

UNIVERSITY OF JAMMU

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

NOTIFICATION (20/Oct/Adp/31)

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 Syllabi and courses of study of **Post-Graduate Programme in Engineering: Master of Technology in Electronics and Communication Engineering (M.Tech.) 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 2020, 2021, 2022
	Semester-II	May 2021, 2022, 2023
	Semester-III	December 2021, 2022, 2023
	Semester-IV	May 2022, 2023, 2024

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


DEAN ACADEMIC AFFAIRS

No. F.Acd/III/20/2390-97.

Dated: 6/10/2020

Copy for information & necessary action to:-

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


6/10
06/10/2020

UNIVERSITY OF JAMMU, JAMMU

Course Scheme

M. Tech 1st Semester Electronics and Communication Engineering
For Examinations to be held in the December 2020, 2021, 2022

Contact Hours/Week: 21

S. No	Subject Code	Subject	Teaching Hours/ Week			Credits	Marks	
			L	T	P		Internal	External
1	MECE101	Advance Digital Communication	3	-	-	3	25	75
2	MECE102	Digital System Design	3	-	-	3	25	75
3	MECE103	Embedded System Design	3	-	-	3	25	75
4	MECE104	Research Methodology	3	-	-	3	25	75
5	MECE11A	Elective-I Device Modelling for Circuit Simulation	3	-	-	3	25	75
	MECE11B	Wireless and Mobile Communication						
6	MECE131	Embedded system laboratory	-	-	3	1.5	75	
7	MECE132	VHDL Programming Laboratory	-	-	3	1.5	75	
Total Credits						18	275	375

Remarks:

- The students will have to select one course from Elective-1.i.e. between ***Device Modelling for Circuit Simulation and Wireless Mobile Communication*** of their choice as per approval of the department.

For Examination to be held in the Year December 2020,2021,2022

Class: M.Tech1st Semester

Branch: ECE

Course Title: Advance Digital Communication

Course No.:MECE101

Duration of Exam: 3 HRS

L	T	P	C	External	Internal
3	-	-	3	75	25

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:

CO1	Understand need of various modulation and spread spectrum techniques
CO2	Analyze the properties of basic Modulation techniques and apply them to Digital Communication
CO3	Familiarize the students with optimum receiver for AWGN and symbol synchronization

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, Band pass and Low pass Signal Representation, Signal space representation of waveforms. **4Hrs**

UNIT 2 Digital modulation Schemes: Representations of digitally modulated signals, memory less modulation methods, PAM, PM, AM, multidimensional signaling, Signaling scheme with memory, Power spectrum of Digitally modulated signals, PSD of a digitally modulated signals with memory, PSD of linearly modulated signals. **10 Hrs**

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. **10 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, phase locked loop, effect of noise on the phase estimation, symbol timing estimation, maximum likelihood timing estimation, non-decision directed timing estimation. **8 Hrs**

UNIT 5 Spread Spectrum Signals for Digital Communication: Model of spread spectrum digital communication system, direct sequence spread spectrum signals, frequency hopped spread spectrum signals, CDMA system based on FHSS signals, Synchronization of spread spectrum systems. **4 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 an 5 questions.

Suggested Books:

1. "Digital Communications", JG Proakis & M Salehi, 7th Edition, McGraw Hill
2. "Digital Communication", Simon Haykins, John Wiley & Sons
3. "Principle of Communication systems", Taub & Schilling, Tata Mc Graw Hill
4. "Digital Communications: Fundamentals and applications", Bernard Sklar, Prentice Hall Publications

For Examination to be held in the Year December 2020,2021,2022

Class: M.Tech1st Semester
Branch: ECE
Course Title: Digital System Design
Course No.:MECE102
Duration of Exam: 3 HRS

L	T	P	C	External	Internal
3	-	-	3	75	25

Course Overview

This course aims to understand optimized 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 modeling using VHDL HDL language.

Course Outcomes:

CO1	Optimize logic circuits using Karnaugh maps, Variable-entered mapping and Tabulation method.
CO2	Understand theoretical and practical aspects of all the combinational & sequential circuits.
CO3	Analyse and design sequential circuits by using the concepts of state table and state reduction techniques.

Detailed Syllabus

UNIT 1 Minimization and Design of Combinational Circuits: Minimization with theorems, Karnaugh Map, Variable-entered mapping and Tabulation method. MS and LS Circuits and Applications, Arithmetic circuits, Comparators, Multiplexers, Code converters, Encoder, Decoder, Inverter, Gates, Wired Logic, TRISTATE, SS, STEM, Propagation Delay.

3 Hrs

UNIT 2 Sequential Machine Fundamentals: Need for sequential circuits, Distinction between combinational and sequential circuits, Concept of memory, Binary Cell, Classification of sequential machines, Flip-flop, Design of clocked flip-flops, Conversion of flip-flops.

3 Hrs

UNIT 3 Analysis and Design of Sequential Circuits: State Diagram, Analysis, Design of Synchronous sequential circuits, State Reduction, Minimizing the next state decoder, Output decoder design, Counters, Design of Single Mode, Multi Mode Counters, Ring Counters. Shift Registers.

3 Hrs

UNIT 4 Asynchronous Finite-State Machines: Introduction, Asynchronous Analysis, The Design of Synchronous Machines, Races and hazards, Read only memories, ROM, RAM, PRAM and applications, Designing the ROM random logic, Programmed Logic arrays, Applications of PLA.

3 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 an 5 questions.

Suggested Books:

1. "An Engineering Approach to Digital Design", William I Fletcher, PHI.
2. "Logic and Computer Design Fundamentals" Morris Mano and Charles R. Kime.

For Examination to be held in the Year December 2020,2021,2022

Class: M.Tech1st Semester
Branch: ECE
Course Title: Embedded System Design
Course No.:MECE103
Duration of Exam: 3 HRS

L	T	P	C	External	Internal
3	-	-	3	75	25

Course Overview To understand the history & basic concepts of embedded system & understanding of different types of programming languages used for embedded systems. Study of PIC 16/17/18 based processors & architecture & programming and interfacing of ARM processor with memory & I/O devices. Study of RTOS.

Course Outcomes:

CO1	Understand Embedded system & its characteristics & architecture & programming and applications.
CO2	Apply the concepts of embedded processors with various interfaces.
CO3	Familiarize with the concepts of Real time Operating System and RTOS.

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 16/17/18 Microcontrollers & CPU architecture & Register file structure & Instruction Set & Programs & Timers and Interrupts & Interrupt Service Routine & Features of Interrupts & Interrupt vector & Priority. **12 Hrs**

UNIT2: Interfacing 16/17/18 in PIC & Interface & LCD interfacing & Seven segment interfacing & C Bus & DAC & ADC. **15 Hrs**

UNIT3: Embedded Core Based Design & System-on-Chip & Application specific Integrated circuit & Overview of Embedded Processors like ARM & MIPS. Architecture & Organization and instruction set & interfacing of ARM with seven segment display & ADC & Keypad & switches etc. **18 Hrs**

UNIT4: Data parallel issues e.g. SIMD & MIMD. Introduction to RTOS & basics of RTOS & RTOS overview. Architecture of an RTOS & Important features of Linux & Locks and Semaphores & Operating System Timers and Interrupts. **17 Hrs**

UNIT5: Applications of Embedded Systems in Embedded Networking Introduction to Wireless Sensor Networks & Architecture of Wireless Sensor Node. **16 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 an 5 questions.

Suggested Books:

1. "Microcontrollers (Theory and Applications)", Ajay V. Deshmukh
2. "An Embedded System", Primer David E. Simon
3. "Embedded System Design", Steve Heath
4. "PIC Microcontroller", John B. Peatman
5. "ARM system architecture", Steve Furber, Addison Wesley
6. "Programming Embedded System in C/C++", M.Barr
7. "Real Time Systems", H. Kopetz
8. "Embedded Systems", Raj Kamal
9. "Embedded Systems", K. V. Shibu
10. "Wireless Sensor Networks", Heath, S.
11. "Embedded Systems Design, Elsevier Science (2003)", Andrew N. Sloss.
12. "ARM System Developer's Guide Designing and Optimizing System Software", Morgan Kaufman Publication 2011

For Examination to be held in the Year December 2020,2021,2022

Class: M.Tech1st Semester

Branch: ECE

Course Title: Research Methodolog

Course No.: MECE104

Duration o Exam: 3 HRS

L	T	P	C	External	Internal
3	-	-	3	75	25

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 would 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.

Detailed Syllabus

UNIT I Research Methodolog An Introduction, Objectives of Research, Types of Research, Research Methods and Methodology, defining a Research Problem, Techniques involved in Defining a Problem. **06hrs**

UNIT 2 Research Design Design needed for Research Design, Features of Good Design, Different Research Designs, Basic Principles of Experimental Designs, Sampling Design, Steps in Sampling Design, Types of Sampling Design, Sampling Fundamentals, Estimation, Sample size Determination, Random sampling. **07hrs**

UNIT 3 Methods of Data Collection and Presentation: Methods of Data Collection and Analysis 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, curve and ogive curves, spread sheets. **06 hrs**

UNIT 4. Statistical tools: Measure of central tendency, mean and its types, range, median, mode, measure of dispersion, Quartiles, deciles and percentiles, standard deviation, variance and coefficient of variance. **07hrs**

UNIT 5. Techniques of Hypotheses: Hypotheses meaning and basics concepts, Flow diagram, Power of hypothesis test, types of hypothesis, limitations of tests of hypothesis, Chi-square Test, correlation and regression, Conversion of Chi to Phi, Caution in using Chi-square test. **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 candidates shall have to attempt an 5 questions.

Suggested Books:

1. "Research Methodology", C.R. Kothari, Wiley Eastern.
2. "Statistics in Psychology and Education" S.K. Mangal
- 3.. "Formulation of Hypothesis", Willkinson K.P, L Bhandarkar, Himalaya Publication, Bombay.
4. "Research in Education", John W Best and V. Kahn, PHI Publication
5. "MATLAB, An introduction with Applications", Amos Gilat, O'Reilly Media, 2003.
6. "Intellectual Property in New Technological Age", A. Lemley, 2016.
7. Booth, Colomb and Williams. The Craft of Research, University of Chicago Press, Chicago & London, Second edition.
8. John W. Creswell. Research Design, Sage Publications, New Delhi, Third Edition.

For Examination to be held in the Year December 2020,2021,2022

Class: M.Tech1st Semester

Branch: ECE

Course Title: Device Modelling or Circuit Simulation

Course No.: MECE11A

Duration of Exam: 3 HRS

L	T	P	C	External	Internal
3	-	-	3	75	25

Course Overview: Semiconductor device modeling aims to create and understand models and their behavior to electrical devices based on fundamental physics such as the doping profiles of the devices. Normally it starts from the output of a semiconductor process simulation. It also focuses on modeling of diode, MOSFET and MESFET.

Course Outcomes:

CO1	Comprehend the insight of electronic devices so as to provide appropriate and economically viable solutions to electronics engineering community and society at large.
CO2	Apply principles of usage of EDA tools & techniques for effective & efficient modeling of e-devices & e-circuits
CO3	Analyze the performance of electronic devices without actual fabrication so as to deal with e-designing for practical aspects and generate interest and competence in self-directed continuing professional development

Detailed Syllabus

UNIT1: Review of semiconductor device physics fundamentals and principles of device modeling and circuit simulation objectives and advantages. Introduction to SPICE AC/DC/Transient/noise/Temperature analysis/etc. of electronic devices and their application in circuit simulation. **08 Hrs**

UNIT2: Junction Diodes/DC/Small signal/Large signal/High frequency and noise models of diodes/Junction and depletion capacitance/narrow and wide base diodes. Measurement and extraction of diode model-parameters. Modeling of DC/small signal/high frequency and noise models of bipolar Junction transistors. Extraction of model parameters. Ebers-Moll and Gummel-Poon models. **10 Hrs**

UNIT3: MOSFETs/Types of MOSFETs/DC/small signal/high frequency and noise models of MOSFETs. MOS Capacitance model. Weak and strong inversion in MOSFETs. Threshold voltage concept. MOS Models/Level-1 and level-2 large signal MOSFET models. **07 Hrs**

UNIT4: Introduction to SEM models. Extraction of MOSFET model parameters. Device Scaling/Short and narrow channel MOSFETs. MOSFET channel mobility model/DNL/charge sharing and various non-linear effects. HET/MESFETs/H₂Ts/Modeling of HET/MESFET and extraction of parameters. Principles of hetero-junction devices/H₂Ts/HEM. **10 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 an 5 questions.

Suggested Books:

- CMOS Digital Integrated Circuits-Analysis & Design by S.M. Kang & R. LeBlond/TMH.
- Physics of Semiconductor Devices by S.M. Sze/Wiley Pub.
- Solid State Electronic Devices by R. Streetman & S. Banerjee/PH
- Computer Simulation of Electronic Circuits by R. Raghuram/Wiley Eastern Ltd.
- SPICE by Sedra and Smith/2nd Edition/University Press.
- Introduction to PSpice by H.M. Rashid/PH

For Examination to be held in the Year December 2020,2021,2022

Class: M.Tech1st Semester

Branch: ECE

Course Title: Wireless and Mobile Communication

Course No.: MECE11B

Duration of Exam: 3 HRS

L	T	P	C	External	Internal
3	-	-	3	75	25

Course Overview: The course addresses the fundamentals of wireless communications and 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:

CO1	Acquire knowledge about fundamentals and classification of mobile communication system.
CO2	Discuss the cellular system design, various propagation model and diversity schemes.
CO3	Analyze Digital cellular standards and various mitigation techniques of impairments that occur in CDMA.

Detailed Syllabus

UNIT 1 Mobile Communication: Types of Mobile Communication Systems, Mobile radio systems around the world, Trends in cellular radio and personal communications. **05 Hrs**

UNIT 2 Cellular Design Fundamentals: Frequency reuse, Channel alignment strategies, handoff strategies, interference and system capacity, improving coverage and capacity in cellular systems, mechanism for capacity improvement-cell splitting, cell sectoring, and micro cell zone concept. **08 Hrs**

UNIT 3 Mobile Radio Propagation: Large scale path loss, reflection, Diffraction, Scattering, Outdoor Propagation model- Okumura Model, Hata Model, Indoor Propagation Models. Small-scale multipath propagation, Types of small scale fading, Rayleigh and Ricean distributions, Diversity Schemes. **08 Hrs**

UNIT 4 CDMA Digital Cellular Standards: Services and Security Aspects, Network Reference Model and Key Features, Advantages over TDMA, CDMA WLL System. **06 Hrs**

UNIT 5 OFDM Principles: Block diagram of CDMA system - generation of sub carrier using FFT - guard time - cyclic extensions - windowing - choice of CDMA parameters - signal processing - bandwidth efficiency - peak to average power ratio - peak power problem - PAPR properties of CDMA signals, PAPR reduction techniques, Signal distortion techniques - multiple signalling and probabilistic techniques - coding techniques. **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 an 5 questions.

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

For Examination to be held in the Year December 2020,2021,2022

Class: M.Tech 1st Semester

Branch: ECE

Course Title: Embedded System Laboratory

Course No.: MECE131

Duration Exam: 3 HRS

L	T	P	C	Internal
-	-	3	1.5	75

Course Outcomes:

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

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 4 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 timer interrupt in ARM
9. Implementation on PPA

NOTE: Additional Practicals Experiments can be performed based on the course content requirements.

For Examination to be held in the Year December 2020,2021,2022

Class: M.Tech1st Semester

Branch: ECE

Course Title: VHDL Programming Laboratory

Course No.: MECE132

Duration Exam: 3 HRS

L	T	P	C	Internal
-	-	3	1.5	75

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:

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.

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 2-bit adder.
5. Design and verification of 2-bit look ahead carry adder
6. Design and verification of 2-bit arithmetic circuit.
7. Design and verification of 2-bit ALU.
8. Design and verification of 16-bit RAM.

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

UNIVERSITY OF JAMMU, JAMMU

Course Scheme

M. Tech 2nd Semester Electronics and Communication Engineering

For Examinations to be held in the Ma^y 2021, 2022, 2023

Contact Hours/Week: 22 hours

S.No	Subject Code	Subject	Teaching Hours/ Week			Credits	Marks	
			L	T	P		Internal	External
1	MECE201	IoT and its applications	3	1	-	4	25	75
2	MECE202	Advance Digital Signal Processing	3	-	-	3	25	75
3	MECE21A	Elective-II RF and Microwave circuit Design	3	1	-	4	25	75
	MECE21B	Digital VLSI Design						
	MECE21C	Machine learning						
	MECE21D	Digital ASIC Design						
4	MECE22A	Elective III Optical Fiber Communication system	3	-	-	3	25	75
	MECE22B	Wireless Sensor network						
	MECE22C	Digital Image Processing						
	MECE22D	VLSI Process Technology						
5	MECE231	IoT laboratory	-	-	3	1.5	75	
6	MECE23A	Elective IoT laboratory	-	-	3	1.5	75	
	MECE23B							
	MECE23C							
	MECE23D							
7	MECE213	Research Seminar-I	-	-	2	1	50	
Total Credits						18	300	300

Remarks:

1. The students will have to select one course from Elective-I i.e. between **IoT and Micro wave circuit Design**, **Digital VLSI Design**, **Machine learning** and **Digital ASIC Design** of their choice as per the approval of the department

2. The students will have to select one course from Elective-II i.e. between **Optical Fiber Communication system**, **Wireless Sensor network** or **Digital Image Processing** and **VLSI Process Technology** of their choice as per the approval of the department

For Examination to be held in the Year Ma^{2021,2022,2023}

Class: M.Tech^{2nd} Semester

Branch: ECE

Course Title: IoT and its Applications

Course No.: MECE201

Duration of Exam: 3 HRS

L	T	P	C	External	Internal
3	1	-	4	75	25

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

Course Outcomes:

CO1	Attain knowledge of IoT design Architecture communication protocols and sensors.
CO2	Implement the concepts Python programming tools Res-pi and Arduino.
CO3	Analyze challenges in IoT and its applications in real time scenario.

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. Constraints affecting design in IoT world- Introduction Technical design Constraints. Communication models and AP **6 Hrs**

UNIT 2 IoT to M2M: The Vision Introduction IoT and M2M fundamentals Devices and gate ways Definitions M2M Value Chains IoT Value Chains Difference between IoT and M2M. Software define network. **6 Hrs**

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 in IoT protocol Sensor deployment and node discovery Data handling and analysis Cloud Platform for IoT. **7 Hrs**

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 as Sensor Smoke Sensor. ultrasonic sensor relay. **6 Hrs**

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. **7 Hrs**

UNIT 6 Challenges in IoT: Design challenges development challenges security challenges and other challenges issues. **5 Hrs**

UNIT 7 Domain specific applications of IoT: Home automation Industry applications Surveillance applications Smart farming Smart city Connected vehicles Other IoT application. **5 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. "From Machine-to-Machine to the Internet of Things: Introduction to a New Age of Intelligence", Jan Holler, Vlasios Tsiatsis, Catherine Mulligan, Stefan Avesand, Stamatis Karnousos, David Doyle, 1st Edition, Academic Press, 2017.
2. "Internet of Things (A Hands-on Approach)", Vijay Madisetti and Arshdeep Bahga, 1st Edition, VPT, 2014
3. "Rethinking the Internet of Things: A Scalable Approach to Connecting Everything", Francis da Costa, 1st Edition, Apress Publications, 2017.
4. "Getting Started with the Internet of Things", Cuno Pfister, O'Reilly Media, 2011, ISBN: 978-1-449-1-2222-1

For Examination to be held in the Year Ma^o 2021,2022,2023

Class: M.Tech2nd Semester

Branch: ECE

Course Title: Advanced Digital Signal Processing

Course No.: MECE202

Duration o^o Exam: 3 HRS

L	T	P	C	External	Internal
3	-	-	3	75	25

Course Overview^o :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 the ability to select opportune algorithms and use it for a specific problem.

Course Outcomes:

CO1	Understand the principle of DFT algorithm approaches in FFT and its use in data reduction.
CO2	Acquire knowledge of different methods requisite for designing digital filters and Apprehend multi rate signal processing and its applications.
CO3	Recognize the concepts of adaptive filters design and its applications.

Detailed Syllabus

UNIT 1 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. **8 Hrs**

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 Butterworth filters Chebyshev filters Realization structures Infinite word length effects in filters **8 Hrs**

UNIT 3 Multirate Digital Signal Processing: Sampling rate conversion filters in sampling rate alteration systems multi rate structure for sampling rate conversion Poly phase decomposition multistage decimator and interpolator multi rate filter banks Quadrature mirror filter bank multilevel filter banks. **10 Hrs**

UNIT 4 Adaptive Filters: Concepts of Adaptive filters the Widrow LMS algorithm Recursive Least square algorithm gradient adaptive lattice method applications of adaptive filters. **10 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 an 5 questions.

Suggested Books:

1. "Digital Signal Processing", Salihanan, Vallavaraj and Gnanapriya, Tata McGraw Hill.
2. "Digital Signal Processing: Principles, Algorithms and Applications", J.G. Proakis and D.G. Manolakis, Pearson Education.
3. "Signals and Systems", Alan V. Oppenheim and Alan S. Willsky, PH
4. "Digital Signal Processing: A practical approach", Ifecher, and Jervis, Pearson Education.
5. "Digital Signal Processing: A computer based approach", S.K. Mitra, Tata McGraw Hill.
6. "Digital Signal Processing", J.S. Chitode, Technical Publications.

For Examination to be held in the Year May 2021,2022,2023

Class: M.Tech 2nd Semester

Branch: ECE

Course Title: RF and Microwave Circuit Design

Course No.: MECE21A

Duration of Exam: 3 HRS

L	T	P	C	External	Internal
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:

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	Design microwave passive devices with the knowledge of various simulation tools.

Detailed Syllabus

UNIT 1 Review of boundary conditions: Wave-guides 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 VC and phase noise, Various RF Synthesizer architecture and frequency dividers, Design issues in integrated RF filters. Thin and Thick film technologies. **10Hrs**

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

UNIT 4 Microwave measurements: SWR, Return loss, impedance, Scattering parameters, attenuation and familiarization with equipment's such as vector network analyzer, Spectrum analyzer, power meters and their block diagrams discussion. Fabrication techniques in microwave. **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 an 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, Academic 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

For Examination to be held in the Year Ma^o 2021,2022,2023

Class: M.Tech 2ndSemester
Branch: ECE
Course Title: Digital VLSI Design
Course No.: MECE21B
Duration o^oExam: 3 HRS

L	T	P	C	External	Internal
3	1	-	4	75	25

Course Overvie^o : This course aims to understand the digital VLS^odesign in CM^oS technology. This course also focuses on the study of fundamental concepts and structures of designing digital VLS^osystems include CM^oS devices and circuits^ostandard CM^oS fabrication processes^oCM^oS design rules^ostatic and dynamic logic structures^ointerconnect analysis^oCM^oS chip layout^osimulation and testing^olow power techni^oues^odesign tools and methodologies.

Course Outcomes:

CO1	Classify ^o Cs ^o static and dynamic VLS ^o design techni ^o ues
CO2	Design any CM ^o S digital VLS ^o combinatorial and se ^o quential circuits.
CO3	Design ^o analy ^o se and verify digital logic circuits and M ^o S memories as well as Physical layout designing of circuits

Detailed S^ollabus

UNIT1: Types and principles of M^oS^oETs^oIntroduction to large signal M^oS models ^olong channel^ofor digital design. M^oS ^ohverters^oStatic and Dynamic characteristics^oResistive^oDepletion and Enhancement load ^oM^oS inverters^othe basic CM^oS inverter^ovoltage transfer characteristics^ologic threshold^o^ooise margins. Dynamic behavior^otransition time^oPropagation Delay^oPower Consumption. **10Hrs^o**

UNIT2: M^oS Circuit Layout ^o Simulation^oStic^o diagrams^oLayout design rules^oM^oS device layout^oTransistor layout^o^ohverter layout^oCM^oS-circuits layout & simulation, Circuit Compaction, Euler’s Rule, Circuit extraction and post-layout simulation. **10Hrs^o**

UNIT3: Combinational M^oS Logic Design^oStatic M^oS design^oComplementary M^oS^oRatioed logic^oPass Transistor logic^oComple^o logic circuits^oDSL^oDCVSL^oTransmission gate logic. Dynamic M^oS design^oDynamic logic families and their performance. **10Hrs^o**

UNIT4: M^oS Memory design^oDesign of R^o M^oSRAM and DRAM cells. Se^oquential M^oS Logic Design^oStatic and dynamic latches^oflip flops ^o registers^oCM^oS Schmitt trigger^oadders and multiplier circuits. Introduction to low power design^o^ohput and ^output ^onterface circuits. ^oiCM^oS Logic Circuits^oIntroduction^o^oasic ^oiCM^oS Circuit behavior^oSwitching Delay in ^oiCM^oS Logic circuits. **12Hrs^o**

Note: The ^ouestion ^oa^oer ^oill com^orise o^o 7 ^ouestions o^o 15 marks each uni^obrml^o distributed over the entire s^ollabus based on teaching hours. The candidate shall have to attem^ot an^o 5 ^ouestions.

Suggested Books:

1. CM^oS Digital ^ontegrated Circuits-Analysis ^o Design by S.M. ^oang ^o ^o. Leblibici^oTMH.
2. Digital ^ontegrated Circuits Design by ^oM. Rabey^oPearson Education.
3. Principles of CM^oS VLS^oDesign^oA System Perspective by ^oHE Weste^o ^o. Eshraghian^oMc^oraw Hill Pub.
4. Solid State Electronic Devices by ^o.^o. Streetman ^o S. ^oaneer^oe^oPH^o
5. CM^oS Logic Circuit Design by ^oyemera^oSpringer ^ondia Pvt. Ltd. ^oew Delhi.
6. Introduction to VLS^oby Eshraghian^o Puc^onell^oPH^o
7. Analysis ^o Design of Digital ^ontegrated Circuits by David A. Hodges^oHorace ^o. ^oac^oson^oR.Saleh^oMc^oraw Hill.
8. Introduction to PSP^oCE by H.M. Rashid^oPH^o
9. J P Rabaey, A P Chandrakasan, B Nikolic, “Digital Integrated circuits: A design perspective”, Prentice Hall electronics and VLS^oseries^o2nd Edition

For Examination to be held in the Year Ma^o 2021,2022,2023

Class: M.Tech 2nd Semester
Branch: ECE
Course Title: Machine Learning
Course No.: MECE21C
Duration o^o Exam: 3 HRS

L	T	P	C	External	Internal
3	1	-	4	75	25

Course Objective: The student should be able to represent multidimensional data in the pattern space and segment the same according to standard paradigms. The student should understand Bayesian decision criteria and probabilistic inferences. The student should understand formation of decision boundaries using a neural network and unsupervised learning paradigms. He should be able to apply the concepts learnt in real world scenarios and databases.

Course Outcomes:

CO1	Familiarize with parametric and non parametric estimations Visualize data in the pattern space and test classifiers using supervised learning.
CO2	Apply clustering algorithms and Bayesian parameter estimation to process big data in real world problems
CO3	Apply learning rate momentum k-fold cross validation in problems of real world scenario.

Detailed Syllabus

UNIT1: Introduction to Machine Perception: Historical perspective Pattern recognition systems pattern association pattern classification segmentation and grouping classification of problem –Regression and Classification applications of machine learning. **6Hrs**

UNIT2: Artificial neural networks: Structure of a neuron McCulloch Pitts model of a neuron learning tasks Hebbian learning supervised and unsupervised learning batch learning and online learning Perceptron and linear separability pattern space and decision boundaries. **8 Hrs**

UNIT3: Bayesian learning: Introduction Bayes theorem Bayes theorem and concept learning Maximum likelihood least squared error hypothesis Maximum likelihood hypothesis for predicting probabilities Minimum description length principle Bayes optimum classifier Gibson algorithm Naive Bayes classifier, first order Hidden Markov's Models. **8Hrs**

UNIT4: Nonparametric techniques: Density estimation Parzen windows in classification problems the nearest neighbor Rule- nearest neighbor algorithm Error bounds and computational complexity of k algorithm. **8 Hrs**

UNIT5: Multi-layer neural networks and unsupervised learning: Feedforward operation and classification Back propagation algorithm R problems learning rates momentum constant weight pruning k-fold cross validation Self organizing maps k-Means clustering algorithm, RBF networks and its learning strategies. **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 an 5 questions.

Suggested Books:

1. "Pattern Classification", Duda, Richard, Peter Hart, and David Stork, New York, NY Wiley-Interscience
2. "Neural Networks and Learning Machines", Simon Hykin, Prentice Hall of India
3. "Machine Learning", Mitchell, Tom. New York, NY: McGraw-Hill
4. "Fundamentals of Neural Networks", Laurene Rausett Pearson Sixth impression
5. "Neural Networks for Pattern Recognition", Bishop, Christophe, NY: Oxford University Press
6. "The Elements of Statistical Learning: Data Mining, Inference and Prediction", Hastie, T., R. Tibshirani, and J. H. Friedman New York Springer

For Examination to be held in the Year May 2021,2022,2023

Class: M.Tech 2nd Semester
Branch: ECE
Course Title: Digital ASIC Design
Course No.: MECE21D
Duration of Exam: 3 HRS

L	T	P	C	External	Internal
3	1	-	4	75	25

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:

CO1	Understand the algorithms used for ASIC construction
CO2	Design chip using the Full Custom Design Flow and Tool.
CO3	Understand the basics of System on Chip and on chip communication architectures appreciate high performance algorithms for ASICs.

Detailed Syllabus

UNIT1: Introduction to ASIC and PLD devices, ASIC and PLD 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. **12Hrs**

UNIT2: Modeling Combinational 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, adders, subtractors, multipliers, ALUs, synthesis constraints. **10Hrs**

UNIT3: Modeling 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 modeling techniques, Path delay modeling, Timing analysis, user defined primitives, compiler directives, and system tasks. **12Hrs**

UNIT4: Implementation on PLD. 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. **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 an 5 questions.

Suggested Books:

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

For Examination to be held in the Year May 2021,2022,2023

Class: M.Tech 2nd Semester

Branch: ECE

Course Title: Optical Fiber Communication System

Course No.: MECE22A

Duration of Exam: 3 HRS

L	T	P	C	External	Internal
3	-	-	3	75	25

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 students to impart knowledge of types, basic laws and transmission characteristics of optical fibers. Further it develops research interest and expertise in the field of WDM systems design.

Course Outcomes:

CO1	Explain the need and significance of optical Communication system and signal degradation.
CO2	Impart knowledge of types, basic laws and transmission characteristics of optical fibers, lightwave systems, system components and applications
CO3	Develop research interest and expertise in the field of optical Amplifiers, Components and Networks

Detailed Syllabus

UNIT 1 Review of Optical Fiber Communication: Need of optical transmission, fiber optic communication system, Advantage of optical fiber, basic optical laws and transmission parameters, geometrical optics description, Step index fiber, graded index fiber, Mode Theory for optical propagation, Modes in planar wave, Phase and Group Velocity. **5Hrs**

UNIT 2 Signal Degradation in OFS: Attenuation, Material Absorption, Scattering Loss, Bending Loss, Information Capacity Determination, Group Delay, Material Dispersion, Waveguide Dispersion, Higher order Dispersion, Polarization Mode Dispersion, Dispersion compensating fibers, Non-linear effects on network performance, SPM, SRS, SBS, PM, WDM. **7Hrs**

UNIT 3 Optical Transmitter: Basic Concept, Emission and absorption Rates, p-n Junctions, Non-radiative recombination, semiconductor materials, LED, Power current relationship, LED spectrum, LASER Diodes, LED and its characteristics, optical gain, feedback and Laser threshold, working principle of Distributed feedback lasers, VCSEL. **6Hrs**

UNIT 4 Optical Receivers: Optical detection principles and devices, Detection response time, p-i-n photo-diode, Avalanche photodiode, Receiver operation, Digital Transmission, Error sources, Receiver configuration, Digital receiver performance, Probability of error. **6 Hrs**

UNIT 5 Transmission System Design: Link power budget, Rise time budget, Modulation formats, Direct and External Modulation, need for modulation, encoding, RZ, NRZ, CSR, DPS, AM modulation formats. Fiber Loss-Induced Limitations, Balanced Coherent Receiver, Dispersion-Induced Limitations, ASE-Induced Limitations, Equivalent noise figure, Impact of Amplifier Spacing, Direct Detection Receiver. **6Hrs**

UNIT 6 Optical Amplifier, Components and Networks: Basic application and types of optical amplifiers, Semiconductor optical amplifiers, Erbium doped fiber amplifiers, architecture and types, Raman Amplifier, Amplifier-noise, Coupler, splitter, optical switches, optical add-drop multiplexers, fiber grating, WDM and DWDM systems, optical CDMA and TDMA. **6Hrs**

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 an 5 questions.

Suggested Books:

1. "Optical Fiber Communications", Gerd Keiser, third edition, Mc Graw Hill
2. "Fiber optic communication technology", D.F Mynbaev and L. Scheiner, Pearson Education
2. "Fiber optic communication systems", Govind P. Agrawal, third edition, Wiley India
2. "Fiber Optic Communications: Fundamentals and Applications", Shiva Kumar, M. Jamal Deen, Wiley Publication
2. "Free Space optical networks for ultra broad band services ", Stamatios V. Kartalopoulos, Wiley Publication
6. "Optical wireless communications, system and channel modeling with MATLAB", Z. Ghassemlooy, W. Popoola, S. Rajbhandari, CRC Press.

For Examination to be held in the Year May 2021,2022,2023

Class: M.Tech2nd Semester

Branch: ECE

Course Title: Wireless Sensor Network

Course No.:MECE22B

Duration of Exam: 3 HRS

L	T	P	C	External	Internal
3	-	-	3	75	25

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 shall 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	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. **6Hrs**

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. **6Hrs**

UNIT 3 Deployment and Configuration: Localization and positioning, Coverage and connectivity, Single-hop and multihop localization, selfconfiguring localization systems, sensor management, Network Protocols, Issues in designing MAC protocol for WSNs, Classification of MAC Protocols, CS-MAC Protocol, TD-MAC protocol, IEEE 802.15.4 standard and ZigBee, Dissemination protocol for large sensor networks. **6Hrs**

UNIT 4 Routing Protocols: Issues in designing routing protocols, Classification of routing protocols, Energy-efficient routing, unicast, broadcast and multicast, geographic routing. **7Hrs**

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

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, Highway Monitoring, Military Applications, Civil and Environmental Engineering Applications, Wildfire Instrumentation, Habitat Monitoring, Nanoscopic Sensor Applications, Case Study, IEEE 802.15.4. **6Hrs**

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 an 5 questions.

Suggested Books:

1. "Wireless Sensor Network: Technology, Protocols and Application", Kazem, Sohraby, Daniel Minoli, TaiebZanti, John Wiley and Sons 1st Ed. 2005 ISBN 0-7893-111-2
2. "Protocols and Architectures for Wireless Sensor Networks", Holger Karl and Andreas Willig, John Wiley & Sons, Ltd
3. "A survey of routing protocols in wireless sensor networks", K. Akkaya and M. Younis, Elsevier Ad Hoc Network Journal, Vol. 2, no. 2, pp. 111-122
4. "Wireless Sensor Network Designs", Anna Ha'c, John Wiley & Sons Ltd.

For Examination to be held in the Year May 2021,2022,2023

Class: M.Tech 2nd Semester

Branch: ECE

Course Title: Digital Image Processing

Course No.: MECE22C

Duration of Exam: 3 HRS

L	T	P	C	External	Internal
3	-	-	3	75	25

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	Understand image formation for the acquisition of images.
CO2	Get knowledge of existing algorithms for the processing of digital images.
CO3	Apply knowledge & skills to solve industrial problems based on image processing.

Detailed Syllabus

Unit-1 Introduction and Digital Image Fundamentals: Application of Image Processing, Image Processing definition, steps in image Processing, Image Sensing and Acquisition, Image Sampling and Quantization, Spatial and Intensity resolution-Effect of reducing spatial resolution, DFT, Effect of reducing image gray levels. Basic relationships between pixels and adjacency. **06 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, Spatial Filtering, Spatial Correlation and Convolution, Smoothing Spatial Filters, order statistic filters, Sharpening Spatial Filters- The Laplacian, The Gradient-Robert cross gradient operator, Sobel operators **10 hrs**

Unit-3 Image Restoration: 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. **06 hrs**

Unit-4 Color Image Processing: Introduction to the color image processing, color models, RGB, HS, CM, CM, Conversion of color models, converting colors from RGB to HS, HS to RGB, RGB to CM and CM 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, spatial and temporal redundancy, irrelevant information, models of image compression, Huffman coding, Arithmetic coding, LZW coding, run-length coding, block transform coding, JPEG compression, predictive coding. **07 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 an 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", PHI

For Examination to be held in the Year May 2021,2022,2023

Class: M.Tech 2nd Semester

Branch: ECE

Course Title: VLSI Process Technology

Course No. :MECE22D

Duration of Exam: 3 HRS

L	T	P	C	External	Internal
3	-	-	3	75	25

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:

CO1	Identify the various design limits material used for fabrication technology
CO2	Understand the complexities involved in the integrated circuits
CO3	Apply principles to identify and Analyze the various steps for the fabrication of various components

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-Seed of epitaxial layer-vapors phase epitaxy-chemistry of epitaxial process-transport mechanism doping - auto doping-selective epitaxy-epitaxial process induced defects-molecular beam epitaxy-recent trends in Epitaxy-oxidation-Importance of oxidation-types of oxidation techniques-growth mechanism - Kinetics-factors affecting the growth mechanisms-silicon oxidation model-dry - wet oxidation-oxidation induced fault-08 Hrs

UNIT2: Lithography-Basic steps in lithography-lithography techniques-optical lithography-electron beam lithography-X-ray lithography-ion beam lithography-resists and mask preparation of respective lithographies-printing techniques-contact-proximity printing and projection printing. 08 Hrs

UNIT3: 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-RECE-etching induced defects. 07 Hrs

UNIT4: Diffusion and Ion Implantation-Diffusion mechanisms-diffusion reactor-diffusion profile-diffusion Kinetics-parameters affecting diffusion profile-Dopants and their behavior-choice of dopants-Ion Implantation- impurity distribution profile-properties of ion implantation-low energy and high energy ion implantation. 06Hrs

UNIT5: Metallization-Desired properties of metallization for VLSI-metallization choices-metallization techniques - vacuum evaporation-sputtering-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. 06 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 an 5 questions.

Suggested Books:

1. VLSI Technology by S.M. Sze-TMH.
2. VLSI Fabrication Principles by S. D. Handhi-John Wiley Sons.
3. Micromachined transducer by J. T.A. Covacs-Mcraw Hill.
4. W. Wolf, "Modern VLSI Design", (3rd edition), Pearson,2002
5. James D. Plummer Silicon VLSI Technology-Fundamentals-Practice and Modeling-Pearson Education
6. Stephen A. Campbell-The Science and Engineering of Microelectronic Fabrication 2nd edition-Oxford University Press
7. C.D. Chang S.M.Sze VLSI Technology-Mcraw Hill

For Examination to be held in the Year Ma^o 2021,2022,2023

Class: M.Tech2nd Semester

Branch: ECE

Course Title: IoT Laborator^o

Course No.:MECE231

Duration o^o Exam: 3 HRS

L	T	P	C	Internal
-	-	3	1.5	75

Course Outcomes:

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

List o^o Ex^operiments:

1. Introduction to various controllers like AVR, ARM, Arduino, Raspberry-pi.
2. Introduction to various sensors, actuators and its applications.
3. Introduction to various IoT based connectivity modules like WiFi, Bluetooth, LoRaWAN, ZigBee, HSM etc.
4. **Open Ended Problem:** Students are required to submit an IoT based project using Microcontroller, ARM, AVR or a Raspberry-pi and connection various sensors and actuators. The data for the same should be displayed via a webpage or web app.

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

Project application consists of Home automation, Health sector, smart farming, Surveillance systems, connected vehicles, industrial automation etc.

For Examination to be held in the Year Ma^{2021,2022,2023}

Class: M.Tech 2ndSemester

Branch: ECE

Course Title: RF and Micro^{Wave} Circuit Design Laborator^y

Course No.: MECE23A

Duration o^f Exam: 3 HRS

L	T	P	C	Internal
-	-	3	1.5	75

Course Outcomes:

CO1	Gain knowl ^e dge of various e ^x perim ^e ntal ^l c ^o mputational tools.
CO2	Design and analy ^s e different microwave passive components ^l filters.
CO3	Perform measurements of VSWR ^l Reflection coefficients ^l impedance for different microwave devices.

Practical tas^k related to theory to be performed on hardware^l kits and^l or any available simulation tool.

OR

Minor pro^ject to be allotted by the instructor.

For Examination to be held in the Year Ma^o 2021,2022,2023

Class: M.Tech 2nd Semester

Branch: ECE

Course Title: Digital VLSI Design Laborator^o

Course No.: MECE23B

Duration Exam: 3 HRS

L	T	P	C	Internal
	-	3	1.5	75

Course Outcomes:

CO1	Design digital Circuits using CM ^o S.
CO2	Use EDA tools like Cadence, Mentor Graphics, Tanner Tools and other open source software tools like gspice

List of Experiments:

- 1) Simulate an NMOS PMOS with minimum dimensions. Determine its dc drain and transfer characteristics at V_{DS} zero and a non-zero values. Hence compute the threshold voltage using available EDA tools.
- 2) Simulate an NMOS with five and ten times the minimum dimensions, determine its dc drain and transfer characteristics at V_{DS} zero and a non-zero values. Hence determine the channel length modulation factor using available EDA tools.
- 3) 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.
- 4) Simulate a CMOS inverter, obtain its transfer characteristics & transient analysis. Hence analyze and plot their power and delay dimension variations.
- 5) Simulate a NAND gate, verify its truth table and obtain its transient analysis. Hence analyze and plot their power and delay with load variations.
- 6) Use V_{DD} 1.2V for 0.1 μ m CMOS process, V_{DD} 1.2V for 0.1 μ m CMOS Process and V_{DD} 1V for 0.2 μ m CMOS Process or any other available Technology.
 - a) Plot I_D vs. V_{DS} at different drain voltages for NMOS/PMOS.
 - b) Plot I_D vs. V_{DS} at particular drain voltage (low) for NMOS/PMOS and determine V_t .
 - c) Plot $\log I_D$ vs. V_{DS} at particular gate voltage (high) for NMOS/PMOS and determine μ_{eff} and sub-threshold slope.
 - d) Plot I_D vs. V_{DS} at different gate voltages for NMOS/PMOS and determine Channel length modulation factor.
 - e) Extract V_{th} of NMOS/PMOS transistors (short channel and long channel) use V_{DS} 200mV
To extract V_{th} use the following procedure.
 - i. Plot g_m vs V_{DS} using SPICE and obtain peak g_m point.
 - ii. Plot $y = \frac{g_m}{I_D}$ as a function of V_{DS} using gspice.
 - iii. Use gspice to plot tangent line passing through peak g_m point in $y = \frac{g_m}{I_D}$ plane and determine V_{th} .
 - f) Plot I_D vs. V_{DS} at different drain voltages for NMOS/PMOS, plot DC load line and calculate g_m/g_{ds} and unity gain frequency.
Tabulate your result according to technologies and comment on it
- 7) Use V_{DD} 1.2V for 0.1 μ m CMOS process, V_{DD} 1.2V for 0.1 μ m CMOS Process and V_{DD} 1V for 0.2 μ m 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_{LH} , V_{MH} , V_{LH} , V_{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 t_{pHL} , t_{pLH} , t_{f} and t_{r} and t_{f} -to- t_{r} etc. Use V_{pLSE} , V_{VCL} , V_{f} etc
 - c) Perform AC analysis of CMOS inverter with fanout 2 and fanout 1. Use C_{in} , ω , p_{CL} , p_{RL} etc
- 8) Use gspice to build a three stage and five stage ring oscillator circuit in 0.1 μ m and 0.1 μ m technology and compare its frequencies and time period.

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

For Examination to be held in the Year Ma^{2021,2022,2023}

Class: M.Tech 2nd Semester

Branch: ECE

Course Title: Machine Learning Laborator²

Course No.: MECE23C

Duration o²Exam: 3 HRS

L	T	P	C	Internal
	-	3	1.5	75

Course Outcomes:

CO1	Understand the implementation and procedures for machine learning algorithms
CO2	Design Python programs for various learning algorithms
CO3	Apply appropriate data sets to the Machine learning algorithms

Practical tas² related to theory to be performed on hardware ²its and²or any available simulation tool.

OR

Minor pro²ect to be allotted by the instructor.

For Examination to be held in the Year May 2021,2022,2023

Class: M.Tech 2nd Semester

Branch: ECE

Course Title: ASIC Design Lab using VHDL HDL

Course No.: MECE23D

Duration of Exam: 3 HRS

L	T	P	C	Internal
	-	3	1.5	75

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, few of which are required for development of various projects and research work.

Course Outcomes:

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.

List of Experiments:

1. Verification of combinational and sequential designs.
2. Design and verification of full adder using three modelling styles.
2. Design and verification of 1-bit ALU.
2. Write HDL code to display messages on an alpha numeric LCD display.
2. Write HDL code to interface Hex key pad and display the key code on seven segment display.
2. Write HDL code to control speed, direction of DC and stepper motor.
2. Write HDL code to accept 2 channel analog signal, Temperature sensors and display the data on LC panel or seven segment display.
2. Write HDL code to generate different waveforms (Sine, Square, Triangle, Ramp) using DAC change the frequency and amplitude.

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

For Examination to be held in the Year May 2021,2022,2023

Class: M.Tech2nd Semester
Branch: ECE
Course Title: Research Seminar
Course No.:MECE213
Duration of Exam: 3 HRS

L	T	P	C	Internal
-	-	2	1	50

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 impart a knowledgeable society. To set the stage for future recruitment by potential employers.

Course Outcomes:

CO1	An ability to work in actual working environment.
CO2	An ability to utilize technical resources.
CO3	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

UNIVERSITY OF JAMMU, JAMMU

Course Scheme

M. Tech 3rd Semester Electronics and Communication Engineering

For Examination to be held in the Year December 2021,2022,2023

Contact hours/Week: 26

S. No	Subject Code	Subject	Teaching Hours/Week			Credits	Marks	
			L	T	P		Internal	External
1	MECE31A MECE31B MECE31C MECE31D	Elective- IV				3	25	75
		Information Theory and Coding						
		Analog VLSI Design	3	-	-			
		Advance Antenna System						
		Cryptography and Network Security						
2	MECE32A MECE32B MECE32C MECE32D	Elective-V				3	25	75
		Advance Computer Networks						
		MEMS	3	-	-			
		Nano-Electronics						
		Bio Medical Electronics						
3	MECE311	Dissertation Phase I To be continued in 4 th Sem			20	10	150	
Total Credits						16	200	150

Remarks:

- The students will have to select one course from Elective-IV i.e between **Information Theory and Coding**, **Analog VLSI Design**, **Advance Antenna System** and **Cryptography and Network Security** of their choice as per the approval of the department
- The students will have to select one course from Elective-V i.e between **Advance Computer Networks**, **MEMS**, **Nano-Electronics** and **Bio Medical Electronics** of their choice as per the approval of the department

For Examination to be held in the Year December 2021, 2022, 2023

Class: M.Tech 3rd Semester

Branch: ECE

Course Title: Information Theory and Coding

Course No.: MECE31A

Duration of Exam: 3 HRS

L	T	P	C	External	Internal
3	-	-	3	75	25

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:

CO1	Ability to 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	Understand how error control coding techniques are applied in communication systems

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. **08 Hrs**

UNIT 2 Sources with and without Memory: Sources coding theorem, Kraft inequality, Prefix, Variable and Fixed-length Codes. Error Correcting Codes. **06 Hrs**

Unit 3 Channel Theories, 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 **08 Hrs**

UNIT 4 Error Control Coding: Channel Coding- Block Codes, Cyclic Codes and Convolution Codes, Decoding, Viterbi Decoding Algorithm. Trellis Codes. **08 Hrs**

UNIT 5 Advanced Coding Techniques and Cryptography: BCH codes, Trellis coded modulation, Introduction to cryptography, overview of encryption techniques, symmetric cryptography. **06 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 an 5 questions.

Suggested Books:

1. "Information Theory, Coding and Cryptography", Ranjan Bose Tata McGraw Hill.
2. "Communication Systems Engineering", John G. Proakis Masoud Salehi, 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
7. "Elements of Information Theory", Thomas Cover & Joy Thomas, John Wiley & Sons

For Examination to be held in the Year December 2021, 2022, 2023

Class: M.Tech 3rd Semester

Branch: ECE

Course Title: Analog VLSI Design

Course No.: MECE31B

Duration of Exam: 3 HRS

L	T	P	C	External	Internal
3	-	-	3	75	25

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:

CO1	Identify the various design metrics of analog Design.
CO2	Describe the MOS based biasing circuits, various MOS based amplifier, p-Amplifier, Differential amplifier
CO3	Assess the results obtained by solving broadly defined engineering technology problems.

Detailed Syllabus

UNIT1: Introduction to Analog VLSI, Analog integrated circuit design, Circuit design consideration for MOS challenges in analog circuit design, Recent trends in analog VLSI circuits, Analog MOS ET Modeling, MOS transistor, Low frequency MOS ET Models, High frequency MOS ET Models, Temperature effects in MOS ET, noise in MOS ET.

07 Hrs

UNIT2: Current Source, Sinks and References, MOS Diode, Active resistor, Simple current sinks and mirror, Basic current mirrors, Advance current mirror, Current and Voltage references, Bandgap references, CMOS Amplifier, Performances matrices of amplifier circuits, Common source amplifier, Common gate amplifier, Frequency response of amplifiers and stability of amplifier.

08 Hrs

UNIT3: CMOS Feedback Amplifier, Feedback equation, Properties of negative feedback on amplifier design, Feedback Topology, Stability, CMOS Differential Amplifier, Differential signaling, source coupled pair, Current source load, Common mode rejection ratio, CMOS Differential amplifier with current mirror load, Differential to single ended conversion.

10 Hrs

UNIT4: CMOS Operational amplifier, Block diagram of p-amplifier, Ideal characteristics of p-Amplifier, Design of two stage p-Amplifier, CMOS Comparator, Characteristic of a comparator, Two stage open loop comparator, Special purpose comparator, Regenerative comparator, High speed comparator, Introduction to Switched Capacitor Circuits, Switched capacitor circuits, Switched capacitor amplifiers, Switch capacitor integrators.

10 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 an 5 questions.

Suggested Books:

- Design of Analog CMOS Integrated Circuits by Behrad Razavi, McGraw Hill.
- CMOS Circuit Design, Layout and Simulation by R. Jacob Baker, Harry W. Li and David E. Hoyle, Prentice Hall of India.
- Analog Integrated circuit Design by David A. Johns and Ken Martin, John Wiley & Son.
- Phillip E. Allen and Douglas R. Holberg, "CMOS Analog Circuit Design", Oxford, 3rd Edition.
- R J Baker, "CMOS circuit Design, Layout and Simulation", IEEE Inc., 2008.
- Pucknell, D.A. and Eshraghian, K., "Basic VLSI Design", PHI, 3rd Edition
- Kang, S. and Leblebici, Y., "CMOS Digital Integrated Circuits, Analysis and Design", TMH
- Paul. R.Gray & Robert G. Meyer, "Analysis and Design of Analog Integrated Circuits", Wiley, 5th Edition, 2009

For Examination to be held in the Year December 2021, 2022, 2023

Class: M.Tech 3rd Semester
Branch: ECE
Course Title: Advance Antenna System
Course No.: MECE31C
Duration of Exam: 3 HRS

L	T	P	C	External	Internal
3	-	-	3	75	25

Course Overview : This course provides comprehensive knowledge of different design and performance parameters of antenna. It helps students to estimate input impedance, efficiency and ease of match for antennas. Further it develops ability to design antennas and antenna arrays for various desired radiation pattern characteristics. It provides principle of operation, analysis and application of different antennas such as broadband antennas, micro-strip antenna, etc.

Course Outcomes:

CO1	Compute the far field distance, radiation pattern and gain of an antenna for given Current distribution
CO2	Foster ability to understand thin linear antennas and arrays, secondary sources, aperture, broadband and frequency independent antennas
CO3	Design antennas and antenna arrays for various desired radiation pattern characteristics

Detailed Syllabus

UNIT 1 Introduction: Review of Radiation Principles, Review of vector algebra, Basic Antenna. Concepts and parameters, Potential functions and the Electromagnetic field, Alternating current element, Power Radiated by a current element, Applications to short antennas, assumed current distributions, Radiation from a quarter-wave monopole or half wave dipole, Near and far fields. **04Hrs**

UNIT 2 Thin Linear Antennas and Arrays: Short Electric dipole, thin linear antenna, Radiation. resistance of antennas, Fields of a thin linear antenna with a uniform travelling wave, Array parameters, Half-power beam-width, Mathematics of linear array, Antenna element spacing without grating lobes, Linear broadside array with non uniform distributions, Gain of regularly spaced planar arrays with $d = \lambda/2$, Discussion on Binomial and Dolph-Tchebyscheff Array antennas. **08Hrs**

UNIT 3 Broadband Antennas: Broadband Antennas, The frequency independent concept, Rum-says Principle, Spherical, conical, Sleeve Dipole, Cylindrical dipole, rhombic antenna, helical antenna, Log-periodic array, Frequency independent antenna, planar and conical spiral, log periodic. **04Hrs**

UNIT 4: Different types of Antennas: Field equivalence principle, Radiation equations, Directivity, Rectangular and Circular aperture, Radiation from apertures and distribution, Horn antenna, E-plane, H-plane, Corrugated, Dielectric loaded-field, directivity calculation, Micro-strip antenna, basic characteristics, Rectangular and Circular patches **08Hrs**

UNIT 5 : Pattern Synthesis: Approximate far field pattern of line sources, Synthesis of line sources, Fourier transform method of line sources, Antenna as a filter, Laplace transform method, Woodward's synthesis method, Optimization methods, Synthesis of Planar rectangular source, Synthesis of planar circular source, Low side-lobe synthesis. **08Hrs**

UNIT6: Applications: Different types of antennas for applications in communication systems, Antennas for space communication **04Hrs**

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 an 5 questions.

Suggested Books:

1. "Antenna Theory Analysis and Design", Constantine A. Balanis, John Wiley & Sons
2. "Antennas for All Applications", John D Kraus, Ronald J Marhefka, Ahmad S Khan, Tata Mcgraw-Hill
3. "Micro-strip antennas", I.J.Bhal and P.Bhartia, Artech house

For Examination to be held in the Year December 2021, 2022, 2023

Class: M.Tech 3rd Semester

Branch: ECE

Course Title: Cryptography and Network Security

Course No.: MECE31D

Duration of Exam: 3 HRS

L	T	P	C	External	Internal
3	-	-	3	75	25

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.

Course Outcomes:

CO1	To understand basic design principles 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) and Discrete Log.
CO3	To gain knowledge of the technologies that underpin the deployment and maintenance of a secure network.

Detailed Syllabus

UNIT 1 Introduction: Security mind-set, Computer Security Concepts, CIA, Threats, Attacks and Assets. **04 Hrs**

UNIT 2 Cryptographic Protocols: Introduction to Protocols, Communications using Symmetric Cryptography, Substitution Ciphers and Transposition Cipher, Block Cipher, Stream Cipher, Modes of Operation, Symmetric and Asymmetric cryptography. **06 Hrs**

UNIT 3 Cryptographic Techniques: Key Length Management, Symmetric Key Length, Public-Key Key Length, Comparing Symmetric and Public-Key Key Length, Generating Keys, Algorithms, Diffie-Hellman, RSA, DES. **08 Hrs**

UNIT 4 Practical Cryptography: Encryption, authentication, hashing, Symmetric and Asymmetric cryptography, Digital Signatures and Certificates. **06 Hrs**

UNIT 5 Network Security and Protocol Standards: Network security issues, sniffing, Spoofing, Common threats, E-mail security, Secure Socket Layer (SSL), Transport Layer Security (TLS), SSH, PSEC, Pretty Good Privacy (PGP), Intruders, Virus, Worms, Firewalls-need and features of firewall, Types of firewall, Intruder Detection Systems. **10 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 an 5 questions.

Suggested Books:

1. Introduction to Modern Cryptography by Jonathan Katz and Shihua Lindell, CRC Press Cryptography and Network Security by William Stallings, Fourth Edition, Prentice Hall, ISBN 0-13-102110-2
2. Handbook of Applied Cryptography by Alfred 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

For Examination to be held in the Year December 2021, 2022, 2023

Class: M.Tech 3rd Semester

Branch: ECE

Course Title: Advance Computer Networks

Course No.: MECE32A

Duration of Exam: 3 HRS

L	T	P	C	External	Internal
3	-	-	3	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 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:

CO1	Design a network with appropriate protocols selected according to requirement.
CO2	Analyze different routing protocols and traffic engineering methods deployed in networking.
CO3	Analyze the implications of shifting from traditional network architectures to software defined networks.

Detailed Syllabus

UNIT 1 Overview : Computer network Topologies LAN, MA and WAN The 5 reference model TCP reference model Addressing Circuit Switched Datagram and Virtual Circuit network Hubs Bridges switches Routers and Gateways. **08Hrs**

UNIT2 Data Link Layer: Design Issues Error Control flow-control protocols Stop-and-wait and Sliding-window. Link protocols HDLC SLIP and PPP Protocols. **07Hrs**

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 Buffer control. Quality of Service Techniques for achieving good Quality of Service Integrated Services Differentiated Services Label Switching and MPLS. **07Hrs**

UNIT4 Internet Working and Internet Protocols: Tunneling Fragmentation. The IPv Protocol IPv addresses IPv Protocol Mobile IP SP ARP DHCP Internet Control Protocols Classless Inter-domain Routing CIDR network Address Translation NAT Sub-netting and Super-netting. **08 Hrs**

UNIT5 Transport Layer: Transport layer protocol issues Addressing Connection Establishment Connection Release flow control and Multiplexing. Internet Transport Protocols TCP and UDP. **06Hrs**

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 an 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
2. "Computer Networks and Internets", 2nd Ed, Comer, D.E, Delhi: Pearson Education Asia, 1998.
2. "An Engineering Approach to Computer Networking: Atm Networks, The Internets, And The Telephone Network", Vishav S. Addison- Wesley Professional Computing Series, A Wiley International Student Edition, 1st Ed
2. "Principles of Wireless Networks", 2002, Pahlavan, K. And Krishna Murthy, Delhi: Pearson Education
2. "High-Speed Networks And Internets: Performance And Quality Of Service", 2nd Ed, Stallings, W, Delhi: Pearson Education Asia
2. "Encyclopedia Of Networking", Sheldon, Tom, TMH
2. "Tcp/Ip Illustrated", Vol. 1: The Protocols, Stevens, R.W, Addison-Wesley

For Examination to be held in the Year December 2021, 2022, 2023

Class: M.Tech3rd Semester

Branch: ECE

Course Title: MEMS

Course No.:MECE32B

Duration o^r Exam: 3 HRS

L	T	P	C	External	Internal
3	-	-	3	75	25

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:

CO1	Understand the basics of material selection and need of micro fabrication of electrical and mechanical components.
CO2	Understand the operation of micro devices, micro systems and their applications.
CO3	Design the micro devices, micro systems using the MEMS fabrication processes.

Detailed Syllabus

UNIT 1 Introduction to MEMS: MEMS, Definition and classification, Evolution of micro fabrication, applications of MEMS. **6 Hrs**

UNIT 2 Materials for MEMS and microsystems: Substrate and wafer, active substrate material, silicon as substrate, gallium arsenide, quartz, piezoelectric materials, polymers, packaging material. **6 Hrs**

UNIT 3 MEMS Fabrication Methods: Photolithography, Ion implantation, diffusion, oxidation, chemical vapor deposition, Physical vapor deposition, Epitaxy, Etching. **8 Hrs**

UNIT 4 Overview of Micromachining: Materials for micromachining, bulk micromachining and surface micromachining, LIGA process. **8 Hrs**

UNIT 5 Working Principles of MEMS Transducers, Sensors and Actuators: Mechanical transducers, thermal transducers, magnetic transducers, chemical and biological transducers, microfluidic devices. **8 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 an 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.
4. “Microsensors MEMS and Smart devices”, Gardner, CBS Publishers.

For Examination to be held in the Year December 2021, 2022, 2023

Class: M.Tech 3rd Semester

Branch: ECE

Course Title: Nano-Electronics

Course No.: MECE32C

Duration of Exam: 3 HRS

L	T	P	C	External	Internal
3	-	-	3	75	25

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. This course explains the fundamentals of nano-electronics and nano-electronics device physics.

Course Outcomes:

CO1	Understanding the insight of nano-electronics device Physics so as to provide appropriate and economical viable solution to electronic engineering community and society at large.
CO2	Understanding the applications of quantum physics in Semiconductor Devices.
CO3	Identifying different devices so as to meet out the present design health safety and environmental challenges

Detailed Syllabus

UNIT1: Introduction to nano-electronics Physical and Technological Limitations of Microelectronics Transitioning from Microelectronics to nano-electronics M²S Scaling Theory- Issues in Scaling M²S 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. **10 Hrs**

UNIT2: The Elastic Resistor Conductance of an Elastic Resistor Elastic Resistor- Heat dissipation Materials for nano-electronics Semiconductor heterostructures Lattice-matched and pseudomorphic heterostructures Organic nanowires Organic semiconductors Carbon nano-materials nanotubes and fullerenes Graphene Ballistic and Diffusive Transport Ballistic and Diffusive Transfer Times Channels for Conduction Conductivity Electron-Phonon Relations Counting States Drude Formula Quantum Conductance. **08 Hrs**

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. **08 Hrs**

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 MDETS heterojunction bipolar transistors Field-effect transistors Single-electron-transfer devices Potential-effect transistors Carbon nano-tube Transistors Semiconductor nano-wire FETs etc. **10 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 an 5 questions.

Suggested Books:

- Fundamentals of Nanoelectronics by George W. Hanson Pearson Education.
- Nanoelectronics and Nanosystems From Transistors to Molecular and Quantum Devices by Carl Bosker Springer
- Introduction to Nanoelectronics Science Nanotechnology Engineering Applications by Vladimir. V. Mitin Cambridge University Press.
- Introduction to Nano Science and Technology by S.M. Lindsay World Scientific.
- Lessons from Nanoscience A Lecture Note Series by Supriyo Dutta World Scientific.
- Quantum Transport- Atom to Transistor by Supriyo Dutta Cambridge University Press.
- Nanotechnology for Microelectronics and optoelectronics by M. Martine-Duart R. Martin Palma. Agulle Rueda Elsevier.

For Examination to be held in the Year December 2021, 2022, 2023

Class: M.Tech 3rd Semester

Branch: ECE

Course Title: Biomedical Electronics

Course No.: MECE32D

Duration of Exam: 3 HRS

L	T	P	C	External	Internal
3	-	-	3	75	25

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:

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	Access and analyze the performance of biomedical electronic devices and signal processing

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. **10 Hrs**

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. **10 Hrs**

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, MR, PET. **10 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. **7 Hrs**

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

Suggested Books:

- Introduction to Bio-medical Instrumentation by R.S. Chandpur, Mcraw Hill Education.
- Bio Medical Instrumentation by Cromwell, Prentice Hall India Learning Private Limited.

For Examination to be held in the Year December 2021, 2022, 2023

Class: M.Tech 3rd Semester

Branch: ECE

Course Title: Dissertation Phase I

Course No.: MECE311

Duration Exam: 3 HRS

L	T	P	C	Internal
-	-	20	10	150

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

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 domains.

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/ET/ETE/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 and 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 the Head of the Department comprising of faculty members of respective specialization shall assess the progress/performance of the student based on the report/presentation and viva voce.

1/ Performance or work done

2/ Seminar

3/ Viva

4/ Report

30/ total Internal marks

25/ total Internal marks

25/ total Internal marks

20/ total Internal marks

UNIVERSITY OF JAMMU, JAMMU

Course Scheme

M. Tech 4th Semester Electronics and Communication Engineering

For Examination to be held in the Year March 2022,2023,2024

Contact Hours/Week :32

S.No	Subject Code	Subject	Teaching Hours/Week			Credits	Marks	
			L	T	P		Internal	External
1	MECE411	Dissertation Phase II Students have to submit the final project report at the end of the semester which will be evaluated followed by a seminar, presentation and viva -voice examination	-	-	32	16	250	150
Total Credits						16	400	

For Examination to be held in the Year Ma^y 2022,2023,2024

Class: M.Tech 4th Semester
Branch: ECE
Course Title: Dissertation Phase II
Course No.: MECE411
Duration of Exam: 3 HRS

L	T	P	C	Internal	External
-	-	32	16	250	150

Course overview :

The dissertation stage is based on a report prepared by the students on dissertation allotted by the department to the students. It may be based on

- Experimental verification
- Simulation
- Proof of concept.
- Design
- fabrication
- testing of System

Evaluation will be based on student seminar, written reports and evaluation of the developed system and/or theories

At least one publication in a journal of repute is mandatory for the final evaluation of Dissertation

- **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 will be done in two parts, internal and external evaluation.

➤ Internal evaluation will be done as mentioned below

- Presentation/Demonstration or work done 20% of total internal marks.
- Viva-voce 20% of total internal marks.
- Report 60% 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.