(12Hrs)**

UNIT 2 Digital Filters Design: Design of FIR filters using window methods, frequency sampling method. Design of IIR filter using Impulse Invariant method, Bilinear transformation, Butter worth filters, Cheby shev filters, Realization structures. **(12Hrs)**

UNIT 3 Effect of Finite word length in Digital Filters: Introduction, rounding and truncations errors, Quantisation effects, Output noise power from Digital systems, Limit cycle oscillation, Product Quantisation, Scaling, Quantization errors in the computation DFT. **(10Hrs)**

UNIT 4 Multi-rate Digital Signal Processing: Sampling rateconversion, filters in sampling rate alteration systems, multi rate structure for sampling rate conversion, Polyphase Decomposition, Multistage decimator and interpolator, Digital filter banks, Quadrature mirror filter bank, Multilevel filter banks. **(12Hrs)**

UNIT 5 Adaptive Filters: Concepts of Adaptive filters, the Windrow LMS algorithm, Recursive Least square algorithm, Forward-Backward lattice method, Gradient adaptive lattice method, Applications of adaptive filters. **(12Hrs)**

Note: The Question paper will comprise of 7 questions of 15 marks each uniformly distributed over the entire syllabus based on teaching hours. The candidate shall have to attempt any 5questions.

Suggested Books:

1. "Digital Signal Processing", Saliahanan, VallavarajandGnanapriya,TataMcGrawHill.
2. "Digital Signal Processing: Principles, Algorithms and Applications", J.G. Proakis and D.G. Manolakis, Pearson Education.
3. "Signals and Systems",Alan V.OppenheimandAlanS.Wilsky,PHI
4. "Digital Signal Processing:Apracticalapproach",Ifeacher,andJervis,PearsonEducation.
5. "Digital Signal Processing:A computerbasedapproach",S.K.Mitra,TataMcGrawHill.
6. "Digital Signal Processing",J.S.Chitode,TechnicalPublications.

M.Tech 2nd Semester Electronics and Communication Engineering For Examinations to be held in May 2024,2025,2026

Branch:ECE Semester:2nd	L	T	P	C	External	Internal
CourseTitle:Wireless and mobile communication CourseNo.: MECE203 Durationof Exam:3HRS	3	1		4	75	25

Course Overview

The course aims to equip students with a comprehensive understanding of wireless and mobile communication systems. It provides an overview of existing and emerging wireless communications networks. It covers radio propagation and fading models, fundamentals of cellular communications, multiple access technologies and multicarrier transmission techniques.

Course Outcomes: By the end of the course, students will be able to:

CO1	Demonstrate a solid understanding of the fundamental principles, concepts, and technologies underlying wireless and mobile communication systems.
CO2	Imbibe knowledge about Wireless Systems And Standards GSM channels, multiplex access scheme.
CO3	Understand the concepts of Handoff, dropped calls and cell splitting, Intersystem handoff.
CO4	Evaluate the performance and analyze the challenges of wireless channels, including fading, diversity, interference, multipath propagation, and channel capacity.
CO5	Understand and Analyse the features and technologies used in advance wireless standards, viz GSM, CDMA2000,4G and 5G.

Detailed Syllabus

Unit 1Wireless communication systems: Wireless network generations, Mobile Radio standards-AMPS, IS-95,GSM,UMTS, CDMA2000;Mobile Wireless systems: cordless and cellular telephone system; Fixed wireless networks-Wireless Local Loop & local Multi point Distribution system; Bluetooth; Mobile radio systems around the world, Overview of 2G 3G, 4G and 5G **(8hrs)**

Unit 2Fundamentals of cellular system: Cellular concept fundamentals- Cell structure, cluster, frequency reuse, basic cellular system: channel assignment strategies, Handoff strategies: concept, types, Hard, Soft, MAHO, Proper and improper handoff, Umbrella cell approach; interference and system capacity: cochannel interference and adjacent channel interference,improving coverage and capacity in cellular systems: mechanism for capacity improvement-cell splitting, cell sectoring, and micro cell zone concept. **(14hrs)**

Unit3Mobile Radio Propagation: Fading, Large scale path loss, reflection, Diffraction, Scattering, Outdoor Propagation model-Okumura Model, HataModel, Indoor Propagation Models; Small-scale multipath propagation, Types of small-scale fading, Rayleigh and Ricean distributions, Diversity Schemes.**(12 Hrs)**

UNIT 4Digital cellular mobile standards: Global system for Mobile communication (GSM): features and services, GSM radio aspect, GSM architecture, GSM channels; GSM call routing: Mobile terminated call and mobile originated call sequence, stages of call processing in GSM;IS-95;Multiplex access scheme, TDMA, FDMA, CDMA, OFDM **(14 hrs)**

Unit 5 Advance Wireless standards: Need for 3G and 4G technology; IMT-2000 Global standards: vision, compatibility, service and spectrum requirements; W-CDMA standard: features, architecture, CDMA2000, features, Next Generation mobile standards: features of 4G &4G LTE,VoLTE,4.5G,5G.

(12hrs)

Suggested Books:

1. "Mobile Communications", Jochen Schiller, Pearson Education
2. "Mobile and Personal Communication-System and Services", Raj Pandya, PHI
3. "Wireless Communications and Network", W. Stallings, Pearson Education
4. "Wireless Communications: Principles &Practice",T.S. Rappaport

M.Tech 2nd Semester Electronics and Communication Engineering For Examinations to be held in May 2024,2025,2026

Branch:ECE Semester:2nd	L	T	P	C	External	Internal
CourseTitle:RF and Microwave Circuit Design CourseNo.:MECE2A1 Durationof Exam:3HRS	3	1	-	4	75	25

Course Overview: This course aims to provide comprehensive knowledge of high frequency circuit design principles and to develop the RF circuit design aspects. It will also refine the concepts related with micro-strip lines; their analysis, design, fabrication and test are addressed

Course Outcomes: By the end of the course students will be able to:

CO1	Recognize the significance of boundary conditions in transmission lines and waveguides.
CO2	Understand the fundamentals of semiconductors, followed by their circuit models and analyze the theory and application of microwave measuring instruments.
CO3	Analyse and design various transmission line structure, such as microstrip line, strip line and waveguides for efficient signal propagation at high frequency.
CO4	Design microwave passive devices with the knowledge of various simulation tools.

Detailed Syllabus:

UNIT 1 Review of boundary conditions: Waveguides and Cavity resonates (rectangular, circular & cylindrical) passive Circuits (design principles), impedance transformers, filters, hybrids, isolates. Detail discussion on S-matrix. **(10Hrs)**

UNIT 2 High frequency semi-conductor devices: Intel valley Scattering, Gunn diodes, IMPATT diodes, Step recovery diodes. Lumped elements: Equivalence circuits of Capacitors and Inductors, Design of lumped element resonators and circuits, Basic blocks in RF system and their VLSI implementation, Design of mixer, Basic topologies VCO and phase noise, Various RF Synthesizer architecture and frequency dividers, Design issues in integrated RF filters. Thin & Thick film technologies. **(15Hrs)**

UNIT 3 Design aspects: Transmission lines fir microwave circuits, Strip lines, Micro-strip lines, Slot line & Coupled lines. Characteristics impedance, Lumped parameters etc. Design considerations and implementation using simulation tools, Design of power dividers, combiners, and directional couplers **(10 Hrs)**

UNIT 4 Microwave measurements: SWR, Return loss, impedance, Scattering parameters, attenuation and familiarization with equipments such as vector network analyzer, Spectrum analyzer, power meters and their block diagrams discussion. Fabrication techniques in microwave**(15Hrs)**

Note: The Question paper will comprise of 7 questions of 15 marks each uniformly distributed over the entire syllabus based on teaching hours. The candidate shall have to attempt any 5 questions.

Suggested Books:

1. "Stripline- Loke Transmission lines for MICS", B.Bhat&S.koul, John Wiley
2. "Hand book of Microwave Technology, Vol.1", T.K. Ishii, Academics Press
3. "Microwave integrated Circuit", Y.Konishi, Marcel Dekker
4. "Microwave Circuit Analysis and Amplifier Design", S.Y.Liao, PHI
5. "RF Micro-Elements", B.Razavi, PHI

M.Tech 2nd Semester Electronics and Communication Engineering For Examinations to be held in May 2024,2025,2026

Branch:ECE Semester:2nd	L	T	P	C	External	Internal
CourseTitle:VLSI Process Technology	3		-	4	75	25
CourseNo.: MECE2A2						
Durationof Exam:3HRS						

Course Overview: This course aims to understand the fabrication process of IC technology and the analysis of the operation of MOS transistor. This course also focuses on the physical design processes of VLSI design flow.

Course Outcomes: By the end of the course, students will be able to:

CO1	Identify the various design limits material used and understand the complexities and Processes involved in the ICs Fabrication Technology
CO2	To study various VLSI fabrication steps involved such as oxidation, lithography, etc.
CO3	Apply principles to Identify and Analyze the various steps for the fabrication of VLSI Chips
CO4	Study of Tools and Technologies involved in VLSI circuit Fabrication

Detailed Syllabus:

UNIT1:Crystal growth: Source of silicon; Single crystalline and Poly crystalline; Requirement of purity for electronics industry; Electronics grade silicon production; Crystal growth techniques; refining; Silicon Wafer Preparation & Crystal Defects; Epitaxial Process: Need of epitaxial layer; vapors phase epitaxy, chemistry of epitaxial process, transport mechanism doping & auto doping; selective epitaxy, epitaxial process induced defects, molecular beam epitaxy. **(15 Hrs)**

UNIT2: Oxidation: Importance of oxidation; types of oxidation techniques; growth mechanism & kinetics; factors affecting the growth mechanisms; silicon oxidation model, dry & wet oxidation; oxidation induced faults. **(08Hrs)**

UNIT3:Lithography: Basic steps in lithography; lithography techniques-optical lithography, electron beam lithography, x-ray lithography, ion beam lithography; resists and mask preparation of respective lithographic, printing techniques-contact, proximity printing and projection printing. **(10Hrs)**

UNIT4: Etching: Performance metrics of etching; types of etching- wet and dry etching; dry etching techniques-ion beam or ion-milling, sputter ion plasma etching and reactive ion etching (RIE); etching induced defects. **(07Hrs)**

UNIT5: Diffusion and Ion Implantation: Diffusion mechanisms; diffusion reactor; diffusion profile: diffusion kinetics; parameters affecting diffusion profile; Dopants and their behaviour, choice of dopants; Ion Implantation- impurity distribution profile, properties of ion implantation, low energy and high energy ion implantation. **(10 Hrs)**

UNIT6: Metallization: Desired properties of metallization for VLSI; metallization choices; metallization techniques –vacuum evaporation, sputtering. **(05 Hrs)**

UNIT7: Assembly Techniques & Packaging of VLSI chip: Introduction to packaging; packaging process; various package types, Prototype fabrication of MOSFETs (Enhancement and depletion mode), n-MOS, p-MOS, CMOS. **(05Hrs)**

Note: The Question paper will comprise of 7 questions of 15 marks each uniformly distributed over the entire syllabus based on teaching hours. The candidate shall have to attempt any 5 questions.

Suggested Books:

1. VLSI Technology by S.M. Sze, TMH.
2. VLSI Fabrication Principles by S.K. Gandhi, John Willey& Sons.
3. Micromachined transducer by G.T.A. Kovacs, McGraw Hill.
4. W. Wolf, "Modern VLSI Design", (3rd edition), Pearson,2002
5. James D. Plummer, Silicon VLSI Technology: Fundamentals, Practice and Modeling, Pearson Education,2000
6. Stephen A. Campbell, The Science and Engineering of Microelectronic Fabrication (2nd edition), Oxford University Press 2001
7. C.Y. Chang &S.M.Sze , ULSI Technology, McGraw Hill ,1996

M.Tech 2nd Semester Electronics and Communication Engineering For Examinations to be held in May 2024,2025,2026

Branch:ECE Semester:2nd	L	T	P	C	External	Internal
CourseTitle:Digital ASIC Design	3	1	-	4	75	25
Course No.: MECE2A3						
Durationof Exam:3HRS						

Course Overview: This course aims to understand Full Custom Design and SOC. This course will provide valuable design experience from architecture to digital circuits and also provides a deeper study of CMOS digital-circuit fundamentals including combinational logic, sequential state, and interconnect.

Course Outcomes: By the end of the course, students shall be able to:

CO1	Understand of ASIC and FPGA design flow, various design Methodologies and different types of programm Technologies and logic Devices
CO2	Understand the performance algorithms and its application to ASIC design
CO3	Design chip using the Full Custom Design Flow and Tool.
CO4	Understand the basics of System on Chip and on chip communication architectures for ASICs.

Detailed Syllabus

UNIT1: Introduction: ASIC and FPGA devices, ASIC and FPGA Design flows, Top-Down and Bottom-Up design methodologies, Hardware Description Languages, Design Automation Tools, HDL Support for Synthesis. Language concepts: Design Entity, Declaration statements, concurrent statements, sequential statements, data types, data objects, expressions, operands, if-else, for-loop, case statements, synthesis equivalents and constraints. **(15Hrs)**

UNIT2: Modelling Combi national Circuits: Control & Data partitioning, Synthesis concepts, non-synthesizable constructs, operators, expressions, conditional statements, post synthesis simulation, basic test bench, Logic and arithmetic equations, multiplexers, encoders, decoders, comparators, 12dders, subtractors, multipliers, ALUs, synthesis constraints. **(15Hrs)**

UNIT3: Modelling sequential circuits: Latches and Flip-flops, counters, mealy and Moore FSM, shifters, sequential adders, multipliers and dividers. Blocking and non-blocking statements, Static timing analysis, Procedures and timing control, procedural blocks, loops, Tasks and functions, Test bench modelling techniques, Path delay modelling, Timing analysis, User defined primitives, compiler directives, and system task. **(15Hrs)**

UNIT4: Implementation on FPGA. Unsigned integer, signed integer, fixed-point, floating-point arithmetic, Asynchronous considerations. Memory design: synchronous and asynchronous, single, dual and multi-port, Error detection and correction, compiler directives. **(15Hrs)**

Note: The Question paper will comprise of 7 questions of 15 marks each uniformly distributed over the entire syllabus based on teaching hours. The candidate shall have to attempt any 5 questions.

Suggested Books:

1. The Designer's Guide to VHDL by Peter J. Ashenden, Morgan Kaufmann Publishers.
2. A Verilog HDL Primer by J. Bhasker, Star Galaxy Press.
3. Verilog HDL: A Guide to Digital Design and Synthesis by Samir Palnitkar, Prentice Hall.
4. The Complete Verilog Book by VivekSagdeo, Kluwer Academic Publishers.
5. HDL Chip Design: A Practical guide for Designing, Synthesizing and Simulating ASICs and FPGAs using VHDL or Verilog by Douglas J. Smith, DoonePubns.
6. VHDL Coding Styles and Methodologies by Ben Cohen, Kluwer Academic Publishers.
7. A VHDL Primer by J. Bhasker, Prentice Hall.

M.Tech 2nd Semester Electronics and Communication Engineering For Examinations to be held in May 2024,2025,2026

Branch: ECE Semester:2nd	L	T	P	C	External	Internal
CourseTitle:Advance Computer Networks Course No.: MECE2B1 Durationof Exam:3HRS	3	1	-	4	75	25

Course overview: This course will cover the practical aspects of computer networks, with emphasis on the Internet. Various aspects of computer networking will be covered including: alternative link-layer, network-layer, and transport-layer technologies, LAN/WAN technologies, topologies, traffic analysis, congestion/flow control, routing etc. The goal of this course is to introduce the students to state-of-the-art network protocols and architectures.

Course Outcomes: By the end of the course, students will be able to:

CO1	Analyze and comprehend various network protocols used in modern computer networks, including TCP/IP, UDP, HTTP, DNS
CO2	Design a network with appropriate protocols selected according to requirement.
CO3	Analyze different routing protocols and traffic engineering methods deployed in networking.
CO4	Analyze the implications of shifting from traditional network architectures to software defined networks.

Detailed Syllabus:

UNIT 1 Overview: Computer Network, Network Topologies, LAN, MAN, and WAN, The OSI reference model, TCP/IP reference model, Addressing, Circuit Switched, Datagram and Virtual Circuit Networks, Hubs, Bridges, switches, Routers and Gateways.**(12Hrs)**

UNIT2 Data Link Layer: Design Issues, Error Control, Flow-control protocols: Stop-and-wait, and Sliding-window. Link protocols: HDLC, SLIP, and PPP Protocols. **(11Hrs)**

UNIT3 Network Layer: Routing Algorithms: Shortest path routing, Flooding, Distance-vector routing, Link- state routing, Hierarchical routing, Broadcast routing and Multicast routing.

Congestion control: Principles and policies congestion control in Virtual-circuit and Datagram subnets. Load shedding and Jitter control. Quality of Service: Techniques for achieving good Quality of Service, Integrated Services, Differentiated Services, Label Switching and MPLS. **(12Hrs)**

UNIT4 Internetworking and Internet Protocols: Tunnelling, Fragmentation. The IPv4 Protocol, IPv4 addresses, IPv6 Protocol, Mobile IP, OSPF, BGP, ARP, DHCP, Internet Control Protocols, Classless Inter-domain Routing (CIDR), Network Address Translation (NAT), Sub-netting and Super-netting. **(12Hrs)**

UNIT5 Transport Layer: Transport layer protocol issues: Addressing, Connection Establishment, Connection Release, Flow control and Multiplexing. Internet Transport Protocols: TCP and UDP.
(10Hrs)

Note: The Question paper will comprise of 7 questions of 15 marks each uniformly distributed over the entire syllabus based on teaching hours. The candidate shall have to attempt any 5 questions.

Suggested Books:

1. **Data Communications and Networks", 2nd Ed Forouzan, Tata Mcgraw Hill**
2. **Computer Networks", 4th Ed, A. S. Tanenbaum, Pearson Education**
3. **Computer Networks and Internets", 2nd Ed, Comer, D.E, Delhi: Pearson Education Asia, 1998.**
4. **An Engineering Approach to Computer Networking: Atm Networks, The Internets, And The Telephone Network", Keshav, S., Addison- Wesley Professional Computing Series, Awl International Student Edition, 1997 Ed**
5. **Principles of Wireless Networks", 2002, Pahlavan, K. And Krishna Murthy, Delhi: Pearson Education**
6. **High-Speed Networks And Internets: Performance And Quality Of Service", 2nd Ed, Stallings, W, Delhi: Pearson Education Asia, 2002**

M.Tech 2nd Semester Electronics and Communication Engineering For Examinations to be held in May 2024,2025,2026

Branch: ECE Semester:2nd	L	T	P	C	External	Internal
CourseTitle:Digital VLSI Circuit Design Course No.: MECE2B2 Durationof Exam:3HRS	3	1	-	4	75	25

Course Overview: This course aims to understand the a in CMOS technology. This course also focuses on the study of fundamental concepts and structures of designing digital VLSI systems include CMOS devices and circuits, standard CMOS fabrication processes, CMOS design rules, static and dynamic logic structures, interconnect analysis, CMOS chip layout, simulation and testing, low power techniques, design tools and methodologies.

Course Outcomes: By the end of the course, students will be able to:

CO1	Classify ICs, static and dynamic VLSI design techniques
CO2	Understanding of MOS Devices and Various associated effects
CO3	Design and Analysis of CMOS digital VLSI Combinational and Sequential circuits.
CO4	Design, analyze and verify digital logic circuits and MOS memories as well as Physical layout designing of circuits

Detailed Syllabus:

UNIT1: Overview of Classification of IC Technologies-Trades off, Necessity of CMOS IC, MOS Transistor, MOS structure, MOS System under different bias, Types, and principles of MOSFETs,Threshold Voltage, Channel length modulation, substrate bias effect, Introduction to large signal MOS models (long channel) for digital design. MOS scaling and small Geometry effects, MOS Capacitances, MOS Inverters-Static characteristics, Resistive, Depletion and Enhancement load NMOS inverters, CMOS inverter-voltage transfer characteristics, logic threshold, Noise margins. Dynamic behaviour, transition time, Propagation Delay, CMOS Power dissipation. **(15 Hrs)**

UNIT2: Overview of nMOS& CMOS (p-well, n-well and Twin Tub) fabrication processes, MOS layers, MOS Circuit Layout & Simulation, Stick diagrams, Layout design rules, MOS device layout, Transistor layout, Inverter layout, Complex CMOS-circuits layout & simulation, Circuit Compaction, Euler's Rule, Circuit extraction and post-layout simulation. **(15 Hrs)**

UNIT3: Combinational MOS Logic Circuits, MOS Logic Circuits with Depletion nMOS Loads,Static MOS design, CMOS logic circuits , Ratioed logic, Pass Transistor logic, Complex nMOS& CMOS logic circuits, AOI & OAI Gates, CMOS Transmission gate & Circuit design. Pseudo nMOS gates, Dynamic MOS design-Synchronous Dynamic Techniques, CMOS Transmission Gate Logic, Dynamic CMOS Logic, High performance Dynamic CMOS logic families and their performance. **(15 Hrs)**

UNIT4: Sequential MOS Logic Design-Static and dynamic latches, flip-flops & registers, MOS Memory design, Design of ROM, SRAM and DRAM cells. CMOS Schmitt trigger, adders and multiplier circuits. **(07 Hrs)**

UNIT-5: Introduction to low power design-Power dissipation in CMOS, design Through Voltage ScalingVTCMOS, MTCMOS Circuits. BiCMOS Logic Circuits, Basic BiCMOS Circuit behaviour, Switching Delay in BiCMOS Logic circuits. **(08 Hrs)**

Note: The Question paper will comprise of 7 questions of 15 marks each uniformly distributed over the entire syllabus based on teaching hours. The candidate shall have to attempt any 5 questions.

Suggested Books:

1. CMOS Digital Integrated Circuits-Analysis & Design by S.M. Kang & Y. Leblibici, TMH.
2. Digital Integrated Circuits Design by J.M. Rabey, Pearson Education.
3. Principles of CMOS VLSI Design: A System Perspective by NHE Weste& K. Eshraghian, McGraw Hill Pub.
4. Solid State Electronic Devices by B.G. Streetman & S. Baneerjee, PHI.
5. CMOS Logic Circuit Design by Uyemera, Springer India Pvt. Ltd. New Delhi.
6. Introduction to VLSI by Eshraghian&Pucknell, PHI.
7. Analysis & Design of Digital Integrated Circuits by David A. Hodges, Horace G. Jackson, R. Saleh, McGraw Hill.
8. Introduction to PSPICE by H.M. Rashid, PHI.
9. J P Rabaey, A P Chandrakasan, B Nikolic, "Digital Integrated circuits: A design perspective", Prentice Hall electronics and VLSI series, 2nd Edition

M.Tech 2nd Semester Electronics and Communication Engineering For Examinations to be held in May 2024,2025,2026

Branch: ECE	L	T	P	C	External	Internal
Semester:2nd	3	1	-	4	75	25
Course Title: Digital Image Processing						
Course No.: MECE2B3						
Duration of Exam: 3 HRS						

Course Overview: This course provides a comprehensive introduction to digital image processing, and various image Transforms, Image Enhancement Techniques, Image restoration Techniques and methods, image compression and Segmentation used in digital image processing.

Course Outcomes: By the end of the course, students shall be able to:

CO1	Demonstrate a fundamental understanding of digital image processing concepts including mage image represent image enhancement, and image restoration.
CO2	Apply various image processing techniques to perform tasks such as noise reduction, contrast trast enhancement sharpening of images
CO3	Evaluate the impact of different image compression techniques on image quality and file size, considering lossless and lossy compression methods.
CO4	Applyknowledge/skills tosolveindustrialproblemsbasedonimageprocessing.

Detailed Syllabus

Unit-1 Introduction and Digital Image Fundamentals: Image processing definition, steps in image Processing, Application of image processing, Elements of visual perception, light and the electromagnetic spectrum, Image Sensing and Acquisition, Image Sampling and Quantization, Spatial and Intensity, resolution-Effect of reducing spatial resolution, DPI, Effect of reducing image gray levels, Image interpolation, Some basic relationships between pixels, Adjacency, Connectivity, Regions and Boundaries, Distance measures. **(12 hrs)**

Unit-2 Intensity Transformation and Spatial Filtering: Basics of intensity transformation and spatial filtering, intensity transformation functions-image negative, log transformation, power law; Piecewise-linear transformation functions-contrast stretching, intensity level slicing, bit plane slicing; Histogram Processing histogram stretching ,histogram equalization, Fundamentals of Spatial Filtering, Spatial Correlation and Convolution, Vector representation of linear filtering, Generating Spatial filter masks, Smoothing Spatial Filters, order statistic filters, Sharpening Spatial Filters-The Laplacian, The gradient-Robert cross gradient operator, Sobel operators. **(13 hrs)**

Unit-3 Image Restoration and Reconstruction: Model of the image degradation/restoration process, Noise Models, Periodic Noise, Estimation of noise parameters, Restoration in the presence of noise-spatial filtering- Mean filters, Order-statistics filters ,Median filter, Max and Min filters, Mid-point filter, Alpha-trimmed mean filter, adaptive filters, Image reconstruction from projections, Principles of computed tomography (CT), Projections and the random transform, The Fourier-slice theorem, Reconstruction using parallel - beam filtered and Fan beam filtered back projections.**(11 hrs)**

Unit-4 Color Image Processing: Introduction to the color image processing, color models: RGB, HSI, CMY/ CMYK; Conversion of color models: converting colors from RGB to HSI, HSI to RGB, RGB to CMY and CMY to RGB etc. Pseudo coloring of images. **(05 hrs)**

Unit-5 Image Compression: Introduction to image compression, need of compression, methods of image compression: coding redundancy, Interpixel redundancy, Psychovisual redundancy, Spatial and temporal redundancy, irrelevant information, models of image compression, Image formats, Containers and compression standards, Huffman coding, Arithmetic coding, LZW coding, run-length coding, block transform coding, JPEG compression, predictive coding.**(14 hrs)**

Note: The Question paper will comprise of 7 questions of 15 marks each uniformly distributed over the entire syllabus based on teaching hours. The candidate shall have to attempt any 5 questions.

Suggested Books:

1. Rafael C. Gonzalez & Richard E. Woods, "Digital Image Processing",3rd edition, Pearson Education.
2. David A. Forsyth, Jean Ponce, "Computer Vision: A Modern Approach", Prentice Hall
3. A.K. Jain, "Fundamental of Digital Image Processing".

M.Tech 2nd Semester Electronics and Communication Engineering For Examinations to be held in May 2024,2025,2026

Branch:ECE Semester:2nd	L	T	P	C	External	Internal
CourseTitle:Advance Computer Network Lab	0		2	1		50
CourseNo.: MECE2BA						

Course Outcomes: By the end of the course, students will be able to:

CO1	Understand fundamental underlining principles of computer networking and functionality of layered network architecture.
CO2	Analyze performance of various communication protocols
CO3	Practice packet/ file transfer between nodes.

Lab Experiments:

1. To study different types of networking cables.
2. To implement the cross-wired cable and straight through cable using crimping tool.
3. To study about different networking devices.
4. To connect two computers in a local area network and to share file between them.
5. To study about IP addressing.
6. To implement various topologies using the LAN trainer kit.
7. To study the UDP protocol and TCP protocol using the LAN trainer software

M.Tech 2nd Semester Electronics and Communication Engineering For Examinations to be held in May 2024,2025,2026

Branch: ECE Semester:2nd	L	T	P	C	External	Internal
CourseTitle:Digital VLSI Circuit Design Lab	0	-	2	1	0	50
Course No.: MECE2BB						

Course Outcomes: By the end of the course, students will be able to:

CO1	Simulate MOS devices and determination of various parameters and study of 2nd order effect in MOS devices.
CO2	Design and simulate the different Combinational circuits using MOS/CMOS Technologies
CO3	Design and simulate the different Latch and FF circuits using MOS/CMOS Technologies
CO4	Use EDA tools like Cadence/Mentor Graphics/Tanner Tools and other open-source software tools like Ngspice

List of Experiments:

1) Study of various simulator commands to perform the different analysis on MOS Devices and Circuits.
2). Simulate an NMOS & PMOS with minimum dimensions. Determine its dc drain and transfer characteristics at V_{BS} = zero and a non-zero values. Hence compute the threshold voltage using available EDA tools.
3). Simulate an NMOS with five and ten times the minimum dimensions, determine its dc drain and transfer characteristics at V_{BS} = zero and a non-zero values. Hence determine the channel length modulation factor using available EDA tools.
4). Design and Simulate a CMOS Inverter & obtain its transfer characteristics & transient analysis. Extract various design parameters from simulation results. Furthermore, analyze and plot the power and delay variations with supply voltage.
5) Design and Simulate a CMOS OR/NOR Gate, verify its truth table and obtain its transient analysis. Hence analyze and plot their power and delay with load variations.
6) Design and Simulate a CMOS AND/NAND Gate, verify its truth table and obtain its transient analysis.
7) Design and simulate a CMOS EX-OR/EX-NOR Gate, verify its truth table and obtain its transient analysis.
8) Design and Simulate a CMOS SR Latch (using NAND) and verify its Truth Table.
9) Design and Simulate a CMOS SR Latch (Using NOR) and verify its Truth Table.
10) Use 0.18um CMOS process, or any other available Technology.
   a) Plot I_D vs. V_{GS} at different drain voltages for NMOS, PMOS.
   b) Plot I_D vs. V_{GS} at particular drain voltage (low) for NMOS, PMOS and determine Vt.
   c) Plot I_D vs. V_{DS} at different gate voltages for NMOS, PMOS and determine Channel length modulation factor.
11) Use 0.18um CMOS process, or any other available Technology.
   a) Perform the following
   i. Plot VTC curve for CMOS inverter and thereon plot dV_{out} vs. dV_{in} and determine transition voltage and gain g. Calculate V_{IL}, V_{IH}, N_{MH}, N_{ML} for the inverter.
   ii. Plot VTC for CMOS inverter with varying V_{DD}.
   iii. Plot VTC for CMOS inverter with varying device ratio.
   b) Perform transient analysis of CMOS inverter with no load and with load and determine tp_{HL}, tp_{LH}, 20%-to-80% tr and 80%-to-20% tf. (use V_{PULSE} = 2V, CL = 50fF etc)
   c) Perform AC analysis of CMOS inverter. (Use C_{in}= 0.012pF, CL = 4pF, RL = 100k etc).

NOTE: Additional Practical / Experiments will be performed based on the course content requirements.

M.Tech 2nd Semester Electronics and Communication Engineering For Examinations to be held in May 2024,2025,2026

Branch: ECE Semester:2nd	L	T	P	C	External	Internal
CourseTitle:Digital Image Processing Lab CourseNo.: MECE2BC	0		2	1	0	50

Course Outcomes: By the end of the course, students will be able to:

CO1	Familiarize with various digital image processing system.
CO2	Acquire knowledge about various intensity transformation image restoration and image processing system in DIP.
CO3	To solve various problems based on image processing by using MATLAB.
CO4	Generate filters directly in the frequency domain.

List of Experiments:

1. Introduction to MATLAB and various commands used in MATLAB for DIP.
2. To study the image processing concept.
3. To perform image sampling and quantization using MATLAB.
4. Implementation of relationships between pixels.
5. To perform intensity transformations of image using MATLAB.
6. To study the histogram and histogram equalization.
7. To perform image enhancement by spatial filtering.
8. To generate filters directly in the frequency domain using MATLAB.
9. To study lines in the images using MATLAB.
10. To study points in the image using MATLAB.
11. To perform region-based segmentation of image using MATLAB.
12. To perform analysis of images with different colour models.
13. Program of sharpen image using gradient mask.

M.Tech 2nd Semester Electronics and Communication Engineering For Examinations to be held in May 2024,2025,2026

Branch: ECE Semester:2nd	L	T	P	C	External	Internal
Course Title: IoT and its Industrial Applications Lab	0		2	1	-	50
Course No.: MECE211						

Course Outcomes: By the end of the course, students will be able to:

CO1	Familiarize with various controllers, sensors and actuators.
CO2	Acquire knowledge about various IoT based connectivity modules.
CO3	Design a real time project

List of Experiments:

1. Introduction to Raspberry pi, Arduino& ESP 32.
2. Experiment to perform interfacing of raspberry pi/Arduino with LED and switch.
3. Experiment to perform serial Communication using raspberry pi/Arduino.
4. Experiment to perform transferring of data through Bluetooth app to raspberry pi/Arduino.
5. Experiment to setup the thing speak cloud for data reception & transmission
6. Experiment to transmit temperature & humidity sensor data to thing speak cloud
7. Experiment to perform graphical Visualization of light intensity data on thing speak cloud and downloading of logged data into Excel format
8. Experiment to setup the Blynk app cloud for data reception & transmission
9. Experiment to perform Interfacing of raspberry pi/Arduino with relay module and controlling through blynk platform.
10. Experiment to perform Interfacing of Esp32 with stepper motor & control the direction of motor through IoT platform.
11. Experiment to perform Interfacing of Esp32 with motion sensor & LCD display and display motion detection information on LCD.
12. Experiment to perform Interfacing of Esp32 with IR sensor & OLED display and display obstacle detection information on OLED
13. Experiment to study Digital Input/ Output using Ladder Logic.
14. Experiment to study Timer/Counter using Ladder Logic.
15. Experiment to study Analog Input/ Output of PLC.
16. Experiment to perform interfacing of HMT with PLC.
17. Experiment to perform IOT control application through SCADA.

NOTE: Minimum Eight experiments to be performed. Additional experiments based upon course contents. Project application consists of Home automation, Health sector, smart farming, Surveillance systems, connected vehicles, industrial automation etc.

M.Tech 2nd Semester Electronics and Communication Engineering For Examinations to be held in May 2024,2025,2026

Branch: ECE	L	T	P	C	EXTERNAL	INTERNAL
Semester:2nd	-	-	4	2	--	100
Course TitleResearch Seminar – I						
Course No.: MECE212						

Course Overview: The course aims to expose students to the 'real' working environment and get acquainted with the organization structure, business operations and administrative functions. To promote and develop presentation skills and import a knowledgeable society. To set the stage for future recruitment by potential employers.

Course Outcomes: By the end of the course, students will be able to:

CO1	An ability to work in actual working environment.
CO2	An ability to identify research problems and formulate clear and well-defined research questions or hypotheses relevant to their engineering discipline.
CO3	Develop proficiency in conducting a thorough literature review to identify gaps in existing knowledge and critically analyze relevant research papers and publications.
CO4	An ability to write technical documents and give oral presentations related to the work completed.

General guidelines for Presentation and File:

Content: Report must contain abundant material clearly related to topic; points should be clearly made and all evidence must support the topic along with varied use of materials.
Coherence and Organization: Topic should be clearly stated and developed; specified examples must be incorporated that would clearly develop the concept; conclusion must be clear and must flow together well.
Multimedia Material used: Report should have a balanced use of multimedia materials to properly showcase the work done.

Note: Seminar will be evaluated on internal scheme with following components:

1) **Presentation** 30%
2) **Viva-Voce** 30%
3) **Report** 40%

M.Tech 3rd Semester Electronics and Communication Engineering For Examinations to be held in December 2024,2025,2026

Branch: ECE	L	T	P	C	EXTERNAL	INTERNAL
Semester:3rd	3	1		4	75	25
Course Title: Information Theory and Coding						
Course No.: MECE3C1						
Duration of Exam: 3 HRS						

Course Overview: This course provides a basic understanding of the nature of information, the effects of noise and capacity in analogue and digital transmission systems and the construction of both source codes and error-detection-correction codes.

Course Outcomes: By the end of the course, students will be able to:

CO1	Determine the amount of information per symbol and information rate of a discrete memory less source.
CO2	Design lossless source codes for discrete memory less source to improve the efficiency of information transmission and channel capacities using Shannon's Theorems.
CO3	Apply different channel coding scheme such as convolution codes and block codes to improve data reliability and error correction capability in communication systems.
CO4	Study real world applications of information theory and coding in fields like data compression, cryptography and error resilient communication.

Detailed Syllabus:

UNIT 1: Information Sources, measurement of information and the Entropy Function: Introduction to Communication process and the nature of information, Entropy, measures of information, marginal entropy, joint entropy, Conditional entropy, and the Chain Rule for Entropy. **(12Hrs)**

UNIT 2 Sources with and without Memory: Sources coding theorem, Kraft inequality, Prefix, Variable and Fixed-length Codes. Error Correcting Codes.**(10 Hrs)**

Unit 3 Channel Types, Properties, Noise and Channel Capacity: Perfect communication through a noisy channel. The binary symmetric channel, their classification and capacity of a noiseless discrete channel. The Hartley and Shannon laws for channel capacity**(12 Hrs)**

UNIT 4 Error Control Coding: Channel Coding- Block Codes, Cyclic Codes and Convolution Codes, Decoding, Viterbi Decoding Algorithm. Trellis Codes.**(10Hrs)**

UNIT 5 Advanced Coding Techniques and Cryptography: BCH codes, Trellis coded modulation, Introduction to cryptography, overview of encryption techniques, symmetric cryptography.**(10Hrs)**

Note: The Question paper will comprise of 7 questions of 15 marks each uniformly distributed over the entire syllabus based on teaching hours. The candidate shall have to attempt any 5 questions.

Suggested Books:

1. "Information Theory, Coding and Cryptography", Ranjan Bose Tata McGraw Hill.
2. "Communication Systems Engineering", John G. ProakisMasoudSalehi, Pearson.
3. "Applied Coding and Information Theory for Engineers", Richard B. Wells ,Pearson
4. "Coding and Information Theory", R.W.Hamming 2nd edition, Prentice Hall
5. "Information Theory and Reliable Communication", R.G.Gallager, Wiley
6. "Principles of communication", Taub& Schilling, McGraw Hill

"Elements of Information Theory", Thomas Cover & Joy Thomas, John Wiley & Sons

M.Tech 3rd Semester Electronics and Communication Engineering For Examinations to be held in December 2024,2025,2026

Branch: ECE	L	T	P	C	EXTERNAL	INTERNAL
Semester:3rd	3	1	-	4	75	25
Course TitleAnalog VLSI Circuit Design						
Course No.: MECE3C2						
Duration of Exam: 3 HRS						

Course Overview: This course aims to teach the fundamentals of CMOS and various MOS based amplifier circuit design techniques used in today's advanced mixed-signal integrated-circuit applications. This course also covered analog amplifiers, current mirrors, op-amp design, noise fundamentals, switched capacitor circuits, Comparators and other analog circuitry used in today's mixed-signal ICs.

Course Outcomes: By the end of the course, students will be able to:

CO1	To Identify the various challenges, various design metrics of Analog design and Analog MOS Devices Modelling.
CO2	To understand various building blocks of all CMOS analog ICs and MOS biasing circuits.
CO3	Study and analyze the Single stage MOS amplifiers, CMOS Differential amplifier, CMOS OP-Amplifiers
CO4	Design and analysis of the MOS Comparator circuits and Switched capacitors circuits

Detailed Syllabus:

UNIT1: Basics of Analog VLSI: Analog integrated circuit design, Circuit design consideration for MOS challenges in analog circuit design, Recent trends in analog VLSI circuits; MOS as switch/linear resistor, MOS Transcendence, second order effects, Analog MOSFET Modelling: MOS Transistor, Low frequency MOSFET Models, High frequency MOSFET Models, Temperature effects in MOSFET, Noise in MOSFET.**(12Hrs)**

UNIT2: Single Stage Amplifiers: Basic Building Blocks- simple Current sources and sinks. Basic Current mirrors. Voltage and current references, MOS Diode/Active resistor, Advance Current mirror, Current and Voltage references, Bandgap references; CMOS Amplifier: Performances parameters of amplifier circuits, Common Source amplifier- with resistive, Diode connected, current source and Triode Loads, Common Gate amplifier, Frequency response of amplifiers-Millers Effect, association of poles with nodes and stability issues of amplifier. **(15Hrs)**

UNIT3: CMOS differential Amplifiers: Single and Differential operation, Basic Differential pair-Qualitative and Quantitative Analysis, CMOS Differential Amplifier: Differential signalling, source coupled pair, Current source load, Common Mode response, Common mode rejection ratio, CMOS Differential amplifier with current mirror load, Differential to single ended conversion, Gilbert Cell.
(13Hrs)

UNIT4: CMOS Operational amplifier: Block diagram of Op-amplifier, Ideal characteristics of Op-Amplifier, Single stage OP-Amp, Design of two stage OP-Amp, General considerations, Multipole system, phase margin, frequency Compensation of OP-Amp, compensation Techniques, CMOS Comparator: Characteristic of a Comparator, Two stage open loop Comparator, Special purpose Comparator, Regenerative Comparator, High speed Comparator. **(15Hrs)**

UNIT5: Switched Capacitor Circuits: Sampling Switches, speed considerations, Precision Considerations, Charge injection cancellation Switched capacitor circuits-Different operating modes, Switched capacitor amplifiers, Switch capacitor Integrator. **(05Hrs)**

Note: The Question paper will comprise of 7 questions of 15 marks each uniformly distributed over the entire syllabus based on teaching hours. The candidate shall have to attempt any 5 questions.

Suggested Books:

1. Design of Analog CMOS Integrated Circuits by BehzadRazavi, McGraw Hill.
2. CMOS: Circuit Design, Layout and Simulation by R. Jacob Baker, Harry W. Li, and David E. Boyce, Prentice Hall of India.
3. Analog Integrated circuit Design by David A. Johns and Ken Martin, John Wiley & Son.
4. Phillip E. Allen and Douglas R. Holberg, "CMOS Analog Circuit Design", Oxford, 3rd Edition.
5. R J Baker, "CMOS circuit Design, Layout and Simulation", IEEE Inc., 2008.
6. Pucknell, D.A. and Eshraghian, K., "Basic VLSI Design", PHI, 3rd Edition
7. Kang, S. and Leblebici, Y., "CMOS Digital Integrated Circuits, Analysis and Design", TMH
8. Paul. R.Gray& Robert G. Meyer, "Analysis and Design of Analog Integrated Circuits", Wiley, 5th Edition, 2009
9. Gregorian, R. and Temes, G.C., Analog MOS Integrated Circuits for Signal Processing, John Wiley (2004).
10. Johns, D.A. and Martin, K., Analog Integrated Circuit Design, John Wiley (2008).
11. Gray, P.R., Hurst, P.J., Lewis, S.H., and Meyer, R.G., Analysis and Design of Analog Integrated Circuits, John Wiley (2001) 5th ed.

M.Tech 3rd Semester Electronics and Communication Engineering For Examinations to be held in December 2024,2025,2026

Branch:ECE Semester:3rd	L	T	P	C	Externa	Internal
CourseTitle: Wireless Sensor Network	3	1	-	4	75	25
CourseNo.: MECE3C3						
Durationof Exam:3HRS						

Course Objective: Students will be introduced to various sensor networks and its applications, their hardware and network architecture along with data storage and manipulation techniques. Moreover, they will learn various routing protocols and real time applications of the subject.

Course Outcomes: By the end of the course, students will be able to:

CO1	Design wireless sensor networks for a given application
CO2	Understand MAC protocols used for different communication standards used in WSN
CO3	Classification and understand of different Routing protocols.
CO4	Analyze data storage and manipulation in various applications of WSN.

Detailed Syllabus

UNIT 1 Introduction: Introduction to Sensor Networks, unique constraints and challenges, Advantage of Sensor Networks, Applications of Sensor Networks, Mobile Adhoc Networks (MANETs) and Wireless Sensor Networks, Enabling technologies for Wireless Sensor Networks **(11Hrs)**

UNIT 2 Sensor Node Hardware and Network Architecture: Single-node architecture, Hardware components & design constraints, Operating systems and execution environments, introduction to TinyOS and nesC, Network architecture, Optimization goals and figures of merit, Design principles for WSNs, Service interfaces of WSNs, Gateway concepts. **(11Hrs)**

UNIT 3 Deployment and Configuration: Localization and positioning, Coverage and connectivity, Single-hop and multihop localization, self-configuring localization systems, sensor management Network Protocols: Issues in designing MAC protocol for WSNs, Classification of MAC Protocols, S-MAC Protocol, B-MAC protocol, IEEE 802.15.4 standard and Zig Bee, Dissemination protocol for large sensor network. **(10Hrs)**

UNIT 4 Routing protocols: Issues in designing routing protocols, Classification of routing protocols, Energy-efficient routing, Unicast, Broadcast and multicast, Geographic routing. **(8 Hrs)**

UNIT 5 Data Storage and Manipulation: Data centric and content based routing, storage and retrieval in network, compression technologies for WSN, Data aggregation technique. Operating systems and execution environments, introduction to TinyOS and nesC. **(7 Hrs)**

UNIT 6 Applications: Detecting unauthorized activity using a sensor network, WSN for Habitat Monitoring. Home Control, Building Automation, Industrial Automation, Medical Applications - Reconfigurable Sensor Networks, HighwayMonitoring, MilitaryApplications ,Civil and Environmental Engineering Applications, Wildfire Instrumentation ,Habitat Monitoring, Nanoscopic Sensor Applications , Case Study: IEEE 802.15.4 **(12Hrs)**

Note: The Question paper will comprise of 7 questions of 15 marks each uniformly distributed over the entire syllabus based on teaching hours. The candidate shall have to attempt any 5 questions.

Suggested Books:

1. "Wireless Sensor Network: Technology, Protocols and Application", Kazem, Sohraby, Daniel Minoli, TaiebZanti, John Wiley and Sons 1st Ed., 2007 (ISBN: 978-0-471-74300-2)
2. "Protocols and Architectures for Wireless Sensor Networks", Holger Karl and Andreas Willig, John Wiley & Sons, Ltd, 2005
3. "A survey of routing protocols in wireless sensor networks", K. Akkaya and M. Younis, Elsevier Ad Hoc Network Journal, Vol. 3, no. 3, pp. 325—349
4. "Wireless Sensor Network Designs", Anna Ha´c, John Wiley & Sons Ltd.

M.Tech 3rd Semester Electronics and Communication Engineering For Examinations to be held in December 2024,2025,2026

Branch: ECE Semester:3rd	L	T	P	C	External	Internal
Course Title: Cryptography and Network Security	3	1	-	4	75	25
Course No.: MECE3C4						
Duration of Exam:3HRS						

Course Overview: This course aims to familiarize the students with basic of computer security concepts, various cryptographic protocols, and techniques along with their practicality. The course will also provide an essential knowledge of network security and protocol standards. To understand the Cyber Ethics and Laws under IT-Act 2000 by which cyberspace is governed in our country and worldwide.

Course Outcomes: - By the end of the course, students will be able to:

CO1	To understand basic design principals of symmetric and asymmetric cryptography and learn how standard cryptanalytic attacks work and thereby how to avoid common design flaws.
CO2	To understand hash functions and existing techniques like Advanced Encryption Standard (AES), Rivest–Shamir–Adleman (RSA) Algorithms and Discrete Log.
CO3	To gain knowledge of the technologies that underpin the deployment and maintenance of a secure network
CO4	Be knowledgeable in the major technical security challenges in each of the following four areas: - Cryptography, Penetration testing, Network Security Tools.

Detailed Syllabus:

UNIT 1 Introduction: Security mind-set, Computer Security Concepts (CIA), Principle of Network Security, Introduction to common attacks & its types, Threats, and Assets. Model of N/w Security, Security Approaches, Security Policies, IP-Spoofing & Sniffing, Phishing Attack, Basics of Cookies. **(10 Hrs)**

UNIT 2 Cryptographic Protocols: Introduction to Protocols, Communications using Symmetric Cryptography, Substitution Ciphers and Transposition Cipher, Block Cipher, Steam Cipher, Modes of Operation, Symmetric and Asymmetric Cryptography. **(08 Hrs)**

UNIT 3 Cryptographic Techniques: Key Length & Management: Symmetric/Private Key Length, Asymmetric/Public-Key Length, Comparing Symmetric and Public-Key Length, Generating Keys, Algorithms: DIFFIE-HELLMAN, RSA, DES, AES **(08 Hrs)**

UNIT 4 Practical Cryptography: Encryption, Authentication, Message Digest/Hash Function, Hashing Tools, Symmetric and Asymmetric cryptography, Digital Signatures, DSS and Certificates, Message Authentication Protocols, Study of Cyber Laws & its significance under IT-Act 2000. **(10 Hrs)**

UNIT 5 Network Security and Protocol Standards: Network security issues, sniffing, IP Spoofing, Common threats, E-mail security, Secure Socket Layer (SSL), Transport Layer Security (TLS), SSH, IPSEC, Pretty Good Privacy (PGP), Intruders, Virus, Worms, Firewalls-and its need and features of firewall, Types of firewalls, Intruder Detection Systems. **(12 Hrs)**

Note: The Question paper will comprise of 7 questions of 15 marks each uniformly distributed over the entire syllabus based on teaching hours. The candidate shall have to attempt any 5 questions. Internals will be evaluated based on Minor-1 comprising of 60% of internal marks and Assignment / Quiz / Case study /Project comprising of 40% of internal marks.

Suggested Books:

1.Introduction to Modern Cryptography by Jonathan Katz and Yehuda Lindell, CRC Press Cryptography and Network Security by William Stallings, Fourth Edition, 2006 Prentice Hall. ISBN 0-13-187316-4

2. Handbook of Applied Cryptography by Alfred J. Menezes, Paul C. van Oorschot and Scott A. Vanstone, CRC Press.

3.Applied Cryptography: Protocols, Algorithms and Source Code in C by Bruce Schneier, John Wiley and Sons.

4. Cryptography & Network Security by Atul Kahate

Jatin Sir Gabindra

M.Tech 3rd Semester Electronics and Communication Engineering For Examinations to be held in December 2024,2025,2026

Branch:ECE Semester:3rd	L	T	P	C	External	Internal
CourseTitle: Advanced Optical Fiber Communication	3	1	-	4	75	25
CourseNo.: MECE3D1						
Durationof Exam:3HRS						

Course Overview: This course provides understanding of the functionality of each of the components that comprise a optic-fiber communication system: transmitter, fiber, amplifier, and receiver. It helps studentsto impart knowledge of types, basic laws, and transmission characteristics of optical fibers. Further itdevelopsresearch interestand expertise inthefieldof different types of networks /systemsused.

Course Outcomes: By the end of the course, students will be able to:

CO1	Describe the building blocks of an optical fiber system and shall be familiarized with basic laws and phenomena of optoelectronics, LASERs, LED diodes, fibers and detectors .
CO2	Summarize the various causes of signal degradation in optical fibers, loss and dispersion management and optical multiplexing schemes
CO3	Explain the working of OpticalAmplifiers, transmitter as well as at the receiver and various measuring instruments etc.
CO4	Explain operation of different fiber techniques and networks used.

Detailed Syllabus

Unit 1 Introduction To Optical Fibers: Evolution of fiber optic system, Need of Optical transmission, Advantages of OFC, Element of an Optical Fiber Transmission link- Ray Optics-Optical Fiber Modes and Configurations -Mode theory for optical propagation, Overview of Modes-Key Modal concepts- Linearly Polarized Modes , Single Mode Fibers, Graded Index fiber structure, Fiber fabrication techniques. **(10hrs)**

Unit 2 Signal Degradation and Management in Optical Communication Systems: Attenuation ,Absorption losses, Scattering losses, Bending Losses, Core and Cladding losses, Signal Distortion in Optical Wave guides-Information Capacity determination, Group Delay, Material Dispersion, Wave guide Dispersion, Signal distortion in SM fibers-Polarization, Mode dispersion, Intermodal dispersion, Pulse Broadening in GI fibers, Mode Coupling ,Design Optimization of SM fibers-RI profile and cut-off wavelength, Dispersion compensation methods: DCF, dispersion shifted and dispersion flattened fibers ,Amplified Spontaneous Emission (ASE) System Impact of ASE, Optical amplifiers: SOA, EDFA, Raman & hybrid amplifiers **(14Hrs)**

Unit 3 Fiber Optical Sources And Coupling: Direct and indirect Band gap materials-LED structures -Light source materials - Quantum efficiency and LED power, Modulation of a LED, lasers Diodes-Modes and Threshold condition -Rate equations -External Quantum efficiency -Resonant frequencies -Laser Diodes, Temperature effects, Introduction to Quantum laser, Fiber amplifiers- Power Launching and coupling, Lencing schemes, Fibre to - Fibre joints, Fiber splicing. Passive Optical Couplers, The 2X2 Fiber Coupler, Star coupler, Isolators and Circulators, optical switches, fiber grating. **(10hrs)**

Unit 4 Fiber Optical Receivers: PIN and APD diodes -Photo detector noise, Responsivity and Quantum efficiency, SNR, Detector Response time, Avalanche Multiplication Noise -Comparison of Photo detectors -Fundamental Receiver Operation - preamplifiers, Error Sources -Receiver Configuration, Digital receiver performance of Error - Quantum Limit. **(8Hrs)**

Unit 5 Transmission System Design: Point- to- point Links, System considerations,Link power budget- Rise- time budget-Noise effects on system performance,Modulation Formats: Direct and External Modulation, need for modulation/encoding, Fiber Loss-Induced Limitations, Balanced Coherent Receiver, Dispersion-Induced Limitations,ASE-InducedLimitations, Equivalent Noise Figure, Direct Detection Receiver. **(10Hrs)**

Unit 6 Advanced Light wave Systems: WDM light wave systems: broadcast-and-select WDM networks, DWDM, wavelength-routed networks, FTTH networks, Subcarrier multiplexing, Soliton based communication, OCDMA, OFDM in optical fiber communication, Polarization Division Multiplexing, Basic concepts of SONET/SDH Network. **(8Hrs)**

Note: The Question paper will comprise of 7 questions of 15 marks each uniformly distributed over the entire s syllabus basedonteachinghours.Thecandidatehavetoattemptany 5questions.

Suggested Books:

1. "OpticalFiberCommunications",GerdKeiser,,Mc GrawHill
2. "Optical fiber communication", John M Senior 3rd edition, Pearson Education India
3. "Fiberopticcommunicationtechnology",D.FMynbaevandL.Scheiner,PearsonEducation
4. "Fiberopticcommunicationsystems",GovindP.Agrawal,thirdedition,WileyIndia
5. "FiberOpticCommunications:FundamentalsandApplications",ShivaKumar,M.JamalDeen,WileyPublication

M.Tech 3rd Semester Electronics and Communication Engineering For Examinations to be held in December 2024,2025,2026

Branch: ECE	L	T	P	C	External	Internal
Semester:3rd	3	1	-	4	25	75
Course Title:MEMS						
Course No.: MECE3D2						
Duration of Exam: 3 HRS						

Course Overview: This course aims to familiarize the students with the fundamentals of MEMS devices, different MEMS sensors, their working principles, their operational characteristics. The course will also provide the basic concepts of fabrication technologies, micromachining keeping in view the recent trends.

Course Outcomes: By the end of the course, students will be able to:

CO1	Understanding the fundamentals of MEMS technology and its applications.
CO2	To study and learn the basics of material selection and need of microfabrication of electrical and mechanical components.
CO3	Understand the operation of micro devices, micro systems and their applications.
CO4	Design the micro devices, micro systems using the MEMS fabrication processes.

Detailed Syllabus:

UNIT 1 Introduction to MEMS: MEMS, Definition and classification, Evolution of Mmicrofabrication, Microsystems and Microelectronics, Multidisciplinary nature of Microsystems, Miniaturization. Applicationsand Markets of MEMS.**(10 Hrs)**

UNIT 2 Materials for MEMS and microsystems: Substrate and wafer, Aactive substrate material, silicon as substrate, Gallium arsenide, Qquartz, Ppiezoelectric materials, Ppolymers, packaging material.**(8 Hrs)**

UNIT 3 MEMS Fabrication Methods: Photolithography, Ion implantation, diffusion, oxidation, chemical vapor deposition, Physical vapor deposition, Epitaxy, Etching.**(10Hrs)**

UNIT 4 Overview of Micromachining: Materials for micromachining, Bulk micromachining -Wet etching and Dry etching and Ssurface micromachining, LIGA process. **(10 Hrs)**

UNIT 5 Working Principles of Microsystems and MEMS Transducers (Sensors and Actuators): Introduction, Microsensors, Micro actuation, MEMS with Micro actuators, Micro accelerometers, Microfluidics. Mechanical transducers, thermal transducers, magnetic transducers, Cchemical and biological transducers, microfluidic devices.**(12 Hrs)**

UNIT 6 RecentDevelopments in Microtechnology: Introduction to Nanotechnology, Carbon Nanotube, Graphene, CNT sensors, Graphene sensors. **(6 Hrs)**

Note: The Question paper will comprise of 7 questions of 15 marks each uniformly distributed over the entire syllabus based on teaching hours. The candidate shall have to attempt any 5 questions.

Suggested Books:

1. Foundations of MEMS", Chang Liu, Pearson Education Inc., 2012.
2. "Micro system Design", Stephan D Senturia, Springer Publications, 2000.
3. "MEMS and Microsystems Design and Manufacture", Tai Ran Hsu, Tata McGraw Hill, New Delhi, 2002.
4. "Microsensors MEMS and Smart devices",Gardner, CBS Publishers.

M.Tech 3rd Semester Electronics and Communication Engineering For Examinations to be held in December 2024,2025,2026

Branch: ECE	L	T	P	C	External	Internal
Semester:3rd	3	1	-	4	75	25
Course Title: Nano-Electronics						
Course No.: MECE3D3						
Duration of Exam: 3 HRS						

Course Overview: This course focuses on Nano-electronic devices which are an integral part of our life, including the billion-plus transistors in every smartphone. Thiscourse explains the fundamentals of Nano-electronics and Nano-electronics device physics.

Course Outcomes: By the end of the course, students will be able to:

CO1	Understanding the Scaling of MOS Transistor and insight of Nano-electronics device Physics.
CO2	Understanding the applications of quantum physics in Semiconductor Devices.
CO3	Study Electron Transport in nano structures
CO4	Study the various nano scale devices.

Detailed Syllabus

UNIT1: Introduction to Nano-electronics: Physical and Technological Limitations of Microelectronics, Transitioning from Microelectronics to Nano-electronics, MOS Scaling Theory- Issues in Scaling MOS Transistors, Short Channel Effects; Free Electron Theory & The New Ohm's Law Electrons flow, Classical free electron theory, Sommerfeld's theory, The quantum of conductance, Coulomb blockade, Towards Ohm's law. **(15Hrs)**

UNIT2: The Elastic Resistor: Conductance of an Elastic Resistor, Elastic Resistor- Heat dissipation; Materials for nano-electronics: Semiconductor heterostructures , Lattice-matched and pseudomorphicheterostructures, Inorganic nanowires, Organic semiconductors , Carbon nano-materials: nanotubes and fullerenes, Graphene; Ballistic and Diffusive Transport: Ballistic and Diffusive Transfer Times, Channels for Conduction Conductivity, Conductivity: E(p) or E(k) Relations, Counting States, Drude Formula, Quantized Conductance.**(15Hrs)**

UNIT3: Electron Density–Conductivity; Electron transport in semiconductors and nanostructures: Time and length scales of the electrons in solids, Statistics of the electrons in solids and nanostructures, Fermi statistics for electrons, the density of states of electrons in nanostructures, Electron transport in nanostructures.**(15Hrs)**

UNIT4: Electrons in traditional low-dimensional structures: Electrons in quantum wells: Single modulation-doped heterojunctions, Numerical analysis of a single heterojunction, Control of charge transfer, Electrons in quantum wires, Electron transport in quantum wires, Electrons in quantum dots; Nanostructure devices: Introduction, MODFETS, hetero junction bipolar transistors, Field-effect transistors, Single-electron-transfer devices, Potential-effect transistors, Carbon Nano-tube Transistors, Semiconductor Nano-wire FETs etc. **(15Hrs)**

Note: The Question paper will comprise of 7 questions of 15 marks each uniformly distributed over the entire syllabus based on teaching hours. The candidate shall have to attempt any 5 questions.

Suggested Books:

1. Fundamentals of Nanoelectronics by George W. Hanson, Pearson Education.
2. Nanoelectronics and Nano systems: From Transistors to Molecular and Quantum Devices by Karl Goser, Springer
3. Introduction to Nanoelectronics: Science, Nanotechnology, Engineering & Applications by Vladimir. V. Mitin, Cambridge University Press.
4. Introduction to Nano Science and Technology by S.M. Lindsay, World Scientific.
5. Lessons from Nanoscience: A Lecture Note Series, By SupriyoDutta, World Scientific.
6. Quantum Transport- Atom to Transistor, By SupriyoDutta, Cambridge University Press.
7. Nanotechnology for Microelectronics and optoelectronics, By J.M. Martinez-Duart, R. J. Martin Palma, F. Agulle Rueda, Elsevier.

M.Tech 3rd Semester Electronics and Communication Engineering For Examinations to be held in December 2024,2025,2026

Branch: ECE	L	T	P	C	External	Internal
Semester:3rd	3	1	-	4	75	25
Course Title : Biomedical Electronics						
Course No.: MECE3D4						
Duration of Exam: 3 HRS						

Course Overview: This aim of this course is to bridge the gap between electronics engineering and biomedical sciences. This course is a combination of design and problem- solving skills of electronics engineering with biological sciences in order to develop healthcare procedures such as diagnosis, monitoring, treatment, and therapy.

Course Outcomes: By the end of the course, students will be able to:

CO1	Identify the various biomedical processes and problems associated with human body.
CO2	Apply principles of electronics and instrumentation to cope up with biomedical processes.
CO3	Study various Instrumentations used in Biomedical field
CO4	Access and analyze the performance of biomedical electronic devices

Detailed Syllabus:

UNIT1: Characteristics of Transducers and Electrodes for Biological Measurement, Introduction to human body, block diagram, classification, characteristics, various physiological events and suitable transducer for their recording, bioelectric potentials. Cardiac System, Cardiac musculature, Electro-cardiography. **(15Hrs)**

UNIT2: ECG recording, Phonocardiography, ECG lead system, Heart rate meter, vector-cardiography, Defibrillators. Blood Pressure and Blood Flow Measurement, Invasive and non-invasive methods of Blood pressure, Characteristics of blood flow and heart sound, Cardiac output measurement, Plethysmography. **(15Hrs)**

UNIT3: Respiratory System, Mechanics of breathing, Parameters of respiration, Respiratory system measurements, Respiratory therapy instruments. Instrumentation for Measuring Nervous Function, EEG signal, frequency band classification, Lead systems, EEG recording, Clinical applications of EEG signal, X-ray, CT scan, MRI, Computer Tomography, PET. **(15 hrs)**

UNIT4: Recent Trends in Biomedical Engineering, Patient care and monitoring, Non-invasive diagnostic instrumentation, Biotelemetry, Telemedicine, Prosthetic devices, Lie detector test, Application of lasers and ultrasonic in biomedical field. **(15Hrs)**

Note: The Question paper will comprise of 7 questions of 15 marks each uniformly distributed over the entire syllabus based on teaching hours. The candidate shall have to attempt any 5 questions.

Suggested Books:

1. Introduction to Bio-medical Instrumentation by R.S. Khandpur, McGraw Hill Education.
2. Bio Medical Instrumentation by Cromwell, Prentice Hall India Learning Private Limited.

M.Tech 3rd Semester Electronics and Communication Engineering For Examinations to be held in December 2024,2025,2026

Branch: ECE	L	T	P	C	EXTERNAL	INTERNAL
Semester:3rd		-	20	10	250	-
Course Title:Dissertation Phase I						
Course No.: MECE311						

Course overview: The dissertation is a yearlong activity, to be carried out and evaluated in two phases
Phase–I: July/August to December/January and
Phase-II: January/February to June/July.

Course Outcomes: At the end of the course, students will demonstrate the ability to:

CO1	Conceive a problem statement either from rigorous literature survey or from the requirements raised by external entity.
CO2	Design, implement and test the prototype/algorithm in order to solve the conceived problem

The dissertation / project topic should be selected / chosen to ensure the satisfaction of the urgent need to establish a direct link between education, national development and productivity and thus reduce the gap between the Industry and Academics.

The dissertation should have the following:

- Relevance to social needs of society.
- Relevance to value addition to existing facilities in the institute.
- Relevance to industry need.
- Problems of national importance.
- Research and development in various domain.

The student should complete the following:

- Literature survey Problem Definition
- Motivation for study and Objectives
- Preliminary design / feasibility / modular approaches
- Implementation and Verification
- Report and presentation

After multiple interactions with guide and based on comprehensive literature survey, the student shall identify the domain and define dissertation objectives. The referred literature should preferably include IEEE/IET/IETE/Springer/Science Direct/ACM journals etc. in the relevant areas and any other related domain. In case of Industry sponsored projects, the relevant application notes, while papers, product catalogues should be referred and reported.

Student is expected to detail out specifications, methodology, resources required, critical issues involved in design, implementation, and phase wise work distribution and submit the proposal to the department.

- **Phase–I Deliverables:** A document report comprising of summary of literature survey, detailed objectives, project specifications, paper and/or computer aided design, proof of concept/functionality, part results, a record of continuous progress.
- **Phase–I Evaluation:** Internal committee constituted by Head of Department comprising of guides of respective specialization, shall assess the progress/performance of the student based on report, presentation and viva voce

1) **Performance or work done** — **30% of total Internal marks**
2) **Seminar** — **25% of total Internal marks**
3) **Viva** — **25% of total Internal marks**
4) **Report** — **20% of total Internal marks**

M.Tech 4th Semester Electronics and Communication Engineering For Examinations to be held in May 2025,2026,2027

Branch: ECE	L	T	P	C	EXTERNAL	INTERNAL
Semester:4th		-	38	18	150	300
Course Title:Dissertation Phase II						
Course No.: MECE411						

Course overview: The student is expected to exert on design, development and testing of the proposed work as per the schedule.Accomplished results/contributions/innovations should be published in terms of research papers in reputed journals and reviewed focused conferences OR IP/Patents.

Course Outcomes: At the end of the course, students will demonstrate the ability to:

CO1	Design, implement and test the prototype/algorithm in order to solve the conceived problem
CO2	Publish the Research work in at least one reputed Journal or conference of repute contributing to growth of technology in the domain.

- **Deliverables**: A dissertation report as per the specified format, developed system in the form of hardware and/or software, a record of continuous progress

- **Evaluation**: Evaluation for dissertation-II will be done in two parts: Internal and external evaluation.

➢ Internal evaluation will be done as mentioned below:

I. Presentation/Demonstration or work done :40% of total internal marks.
II. Seminar/Viva-voce : 20%of total internal marks.
III. Report : 40%of total internal marks.

➢ External Evaluation: Guide along with appointed External Examiner shall assess the progress/performance of the student based on report, presentation and viva-voce.