



# UNIVERSITY OF JAMMU

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

## NOTIFICATION

(20/Oct/Adp/3f)

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](http://www.jammuuniversity.ac.in)

DEAN ACADEMIC AFFAIRS

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26/10/2020

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)

# UNIVERSITY OF JAMMU, JAMMU

## Course Scheme

M. Tech 1<sup>st</sup> 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	<b>Elective-I</b> 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	
<b>Total Credits</b>						<b>18</b>	<b>275</b>	<b>375</b>

### Remarks:

- The students will have to select one course from Elective-1i.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.Tech1<sup>st</sup> 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:**

<b>CO1</b>	Understand need of various modulation and spread spectrum techniques
<b>CO2</b>	Analyze the properties of basic Modulation techniques and apply them to Digital Communication
<b>CO3</b>	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,QAM, 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)**

**UNIT5 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 any 5 questions.**

**Suggested Books:**

1. "Digital Communications", JG Proakis & M Salehi, 5th 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.Tech1<sup>st</sup> 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 optimize logic circuit designs using Karnaugh maps. This course also focuses on how to design of combinational and sequential digital logic circuits by using different types of modeling using VHDL HDL language.

**Course Outcomes:**

<b>CO1</b>	Optimize logic circuits, using Karnaugh maps, Variable-entered mapping and Tabulation method.
<b>CO2</b>	Understand theoretical and practical aspects of all the combinational & sequential circuits.
<b>CO3</b>	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. MSI and LSI Circuits and Applications: Arithmetic circuits, Comparators, Multiplexers, Code converters, EXOR AND-OR-INVERT Gates, Wired Logic, TRI -STATE BUS SYSTEM, Propagation Delay.

**(9Hrs)**

**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 Flop-Flops, Conversion of Flip- Flops. **(9Hrs)** **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. **(9Hrs)** **UNIT 4 Asynchronous Finite-State Machines:** Introduction, Asynchronous Analysis, The Design of Synchronous Machines, Cycles and races, Hazards, Read only memories, ROM'S PROMS and applications, Using the ROM random

logic, Programmed Logic arrays, Applications of PLA.

**(9Hrs)**

**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. "An Engineering Approach to Digital Design", Willian 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.Tech1<sup>st</sup> 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 16F8XX based processors: architecture, programming and interfacing of ARM processor with memory & I/O devices. Study of RTOS.

**Course Outcomes:**

<b>CO1</b>	Understand Embedded system, its characteristics, architecture, programming and applications.
<b>CO2</b>	Apply the concepts of embedded processors with various interfaces.
<b>CO3</b>	Familiarize with the concepts of Real time Operating System and FPGA.

**Detailed Syllabus**

**UNIT 1:** Definition of Embedded System. Embedded systems Vs Computing systems. Embedded system model. Major application areas. Purpose of embedded systems. Characteristics and quality attributes of embedded systems Introduction to PIC 16F8XX Microcontrollers, CPU architecture, Register file structure, Instruction Set, Programs, Timers and Interrupts, Interrupt Service Routine, Features of Interrupts, Interrupt vector & Priority. **(9Hrs)**

**UNIT2:** Interfacing 16F8XX in PIC, I/O Interface, LCD interfacing, Seven segment interfacing, I2 C Bus, DAC, ADC. **(5Hrs)**

**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. **(8Hrs)** **UNIT4:** Data parallel issues e.g SIMD, MIMD. Introduction to FPGA, Basics of FPGA, RTOS overview. Architecture of an RTOS, Important features of Linux, Locks and Semaphores, Operating System Timers and Interrupts. **(7Hrs)**

**UNIT5:** Applications of Embedded Systems in Embedded Networking Introduction to Wireless Sensor Networks, Architecture of Wireless Sensor Node. **(6 Hrs)**

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

**Suggested Books:**

1. "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 (2010).

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

**Class: M.Tech1<sup>st</sup> Semester**  
**Branch: ECE**  
**Course Title: Research Methodology**  
**Course No.: MECE104**  
**Duration of 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 Methodology:** 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 Need 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, medium, 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 any 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, 2003.
8. John W. Creswell. Research Design, Sage Publications, New Delhi, Third Edition, 2009.

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

**Class: M.Tech1<sup>st</sup> Semester**

**Branch: ECE**

**Course Title: Device Modelling for 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, BJT, MOS, MOSFET, JFET 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 BJT, DC, small signal, high frequency and noise models of bipolar junction transistors. Extraction of BJT 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 BSIM models. Extraction of MOSFET model parameters. Device Scaling, Short and narrow channel MOSFETs. MOSFET channel mobility model, DIBL, charge sharing and various non-linear effects. JFET, MESFETs & HBTs, Modeling of JFET & MESFET and extraction of parameters. Principles of hetero-junction devices, HBTs, 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 any 5 questions.**

**Suggested Books:**

1. CMOS Digital Integrated Circuits-Analysis & Design by S.M. Kang & Y. Leblibici, TMH.
2. Physics of Semiconductor Devices by S.M. Sze, Wiley Pub.
3. Solid State Electronic Devices by B.G. Streetman & S. Banerjee, PHI.
4. Computer Simulation of Electronic Circuits by R. Raghuram, Wiley Eastern Ltd.
5. SPICE by Sedra and Smith, Oxford University Press.
6. Introduction to PSPICE by H.M. Rashid, PHI

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

**Class: M.Tech1<sup>st</sup> 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::**

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

**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:** Fading, 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 OFDM system - generation of sub carrier using IFFT - guard time - cyclic extensions - windowing - choice of OFDM parameters - signal processing - bandwidth efficiency - peak to average power ratio - peak power problem - PAPR properties of OFDM 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 any 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 1<sup>st</sup> 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:**

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

**List of Experiments:**

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

**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.Tech1<sup>st</sup> 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::**

<b>CO1</b>	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 4-bit adder.
5. Design and verification of 4-bit look ahead carry adder
6. Design and verification of 8-bit arithmetic circuit.
7. Design and verification of 8-bit ALU.
8. Design and verification of 1024x4 RAM.

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

# UNIVERSITY OF JAMMU, JAMMU

## Course Scheme

**M. Tech 2<sup>nd</sup> Semester Electronics and Communication Engineering**  
**For Examinations to be held in the May 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	<b>Elective-II</b> RF and Microwave circuit Design	3	1	-	4	25	75
	MECE21B	Digital VLSI Design						
	MECE21C	Machine learning						
	MECE21D	Digital ASIC Design						
4	MECE22A	<b>Elective III</b> 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 II laboratory	-	-	3	1.5	75	
	MECE23B							
	MECE23C							
	MECE23D							
7	MECE213	Research Seminar-II	-	-	2	1	50	
<b>Total Credits</b>						<b>18</b>	<b>300</b>	<b>300</b>

### Remarks:

1. The students will have to select one course from Elective-II i.e. between **RF and Microwave 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-III i.e between **Fiber Optical Communication system**, **Wireless Sensor Network**, **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 May 2021,2022,2023**

**Class: M.Tech2<sup>nd</sup> 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, internetworking and cyber space. In the end they will also be able to design and implement IoT circuits and solutions.

**Course Outcomes:**

<b>CO1</b>	Attain knowledge of IoT, design, Architecture, communication protocols and sensors.
<b>CO2</b>	Implement the concepts Python programming tools, Res-pi and Arduino.
<b>CO3</b>	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 API. **(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 analyst, Cloud Platform for IoTs.

**(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**, Gas **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.

**(5Hrs)**

**UNIT 7 Domain specific applications of IoT:** Home automation, Industry applications, Surveillance applications, Smart farming, Smart city, Connected vehicles, Other IoT application.

**(5Hrs)**

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

**Suggested Books:**

1. "From Machine-to-Machine to the Internet of Things: Introduction to a New Age of Intelligence", Jan Holler, VlasiosTsiatsis, Catherine Mulligan, Stefan Avesand, Stamatis Karnouskos, David Boyle, 1st Edition, Academic Press, 2014.
2. "Internet of Things (A Hands-onApproach)", Vijay Madisetti and ArshdeepBahga, 1st Edition, VPT, 2014
3. "Rethinking the Internet of Things: A Scalable Approach to Connecting Everything", Francis da Costa, 1st Edition, Apress Publications, 2013
4. "Getting Started with the Internet of Things", Cuno Pfister, O'Reilly Media, 2011, ISBN: 978-1-4493- 9357-1

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

**Class: M.Tech<sup>2<sup>nd</sup></sup> Semester**

**Branch: ECE**

**Course Title: Advanced Digital Signal Processing**

**Course No.: MECE202**

**Duration of Exam: 3 HRS**

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

**Course Overview:** This course aims to introduce fundamentals of discrete systems and digital signal processing. It will provide the advanced methods of designing and analyzing algorithms that will help the students in developing the ability to select opportune algorithms and use it for a specific problem.

**Course Outcomes:**

<b>CO1</b>	Understand the principle of DTFT, algorithm approaches in FFT and its use in data reduction.
<b>CO2</b>	Acquire knowledge of different methods requisite for designing digital filters and Apprehend multi rate signal processing and its applications.
<b>CO3</b>	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, Finite 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. **(10Hrs)** **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 any 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. Wilsky, PHI
4. "Digital Signal Processing: A practical approach", Ifeather, 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 2<sup>nd</sup> 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:

<b>CO1</b>	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.
<b>CO3</b>	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 VCO and phase noise, Various RF Synthesizer architecture and frequency dividers, Design issues in integrated RF filters. Thin & Thick film technologies. **(10Hrs)**

**UNIT 3 Design aspects:** Transmission lines for microwave circuits, Strip lines, Micro-strip lines, Slot line & Coupled lines. Characteristics impedance, Lumped parameters etc. Design considerations and implementation using simulation tools, Design of power dividers, combiners, and directional couplers **(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 any 5 questions.**

### Suggested Books:

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

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

**Class: M.Tech 2<sup>nd</sup> Semester**  
**Branch: ECE**  
**Course Title: Digital VLSI Design**  
**Course No.: MECE21B**  
**Duration of Exam: 3 HRS**

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

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

### Course Outcomes:

CO1	Classify ICs, static and dynamic VLSI design techniques
CO2	Design any CMOS digital VLSI combinatorial and sequential circuits.
CO3	Design, analyze and verify digital logic circuits and MOS memories as well as Physical layout designing of circuits

### Detailed Syllabus

**UNIT1:** Types and principles of MOSFETs, Introduction to large signal MOS models (long channel) for digital design. MOS Inverters, Static and Dynamic characteristics, Resistive, Depletion and Enhancement load NMOS inverters, the basic CMOS inverter, voltage transfer characteristics, logic threshold, Noise margins. Dynamic behavior, transition time, Propagation Delay, Power Consumption. **(10Hrs)** **UNIT2:** MOS Circuit Layout & Simulation, Stick diagrams, Layout design rules, MOS device layout, Transistor layout, Inverter layout, CMOS-circuits layout & simulation, Circuit Compaction, Euler's Rule, Circuit extraction and post-layout simulation. **(10Hrs)** **UNIT3:** Combinational MOS Logic Design, Static MOS design, Complementary MOS, Ratioed logic, Pass Transistor logic, Complex logic circuits, DSL, DCVSL, Transmission gate logic. Dynamic MOS design, Dynamic logic families and their performance. **(10Hrs)** **UNIT4:** MOS Memory design, Design of ROM, SRAM and DRAM cells. Sequential MOS Logic Design, Static and dynamic latches, flip flops & registers, CMOS Schmitt trigger, adders and multiplier circuits. Introduction to low power design, Input and Output Interface circuits. BiCMOS Logic Circuits, Introduction, Basic BiCMOS Circuit behavior, Switching Delay in BiCMOS Logic circuits. **(12Hrs)**

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

### Suggested Books:

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

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

**Class: M.Tech 2<sup>nd</sup> Semester**  
**Branch: ECE**  
**Course Title: Machine Learning**  
**Course No.: MECE21C**  
**Duration of 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/databases.

### Course Outcomes:

<b>CO1</b>	Familiarize with parametric and non parametric estimations, Visualize data in the pattern space and test classifiers using supervised learning.
<b>CO2</b>	Apply clustering algorithms and Bayesian parameter estimation to process big data in real world problems
<b>CO3</b>	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, Mc.Culloch 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. **(9 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. **(9Hrs)** **UNIT4: Nonparametric techniques:** Density estimation, Parzen windows in classification problems, the Nearest Neighbor Rule, K- Nearest Neighbor algorithm, Error bounds and computational complexity of KNN algorithm. **(8 Hrs)** **UNIT5: Multi-layer neural networks and unsupervised learning:** Feedforward operation and classification, Back propagation algorithm, XOR problems, learning rates, momentum constant, weight pruning, K-fold cross validation,

Self organizing maps, K-Means clustering algorithm, RBF networks and it's 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 any 5 questions.**

### Suggested Books:

1. "Pattern Classification", Duda, Richard, Peter Hart, and David Stork, New York, NYWiley-Interscience (2000).
2. "Neural Networks and Learning Machines", Simon Hykin, Prentice Hall of India (2010)
3. "Machine Learning", Mitchell, Tom. New York, NY: McGraw-Hill (1997).
4. "Fundamentals of Neural Networks", Laurene Fausett, Pearson, Sixth impression (2011)
5. "Neural Networks for Pattern Recognition", Bishop, Christophe, NY: Oxford University Press, 1995. ISBN: 9780198538646.
6. "The Elements of Statistical Learning: Data Mining, Inference and Prediction", Hastie, T., R. Tibshirani, and J. H. Friedman, New York, NY: Springer, 2001. ISBN: 9780387952840.



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

**Class: M.Tech 2<sup>nd</sup> 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:

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

### Detailed Syllabus

**UNIT1:** Introduction: ASIC and FPGA devices, ASIC and FPGA Design flows, Top-Down and Bottom-Up design methodologies, Hardware Description Languages, Design Automation Tools, HDL Support for Synthesis. Language concepts: Design Entity, Declaration statements, concurrent statements, sequential statements, data types, data objects, expressions, operands, if-else, for-loop, case statements, synthesis equivalents and constraints. **(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 task. **(12Hrs)**

**UNIT4:** Implementation on FPGA. Unsigned integer, signed integer, fixed point, floating point arithmetic, Asynchronous considerations. Memory design: synchronous and asynchronous, single, dual and multi-port, Error detection and correction, compiler directives. **(08Hrs)**

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

### Suggested Books:

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

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

Class: M.Tech 2<sup>nd</sup> 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:

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

### Detailed Syllabus

**UNIT 1 Review of Optical Fiber Communication:** Need of optical transmission, Fiber optic communication system, Advantage of OFC, 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 & 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, XPM & FWM). **(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, ILD & its characteristics, Optical Gain, Feedback and Laser threshold, working principle of Distributed feedback lasers & VCSEL.

**(6Hrs)**

**UNIT 4 Optical Receivers:** Optical detection principles & 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, NRZ, RZ, CSRZ, DPSK, QAM 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 & 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 & DWDM systems, optical CDMA & 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 any 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
3. "Fiber optic communication systems", Govind P. Agrawal, third edition, Wiley India
4. "Fiber Optic Communications: Fundamentals and Applications", Shiva Kumar, M. Jamal Deen, Wiley Publication
5. "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.Tech2<sup>nd</sup> 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:

<b>CO1</b>	Design wireless sensor networks for a given application
<b>CO2</b>	Understand MAC protocols used for different communication standards used in WSN
<b>CO3</b>	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, S-MAC Protocol, B-MAC protocol, IEEE 802.15.4 standard and

Zig Bee, Dissemination protocol for large sensor network. **(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 network, 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 any 5 questions.**

**Suggested Books:**

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

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

Class: M.Tech 2<sup>nd</sup> 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:

<b>CO1</b>	Understand image formation for the acquisition of images.
<b>CO2</b>	Get knowledge of existing algorithms for the processing of digital images.
<b>CO3</b>	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, DPI, 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, HSI, CMY/ CMYK; Conversion of color models: converting colors from RGB to HSI, HSI to RGB, RGB to CMY and CMY to RGB etc. Pseudo coloring of images. **(05 hrs)**

**Unit-5 Image Compression:** Introduction to image compression, need of compression, methods of image compression: coding redundancy, 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 any 5 questions.

### **Suggested Books:**

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

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

Class: M.Tech 2<sup>nd</sup> 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: Need of epitaxial layer; vapors phase epitaxy, chemistry of epitaxial process, transport mechanism doping & auto doping; selective epitaxy, epitaxial process induced defects, molecular beam epitaxy; 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 (RIE); 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 any 5 questions.**

### Suggested Books:

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

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

**Class: M.Tech2<sup>nd</sup> Semester**

**Branch: ECE**

**Course Title: IoT Laboratory**

**Course No.:MECE231**

**Duration of Exam: 3 HRS**

L	T	P	C	Internal
-	-	3	1.5	75

**Course Outcomes:**

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

**List of Experiments:**

1. Introduction to various controllers like AVR, ARM, Arduino, Raspberry-pi, 8051.
2. Introduction to various sensors, actuators and it's 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 May 2021,2022,2023**

**Class: M.Tech 2<sup>nd</sup>Semester**

**Branch: ECE**

**Course Title: RF and Microwave Circuit Design Laboratory**

**Course No.: MECE23A**

**Duration of Exam: 3 HRS**

L	T	P	C	Internal
-	-	3	1.5	75

**Course Outcomes:**

<b>CO1</b>	Gain knowledge of various experimental, computational tools.
<b>CO2</b>	Design and analyze different microwave passive components, filters.
<b>CO3</b>	Perform measurements of VSWR, Reflection coefficients, impedance for different microwave devices.

Practical task related to theory to be performed on hardware kits and/or any available simulation tool.

**OR**

Minor project to be allotted by the instructor.

M.Tech 2<sup>nd</sup> Semester

Branch: ECE

Course Title: Digital VLSI Design Laboratory

Course No.: MECE23B

Duration Exam: 3 HRS

	L	T	P	C	Internal
	-		3	1. 5	75

**Course Outcomes:**

<b>CO1</b>	Design digital Circuits using CMOS.
<b>CO2</b>	Use EDA tools like Cadence/Mentor Graphics/Tanner Tools and other open source software tools like Ngspice

**List of Experiments:**

- 1). Simulate an NMOS & PMOS with minimum dimensions. Determine its dc drain and transfer characteristics at  $V_{BS} =$  zero and a non-zero values. Hence compute the threshold voltage using available EDA tools.
- 2). Simulate an NMOS with five and ten times the minimum dimensions, determine its dc drain and transfer characteristics at  $V_{BS} =$  zero and a non-zero values. Hence determine the channel length modulation factor using available EDA tools.
- 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  $V_{DD}=1.8V$  for 0.18um CMOS process,  $V_{DD}=1.3V$  for 0.13um CMOS Process and  $V_{DD}=1V$  for 0.09um CMOS Process or any other available Technology.
  - a) Plot  $I_D$  vs.  $V_{GS}$  at different drain voltages for NMOS, PMOS.
  - b) Plot  $I_D$  vs.  $V_{GS}$  at particular drain voltage (low) for NMOS, PMOS and determine  $V_t$ .
  - c) Plot  $\log I_D$  vs.  $V_{GS}$  at particular gate voltage (high) for NMOS, PMOS and determine  $I_{OFF}$  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  $V_{DS} = 30mV$   
To extract  $V_{th}$  use the following procedure.
    - i. Plot  $g_m$  vs  $V_{GS}$  using NGSPICE and obtain peak  $g_m$  point.
    - ii. Plot  $\gamma=I_D/(g_m)1/2$  as a function of  $V_{GS}$  using Ngspice.
    - iii. Use Ngspice to plot tangent line passing through peak  $g_m$  point in  $\gamma (V_{GS})$  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  $g_m$ ,  $g_{ds}$ ,  $g_m/g_{ds}$ , and unity gain frequency.  
Tabulate your result according to technologies and comment on it
- 7) Use  $V_{DD}=1.8V$  for 0.18um CMOS process,  $V_{DD}=1.2V$  for 0.13um CMOS Process and  $V_{DD}=1V$  for 0.09um CMOS Process or any other available Technology.
  - a) Perform the following
    - i. Plot VTC curve for CMOS inverter and thereon plot  $dV_{out}$  vs.  $dV_{in}$  and determine transition voltage and gain  $g$ . Calculate  $V_{IL}$ ,  $V_{IH}$ ,  $N_{MH}$ ,  $N_{ML}$  for the inverter.
    - ii. Plot VTC for CMOS inverter with varying  $V_{DD}$ .
    - iii. Plot VTC for CMOS inverter with varying device ratio.
  - b) Perform transient analysis of CMOS inverter with no load and with load and determine  $tp_{HL}$ ,  $tp_{LH}$ , 20%-to-80%  $tr$  and 80%-to-20%  $tf$ . (use  $V_{PULSE} = 2V$ ,  $CL = 50fF$  etc)
  - c) Perform AC analysis of CMOS inverter with fanout 0 and fanout 1. (Use  $C_{in}= 0.012pF$ ,  $CL = 4pF$ ,  $RL = 100k$  etc).
- 8) Use Ngspice to build a three stage and five stage ring oscillator circuit in 0.18um and 0.13um 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 May 2021,2022,2023**

**Class: M.Tech 2<sup>nd</sup> Semester**  
**Branch: ECE**  
**Course Title: Machine Learning Laboratory**  
**Course No.: MECE23C**  
**Duration of Exam: 3 HRS**

L	T	P	C	Internal
	-	3	1.5	75

**Course Outcomes:**

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

Practical task related to theory to be performed on hardware kits and/or any available simulation tool.

**OR**

Minor project to be allotted by the instructor.

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

**Class: M.Tech 2<sup>nd</sup> 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, w of hich 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.
3. Design and verification of 16-bit ALU.
4. Write HDL code to display messages on an alpha numeric LCD display.
5. Write HDL code to interface Hex key pad and display the key code on seven segment display.
6. Write HDL code to control speed, direction of DC and stepper motor.
7. Write HDL code to accept 8 channel analog signal, Temperature sensors and display the data on LC panel or seven segment display.
8. 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.Tech2<sup>nd</sup> 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 import a knowledgeable society. To set the stage for future recruitment by potential employers.

**Course Outcomes:**

<b>CO1</b>	An ability to work in actual working environment.
<b>CO2</b>	An ability to utilize technical resources.
<b>CO3</b>	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 3<sup>rd</sup> 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	<b>Elective- IV</b>						
		Information Theory and Coding						
		Analog VLSI Design	3	-	-	3	25	75
		Advance Antenna System						
		Cryptography and Network Security						
2	MECE32A MECE32B MECE32C MECE32D	<b>Elective-V</b>						
		Advance Computer Networks						
		MEMS	3	-	-	3	25	75
		Nano-Electronics						
		Bio Medical Electronics						
3	MECE311	<b>Dissertation Phase I</b> (To be continued in 4th Sem)			20	10	150	
<b>Total Credits</b>						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 3<sup>rd</sup> 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:**

<b>CO1</b>	Ability to determine the amount of information per symbol and information rate of a discrete memory less source.
<b>CO2</b>	Design lossless source codes for discrete memory less source to improve the efficiency of information transmission and channel capacities using Shannon's Theorems.
<b>CO3</b>	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. **(08Hrs)** **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 Types, Properties, Noise and Channel Capacity:** Perfect communication through a noisy channel. The binary symmetric channel, their classification and capacity of a noiseless discrete channel. The Hartley and Shannon

laws for channel capacity **(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. **(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 any 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 3<sup>rd</sup> 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:**

<b>CO1</b>	Identify the various design metrics of analog Design.
CO2	Describe the MOS based biasing circuits, various MOS based amplifier, Op-Amplifier, Differential amplifier
<b>CO3</b>	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 MOSFET Modeling: MOS transistor, Low frequency MOSFET Models, High frequency MOSFET Models, Temperature effects in MOSFET, Noise in MOSFET.

(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 Op-amplifier, Ideal characteristics of Op-Amplifier, Design of two stage Op-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 any 5 questions.**

**Suggested Books:**

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

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

**Class: M.Tech 3<sup>rd</sup> 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::**

<b>CO1</b>	Compute the far field distance, radiation pattern and gain of an antenna for given Current distribution
<b>CO2</b>	Foster ability to understand thin linear antennas and arrays, secondary sources, aperture, broadband and frequency independent antennas
<b>CO3</b>	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, (Bi-conical, Sleeve Dipole, Cylindrical dipole, rhombic antenna, helical antenna, Yagi-Uda 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, Hplane, Corrugated, Di-electric 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 any 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 3<sup>rd</sup> 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. To understand hash functions and existing techniques like Advanced Encryption
CO2	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, Steam 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, IP Spoofing, Common threats, E-mail security, Secure Socket Layer (SSL), Transport Layer Security (TLS), SSH, IPSEC, Pretty Good Privacy (PGP), Intruders, Virus, Worms, Firewalls-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 any 5 questions.**

**Suggested Books:**

- 1.Introduction to Modern Cryptography by Jonathan Katz and Yehuda Lindell, CRC Press Cryptography and
- 2.Network Security by William Stallings, Fourth Edition, 2006 Prentice Hall. ISBN 0-13-187316-4
3. Handbook of Applied Cryptography by Alfred J. Menezes, Paul C. van Oorschot and Scott A. Vanstone, CRC Press.
- 4.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 3<sup>rd</sup> 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, network-layer, and transport-layer technologies, LAN/WAN technologies, topologies, traffic analysis, congestion/flow control, routing etc. The goal of this course is to introduce the students to state-of-the-art network protocols and architectures.

**Course Outcomes:**

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

**Detailed Syllabus**

**UNIT 1 Overview:** Computer Network, Network Topologies, LAN, MAN, and WAN, The OSI reference model, TCP/IP reference model, Addressing, Circuit Switched, Datagram and Virtual Circuit Networks, Hubs, Bridges, switches, Routers and Gateways. **(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 Jitter control. Quality of Service: Techniques for achieving good Quality of Service, Integrated Services, Differentiated Services, Label Switching and MPLS. **(07Hrs)**

**UNIT4 Internetworking and Internet Protocols:** Tunneling, Fragmentation. The IPv4 Protocol, IPv4 addresses, IPv6 Protocol, Mobile IP, OSPF, BGP, ARP, DHCP, Internet Control Protocols, Classless Inter-domain Routing (CIDR), Network Address Translation (NAT), Sub-netting and Super-netting. **(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 any 5 questions.**

**Suggested Books:**

1. "Data Communications and Networks", 2nd Ed Forouzan, Tata Mcgraw Hill
2. "Computer Networks", 4th Ed, A. S. Tanenbaum, Pearson Education
3. "Computer Networks and Internets", 2nd Ed, Comer, D.E, Delhi: Pearson Education Asia, 1998.
4. "An Engineering Approach to Computer Networking: Atm Networks, The Internets, And The Telephone Network", Keshav, S., Addison- Wesley Professional Computing Series, Awl International Student Edition, 1997 Ed
5. "Principles of Wireless Networks", 2002, Pahlavan, K. And Krishna Murthy, Delhi: Pearson Education
6. "High-Speed Networks And Internets: Performance And Quality Of Service", 2nd Ed, Stallings, W, Delhi: Pearson Education Asia, 2002
7. "Encyclopedia Of Networking", Sheldon, Tom, TMH
8. "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.Tech3<sup>rd</sup> Semester

Branch: ECE

Course Title: MEMS

Course No.:MECE32B

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

**UNIT 5 Working Principles of MEMS Transducers (Sensors and Actuators):** Mechanical transducers, thermal transducers, magnetic transducers, chemical and biological transducers, microfluidic devices. **(8Hrs)**

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

### Suggested Books:

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

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

Class: M.Tech 3<sup>rd</sup> 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, MOS Scaling Theory- Issues in Scaling MOS Transistors, Short Channel Effects; Free Electron Theory & The New Ohm's Law Electrons flow, Classical free electron theory, Sommerfeld's theory, The quantum of conductance, Coulomb blockade, Towards Ohm's law. **(09 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, Inorganic nanowires, Organic semiconductors, Carbon nano-materials: nanotubes and fullerenes, Graphene; Ballistic and Diffusive Transport: Ballistic and Diffusive Transfer Times, Channels for Conduction Conductivity, Conductivity:  $E(p)$  or  $E(k)$  Relations, Counting States, Drude Formula, Quantized Conductance. **(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, MODFETS, 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 any 5 questions.

### Suggested Books:

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

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

**Class: M.Tech 3<sup>rd</sup> 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:

<b>CO1</b>	Identify the various biomedical processes and problems associated with human body.
<b>CO2</b>	Apply principles of electronics and instrumentation to cope up with biomedical processes.
<b>CO3</b>	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. **(09 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. **(09 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, MRI, 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. **(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 any 5 questions.**

### Suggested Books:

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

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

**Class: M.Tech 3<sup>rd</sup> 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/IET/IETE/Springer/Science Direct/ACM journals etc. in the relevant areas and any other related domain. In case of Industry sponsored projects, the relevant application notes, while papers, product catalogues should be referred and reported.

Student is expected to detail out specifications, methodology, resources required, critical issues involved in design 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.

<b>1) Performance or work done</b>	<b>30% of total Internal marks</b>
<b>2) Seminar</b>	<b>25% of total Internal marks</b>
<b>3) Viva</b>	<b>25% of total Internal marks</b>
<b>4) Report</b>	<b>20% of total Internal marks</b>

# UNIVERSITY OF JAMMU, JAMMU

## Course Scheme

**M. Tech 4<sup>th</sup> Semester Electronics and Communication Engineering  
For Examination to be held in the Year May 2022,2023,2024**

Contact Hours/Week :32

S.No	Subject Code	Subject	Teaching Hours/Week			Credits	Marks	
			L	T	P		Internal	External
1	MECE411	<b>Dissertation Phase II</b>  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
<b>Total Credits</b>						<b>16</b>	<b>400</b>	

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

Class: M.Tech 4<sup>th</sup> 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 II is based on a report prepared by the students on dissertation -I 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-II will be done in two parts: Internal and external evaluation.



Internal evaluation will be done as mentioned below:

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



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