GANGA INSTITUTE OF TECHNOLOGY AND MANAGEMENT, KABLANA (JHAJJAR)
(An Autonomous Institute)

'A' GRADE ACCREDITED BY NAAC

Evaluation Scheme & Syllabus For

Master of Technology (Electronics and Communication Engineering)

(Effective from the Session: 2025-26)

APPROVED BY AICTE, NEW DELHI AND AFFILIATED TO MDU, ROHTAK

1. DEFINITION OF CREDIT

1	1 Hr. Lecture (L) per week	1 Credit
2	2 Hr. Practical (P) per week	1 Credit
3	2 Hr. Seminar per Week	2 Credit
4	2 Hr. Project per week	1 Credit

2. RANGE OF CREDIT

A credit range of 80–90 is required for a student to be eligible for a Postgraduate degree in Engineering.

3. STRUCTURE OF POSTGRADUATE ENGINEERING PROGRAM (M.TECH - ECE)

Sr. No.	Category	Breakup of Credits
1	Professional Core Courses	32
2	Professional Elective Courses (Relevant to chosen specialization/branch)	8
3	Multidisciplinary Open Elective Courses	6
4	Foundation Elective Courses	3
5	Mandatory Learning Course	3
6	Seminar	6
7	Lab Courses	5
8	Project	2
9	Dissertation	22
Total Credits		87

4. COURSE CODE AND DEFINITIONS

Sr. No.	Category	Course Code
1	Professional Core Courses	PCC
2	Professional Elective Courses (Relevant to chosen specialization/branch)	PEC
3	Multidisciplinary Open Elective Courses	OEC
4	Foundation Elective Courses	FEC
5	Mandatory Learning Course	MLC
6	Seminar	SM
7	Lab Courses	LC
8	Project	PROJ
9	Dissertation	DISS

GANGA INSTITUTE OF TECHNOLOGY AND MANAGEMENT, KABLANA, JHAJJAR (HR.), DELHI-NCR

Scheme of Studies and Examination

M.Tech (Electronics & Communication Engineering) – 1st Semester

***W.e.f.* 2025-26**

Sr. No.	Category	Course Code	Course Title	Lectures per week			Total Load Per Week	Credits	Examination Scheme (Marks)				Exam Duration inHours
				Lecture (L)	Tutorial (T)	Practical (P)			Assessment	End Semester Examination		Total	
										Theory	Practical		
1	Professional Core Courses	PCC-MTECE-101A	Satellite Communication and Space Technology	4	0	0	4	4	40	60		100	3
2	Professional Core Courses	PCC-MTECE-103A	Information Theory and Coding Techniques	4	0	0	4	4	40	60		100	3
3	Professional Core Courses	PCC-MTECE-105A	Advanced Digital Signal Processing and Systems	4	0	0	4	4	40	60		100	3
4	Professional Core Courses	PCC-MTECE-107A	Data Networks and Communication Protocols	4	0	0	4	4	40	60		100	3
5	Professional Core Courses	PCC-MTECE-109A	Microprocessor and Embedded Systems	4	0	0	4	4	40	60		100	3
6	Lab Course	LC-MTECE-111A	Satellite Communication Lab	0	0	2	2	1	25		25	50	3
7	Lab Course	LC-MTECE-113A	Microprocessor and Embedded Systems Lab	0	0	2	2	1	25		25	50	3
8	Seminar	SM-MTECE-115A	Seminar-I	0	0	2	2	2	50			50	
Total Credits								**24**	**300**	**300**	**50**	**650**	

GANGA INSTITUTE OF TECHNOLOGY AND MANAGEMENT, KABLANA, JHAJJAR (HR.), DELHI-NCR

Scheme of Studies and Examination

M.Tech (Electronics & Communication Engineering) – 2nd Semester

***W.e.f.* 2025-26**

Sr. No.	Category	Course Code	Course Title	Lectures per week			Total Load Per Week	Credits	Examination Scheme (Marks)				Exam Duration in Hours
				Lecture (L)	Tutorial (T)	Practical (P)			Assessment	End Semester Examination		Total	
										Theory	Practical		
1	Professional CoreCourses	PCC-MTECE-102A	Optical Communication	4	0	0	4	4	40	60		100	3
2	Professional CoreCourses	PCC-MTECE-104A	VLSI Design and Semiconductor Technologies	4	0	0	4	4	40	60		100	3
3	Professional Elective Courses	Refer Annexure -I	Professional Elective Table -I	4	0	0	4	4	40	60		100	3
4	Multidisciplinary Open Elective Courses	Refer Annexure -I	MultidisciplinaryOpen Elective Table -II	3	0	0	3	3	40	60		100	3
5	Foundation Elective Courses	Refer Annexure -I	Foundation Elective Table -III	3	0	0	3	3	40	60		100	3
6	Lab Course	LC-MTECE-106A	VLSI Lab	0	0	2	2	1	25		25	50	3
7	Lab Course	LC-MTECE-108A	Optical Communication Lab	0	0	2	2	1	25		25	50	3
8	Seminar	SM-MTECE-110A	Seminar-II	0	0	2	2	2	50			50	
Total								**22**	**300**	**300**	**50**	**650**	

Annexure-I

Professional Elective Table-1

S. No	Course Code	Course Name
1	PEC-MTECE-112A	Electronic System Design
2	PEC-MTECE-114A	Image Processing
3	PEC-MTECE-116A	Advanced Mathematics for Engineers
4	PEC-MTECE-118A	Modern Wireless Networks & Technologies

Multidisciplinary Open Elective Table -II

Students of all M.Tech programmes are required to study one Multidisciplinary open elective course in each of the 2nd and 3rd Semesters and one foundation elective course in 2nd Semester for 2-Years Programmes. They may choose any one of the following courses (excluding the courses offered by the departments of their own subjects, if not stated otherwise).

Multidisciplinary Open Elective-I Courses

SN	Course Code	Course Name	Offered by Department
1	OEC-130A	Basic of Economics	Management Department
2	OEC-132A	Fundamentals of Management	Management Department
3	OEC-134A	Disaster Management	Civil Engineering
4	OEC-136A	Industrial Safety	Fire Technology and Safety
5	OEC-138A	Indian Literature in Translation-I	Applied Sc. & Humanities (English)
6	OEC-140A	Environmental Issues	Applied Sc. & Humanities (Chemistry)
7	OEC-142A	Quantitative Techniques	Applied Sc. & Humanities (Mathematics)
8	OEC-144A	Sources of Energy-I	Electrical Engineering
9	OEC-146A	Operation Research	Mechanical Engineering
10	OEC-148A	Multimedia Communication	Electronics and Communication Engineering
11	OEC-150A	Introduction to Information Technology	Computer Sc. & Applications
12	OEC-152A	Cyber Forensics and Security	Computer Sc. & Engineering
13	OEC-154A	Computer Science and Principles	Computer Sc. & Engineering
14	OEC-156A	Software Engineering Practice	Computer Sc. & Engineering

Foundation Elective Table –III

SN	Course Code	Course Name	Offered by Department
1	FEC-158A	Basics of Accounting	Management Department
2	FEC-160A	Basics of E-commerce	Management Department
3	FEC-162A	Elements of Banking	Management Department
4	FEC-164A	Computer Fundamentals	Computer Science and Engineering
5	FEC-166A	Communication and Soft Skills	Applied Science and Humanities (English)
6	FEC-168A	Entrepreneurship Development	Management Department
7	FEC-170A	Electronics Engineering	Electronics and Communication Engineering

Course Code	**PCC-MTECE-101A**				
Category	Professional Core Course				
Course Title	**Satellite Communication and Space Technology**				
Scheme and Credits	L	T	P	**Credits**	**Semester-I**
	4	0	0	4	
Course Objectives	The objectives of this course are to ● Learn about the history, advantages and applications of satellite communication systems. ● Study the effects of environmental factors on satellite signal propagation. ● Explore orbital mechanics and satellite launching processes. ● Gain insights into the design of satellite communication links. ● Understand modulation, detection techniques of satellite systems.				
Assessment	40 Marks				
End Semester Examination	60 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Course Outcomes: After successful completion of this course, the students will be able to

COs	Skills Demonstrated
CO1	Define fundamental concepts and operational terminologies of satellite communication systems.
CO2	Explain launch mechanisms, Earth station parameters, subsystems, link design equations and environmental effects influencing signal propagation and satellite performance.
CO3	Apply Kepler's laws, orbital determination techniques, modulation methods, detection techniques, and error rate performance to optimize satellite communication systems.
CO4	Analyze synchronization techniques, multiple access methods, security protocols and their effects on satellite communication performance.

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 8 parts of 1.5 marks each from all units and remaining eight questions of 12 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit No.	Contents
Unit-I	**Introduction:** Origin, brief history & elements of communication satellites, Satellite frequency allocation & band spectrum, Satellite orbits, types, advantages and applications of satellite communication, Concept of download and uplink frequency in satellite communication, Space debris and collision avoidance, Current status of satellite communication.
Unit-II	**Orbital Mechanism and Satellite Launching :** Kepler`s laws, LEO, MEO, GEO and HEO satellites and their characteristics, Look angle, Azimuth angle, Elevation angle, Orbital determination, Orbital perturbations and station keeping, Mechanism of launching a Satellite, Overview of current and reusable launch vehicles. **Satellite Link Design:** General link design equation, Complete link design, FM improvement factor, Interference effects on complete link design, Earth Station parameters, Delay Transponders, Eclipse effects.

Unit-III	**Propagation Effects:** Introduction, Atmospheric absorption, Rainfall Attenuation, Ionospheric scintillation, Eliminating propagation effects, ITU-R propagation models. **Satellite Subsystems:** Telemetry, tracking and command system, Transponder communication link, Antenna subsystems, frequency reuse antennas.
Unit-IV	**Multiple Access Techniques:** Introduction and comparison of FDMA, TDMA, CDMA, SDMA, Advantages and disadvantages of TDMA and FDMA, Hybrid systems. **Global positioning Satellite Systems:** GPS Development, Technical Structure Applications, The Trilateration method, GPS codes, GPS receiver Error correction, Applications of GPS technology. **Satellite Security and Encryption:** Overview to Cyber Security threats in satellite systems, Encryption techniques, Authentication, Early warning satellites, Reconnaissance satellites.

Suggested Readings:

- Satellite Communications by Dennis Roddy, TMH
- Satellite Communication by D.C. Aggarwal, Khanna Publishers
- Satellite Communication by T. Pratt and C.W. Boston, John Willey and sons
- Satellite Communication by Monojit Mitra, PHI
- Fundamentals of satellite Communication by K.N.Raja Rao, PHI
- Satellite Communications by Sapna Katiyar , Katson Books
- Satellite Communications Systems Engineering by Louis J. Ippolito, Wiley

Useful Video Links:

Unit No.	Topics	Links
Unit-I	Space Debris and Collision Avoidance	https://www.youtube.com/watch?v=OlZfC_6b-dY
	Active & Passive satellite. Applications of satellite communication	https://www.youtube.com/watch?v=Xf7AqkTiZf4
Unit-II	Overview of launch vehicle technologies	https://www.youtube.com/watch?v=SMX4-rIlIak
	Satellite and Orbits, Types of Orbits	https://www.youtube.com/watch?v=GGncz-DKkeU
	Propagation Effects in Satellite Communication	https://www.youtube.com/watch?v=-ltobgKDdWU
Unit-III	Rain Attenuation	https://youtu.be/ulCRyxC5H3o
Unit-IV	Satellite Cyber security and Encryption	https://www.youtube.com/watch?v=AltCfizF_4w
	Multiple Access Techniques (FDMA, TDMA, CDMA)	https://www.youtube.com/watch?v=HFNbkmub6MQ

Course Code	**PCC-MTECE-103A**				
Category	Professional Core Course				
Course Title	**Information Theory and Coding Techniques**				
Scheme and Credits	L	T	P	**Credits**	**Semester-I**
	4	0	0	4	
Course Objectives	The objectives of this course are to ● Understand key concepts in information theory, like informationand redundancy. ● Explore methods to detect and correct errors in data. ● Study linear block codes and their use for error correction. ● Compare the effectiveness of different coding methods for errorcorrection.				
Assessment	40 Marks				
End Semester Examination	60 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Course Outcomes: After successful completion of this course, the students will be able to

COs	Skills Demonstrated
CO1	Define the fundamental concept of information, entropy, mutual and joint information for efficient encoding schemes used in communication system.
CO2	Understand and apply the principle of various channel encoding/decoding schemes used in communication system.
CO3	Apply various error detection and correction techniques used in communication system like linear block code, cyclic code & hamming code etc.
CO4	Analyze the various parameters and coding schemes to maximize the efficiency rate of communication system.

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 8 parts of 1.5 marks each from all units and remaining eight questions of 12 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit No.	Contents
Unit-I	**Information Theory:** Concept of Information and Entropy, Shannon's theorems, Channel Capacity Self information, Discrete and Continuous entropy, Mutual and joint information, Redundancy.
Unit-II	**Coding Theory:** Source encoding & channel encoding, Error detection & Correction, Various codes for channel coding, Rate Distortion functions. Linear block codes, systematic linear codes & optimum coding for Binary symmetric channel. Systematic Cyclic Codes, Non-systematical Cyclic Codes.
Unit-III	**Information Theory Codes:** The Generator & parity check matrices, Syndrome decoding & Symmetric channels. Hamming codes, Weight enumerator, Perfect codes, BCH codes, Idempotent & Mattson Solomon polynomials, Reed Solomon codes, Justeen codes, MDS codes & generalized BCH codes, Convolution codes & Viterbi decoding algorithm.
Unit-IV	**Performance of codes:** Performance comparison for coded and uncoded system, Performance of linear block codes & convolution code, code incurable error probability Upper & lower bounds. Interleaving of coded data for channels with burst errors.

Suggested Readings:

- Digital Modulation and Coding by Wilson, Pearson
- Communication System by B.P. Lathi, Oxford
- Information Theory, Coding & Cryptography by Ranjan Bose, TMH
- Principles of Digitals Communication by J. Dass. , S.K. Malik & P.K. Chatterjee
- Information Theory and Coding by Nitin Mittal, Bharat
- Information Theory and Coding by Murlidhar Kulkarni, K.S. Shivaprakasha, Wiley

Useful Video Links:

Unit No.	Topics	Links
Unit-I	Huffman Coding	https://www.youtube.com/watch?v=uDS8AkTAcIU
Unit-II	Introduction to Rate Distortion Theory	https://youtu.be/qmCTnAoMSc8
Unit-III	Convolution Codes	https://youtu.be/9JTXHsZVutM
Unit-IV	Block Code & Amp; its Properties	https://youtu.be/5d9O530dUKQ

Course Code	**PCC-MTECE-105A**				
Category	Professional Core Course				
Course Title	**Advanced Digital Signal Processing and Systems**				
Scheme and Credits	L	T	P	**Credits**	**Semester-I**
	4	0	0	4	
Course Objectives	The objectives of this course are to ● Learn discrete Fourier transform, properties of DFT and its applications to linear filtering. ● Understand the characteristics of digital filters, design digital FIR filters and apply these filters to filter undesirable signals in various frequency bands. ● Design digital IIR filters and apply these filters to filter undesirable signals in various frequency bands. ● Understand the effects of finite precision representation on digital filters.				
Assessment	40 Marks				
End Semester Examination	60 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Course Outcomes: After successful completion of this course, the students will be able to

COs	Skills Demonstrated
CO1	Define the fundamental concepts, properties and principles of discrete time signals and systems.
CO2	Explain the classifications, characteristics and applications of Fourier, Z-transforms and digital filters to design digital systems for signal processing.
CO3	Apply discrete signal processing techniques for digital filter design and system implementations.
CO4	Analyze the realization, effects and methods for designing digital filters in digital signal processing systems.

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 8 parts of 1.5 marks each from all units and remaining eight questions of 12 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit No.	Contents
Unit-I	**Introduction of DSP:** Introduction to Signal Processing, Discrete Linear Systems, superposition Principle, Unit-Sample response, stability & causality Criterion. **Fourier Transform & inverse Fourier transform:** Frequency domain design of digital filters, Fourier transform, use of Fourier transform in Signal processing. The inverse Fourier transform, Sampling continuous function to generate a sequence, Reconstruction of continuous -time signals from Discrete-time sequences.
Unit-II	**DFT & FFT & Z transform with Applications:** Discrete Fourier transform, properties of DFT, Circular Convolution, Fast Fourier Transform, and Realizations of DFT. The Z-transform, the system function of a digital filter, Digital Filter implementation from the system function, the inverse Z- transform, properties & applications, Special computation of finite sequences, sequence of infinite length & continuous time signals, computation of fourier series & time sequences from spectra.

Unit-III	**Digital Filter Structure & Implementation:** Linearity, time- invariance & causality, the discrete convolution, the transfer function, stability tests, steady state response, Amplitude & Phase characteristics, stabilization procedure, Ideal LP Filter, Physical reliability & specifications. FIR Filters, Truncation windowing & Delays, design example, IIR Filters: Review of design of analog filters & analog frequency transformation. Digital frequency transformation. Design of LP filters using impulse invariance method, Bilinear transformation, Phase equalizer, digital all pass filters.
Unit-IV	**Implementation of Filters:** Realization block diagrams, Cascade & parallel realization, effect of infinite-word length, transfer function of degree 1&2, Sensitivity comparisons, effects of finite precision arithmetic on Digital filters.

Suggested Readings:

- Digital Signal Processing by Alam V. Oppenheim & Ronald W. Schafer, PHI
- Digital Signal Processing by JG Proakis, (PHI) 3rd Edition
- Communication System by B.P. Lathi, Oxford
- Theory & application of digital Signal Processing by Rabiner & Gold, PHI
- Introduction to Digital Signal Processing by Roman kuc, McGraw Hill Edition

Useful Video Links:

Unit No.	Topics	Links
Unit-I	Basics of DSP	https://youtu.be/4hVWXQEVYSA?si=B-MsPfL1cjndXsO_
Unit-II	Fourier Transform	https://youtu.be/l2I2hys8uGQ?si=noWoflLMPtI4Fl3q
	Fast Fourier Trans form	https://youtube.com/playlist?list=PL4K9r9dYCOoqmykdiyCq2jyAb0zwO0p-b&si=4ZF8MysP1h5rBUKs
Unit-III	Z-Transform	https://youtu.be/RlJi-83X9BE?si=61F8TehDlP0s0xSu
Unit-IV	FIR and IIR Filter	https://youtu.be/lvgCyZefR1Y?si=mVqWV4RwexTS2or8

Course Code	**PCC-MTECE-107A**				
Category	Professional Core Course				
Course Title	**Data Networks and Communication Protocols**				
Scheme and Credits	L	T	P	**Credits**	**Semester-I**
	4	0	0	4	
Course Objectives	The objectives of this course are to ● Introduce the fundamentals of data communication networks. ● Understand the functions of various topologies and switching techniques. ● Understand the functions of various protocols of the Data link layer. ● Examine various layer Protocols of OSI & TCP/IP models.				
Assessment	40 Marks				
End Semester Examination	60 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Course Outcomes: After successful completion of this course, the students will be able to

COs	Skills Demonstrated
CO1	Define the fundamental concepts of analog and digital transmission of data communication network.
CO2	Describe various switching techniques and topologies of data communication network.
CO3	Apply various detection and correction techniques used in data communication network.
CO4	Analyze various communication architectures and their protocols in data communication network.

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 8 parts of 1.5 marks each from all units and remaining eight questions of 12 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit No.	Contents
Unit-I	**Introduction to Data Transmission:** Overview of Data Communication and networking, Analog And Digital Data Transmission, Transmission Impairments, Various Transmission Media, Data Encoding. **Digital Data Communication Techniques**: Asynchronous And Synchronous Transmission, Error Detection and correction techniques, Physical interfaces.
Unit-II	**Data Link Control:** Link Configurations, Protocol principles (Error control, Flow control), Bit Oriented and character oriented protocol, Data link layer services, Link Control. **Multiplexing and access techniques:** F.D.M. Synchronous TDM, Statistical TDM, FDMA, TDMA, CDMA, SDMA and their comparison .
Unit-III	**Communication Networking Techniques:** Communication Networks, Circuit Switching, Message Switching, Packet Switching, Local Networking Technology, The bus / tree topology, the ring topology, Medium Access control protocols (CSMA/CD, Token ring, FDDI, DQDB).

Unit-IV	**Computer Communication Architecture:** OSI and TCP/IP Model, Protocol And Architecture, Networking Access protocols, Inter Networking, Transport layer Protocols, Session Service And Protocols, and Presentation/ Application protocols **ISDN Networks**: Concepts & Architecture, Protocols.

Suggested Readings:

- Data and Computer Communication by William Stallings, PHI
- Data communications and networking by Forouzan, TMH
- Computer Networking by Andrew Tanenbaum, PHI
- Data communications and network by Godbole, TMH
- Data Communication and networks by Dr. Sanjay Sharma, Katson
- Introduction to data communications and networking by Wayne Tomasi, Pearson

Useful Video Links:

Unit No.	Topics	Links
Unit-I	Communication Networks–An Introduction and Overview	https://www.youtube.com/watch?v=VwN91x5i25g&list=PLBlnK6fEyqRgneraVKkEXrwyLVx2vJUvt
Unit-II	Multiplexing	https://www.youtube.com/watch?v=L5jJIN8Z4lo
Unit-III	Switching Techniques Circuit Switching	https://www.youtube.com/watch?v=yZV3y-usK_g
Unit-IV	ISDN Networks	https://www.youtube.com/watch?v=CGXkmyRLSLk

Course Code	**PCC-MTECE-109A**				
Category	Professional Core Course				
Course Title	**Microprocessor and Embedded Systems**				
Scheme and Credits	L	T	P	**Credits**	**Semester-I**
	4	0	0	4	
Course Objectives	The objectives of this course are to ● Understand microprocessor architecture, registers, ALU, and memory addressing techniques. ● Explore microprocessor instruction sets, addressing modes, and I/O communication protocols. ● Learn 8051 microcontroller architecture, programming, and interrupt handling. ● Study Intel x86 and Motorola 68XXX families, including instruction sets and hardware features. ● Develop microprocessor-based systems, focusing on design, testing, and regulatory compliance.				
Assessment	40 Marks				
End Semester Examination	60 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Course Outcomes: After successful completion of this course, the students will be able to

COs	Skills Demonstrated
CO1	Define the basic concepts of microprocessors, microcontrollers and different peripheral chips.
CO2	Describe the features, commands and architecture design of different microprocessors and microcontrollers.
CO3	Applying interfacing between microprocessors/microcontrollers and peripheral chips.
CO4	Differentiate architecture, pin configuration and working operations of different microprocessors and microcontrollers.

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 8 parts of 1.5 marks each from all units and remaining eight questions of 12 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit No.	Contents
Unit-I	**Design of basic microprocessor architectural Concepts:** Microprocessor architecture of 8086, Pentium series, word Lengths, addressable memory, Microprocessor's speed architectural characteristics, registers, instructions **Microprocessor Instructions & Communication:** Instruction Set, Mnemonics, Basic Instruction Types, Addressing modes, Microprocessor I/O devices, Polling and Interrupts.
Unit-II	**Microcontroller:** Introduction to 8051 architecture and programming model, Internal RAM and registers, I/O ports, Interrupt system & Instruction sets, ARM controller, Sleep mode of low power 8051 microcontroller.

Unit-III	**Advanced microprocessors:** Intel X86 family of advanced Microprocessor, programming model for XX86 family. Motorola 68 XXX family of microprocessor, 68 XXX addressing modes, instruction set, multi-core processor.
Unit-IV	**Microprocessor I/O:** Data Communication, parallel I/O serial communication, Serial interface and UART modems, I/O devices, D/A, A/D interface, special I/O devices, viz timers and sensors **Developing Microprocessor Based Products:** Introduction to the Design Process, Preparing the specifications, Developing a design, Implementing and Testing and design, Regulatory Compliance Testing, design tool for Microprocessor Development.

Suggested Readings:

- Microprocessors Principals and Application by C.M. Gilmore, MGH
- Embedded System, Architecture & Programming by Rajkamal, TMH
- Inter Series of microprocessors by Berry B. Berry, PHI
- Microprocessor & Interfacing by D. V. Hall, TMH
- Microprocessor Based System Design by Peatman, Pearson
- Fundamentals of Microprocessor and Microcontroller by B. Ram, Dhanpat Rai Publications

Useful Video Links:

Unit No.	Topics	Links
Unit-I	Microprocessor and Microcontroller in Computer system	https://www.youtube.com/watch?v=SBh6dJMM6AI&list=PLxCzCOWd7aiHL7mF_dRsj4Q9x1NNaZqkh
Unit-II	8086 Basics of Buses & Memory	https://youtu.be/RFDZbZWPMvg
Unit-III	Addressing Modes	https://www.youtube.com/watch?v=Bu8CZSI-1zc
Unit-IV	D/A, A/D Interface	https://www.youtube.com/watch?v=bkQVpZoRw9g

Course Code	**LC-MTECE-111A**					
Category	Lab Course					
Course Title	**Satellite Communication Lab**					
Scheme and Credits	L	T	P	**Credits**	**Semester-I**	
	0	0	2	1		
Course Objectives	The objectives of this course are to ● Understand transmission and reception processes in satellite communication systems. ● Identify various components, their working, applications and setups of satellite communication links. ● Understand various parameters and assess the effect on link quality in satellite communication. ● Study propagation delay, GPS data analysis and radiation patterns for effective satellite communication design.					
Assessment	25 Marks					
End Semester Examination	25 Marks					
Total	50 Marks					
Duration of Exam	03 Hours					

Course Outcomes: After successful completion of this course, the students will be able to

COs	Skills Demonstrated
CO1	Show the process of transmitting/receiving the signals in a satellite communication link.
CO2	Explain the working of satellite transmitter, receiver and transponder for setting up the satellite communication link.
CO3	Calculate carrier to noise ratio, signal to noise ratio and radiation pattern of parabolic reflector.
CO4	Analyze and measure the propagation delay of signals in satellite communication link.

List of Experiments

Sr. No.	Contents
1	To study the process of signal transmission and reception in satellite communication systems.
2	To analyze and observe baseband signal characteristics in a satellite communication link.
3	To calculate and evaluate the Signal-to-Noise (S/N) ratio in a satellite link.
4	To establish and test a digital satellite communication link.
5	To plot and analyze the radiation pattern of a parabolic reflector antenna.
6	To study the working and design aspects of satellite communication receivers.
7	To set up a PC-to-PC satellite communication link and evaluate its performance.
8	To measure and analyze the propagation delay of signals in a satellite communication link.
9	To transmit and receive function generator waveforms through a satellite link and analyze the signal integrity.
10	To configure and study the characteristics of an active satellite communication link and compare it with a passive link.
11	To interface with a GPS receiver and analyze data such as longitude, latitude, and various dilution of precision (DOP) parameters.
12	To study data modulation techniques and generate Pseudo-Noise (PN) sequences for spread spectrum applications.

Note: At least 10 experiments are to be performed by the students. Faculty member can add 2-3 extra experiment under topic beyond syllabus.

Useful Video Links:

Exp No.	Topics	Links
1	To study uplink transmitter, downlink receiver and transponder	https://www.youtube.com/watch?v=sWYJcoV4mlY
2	To Estimate S/N Ratio	https://www.youtube.com/watch?v=_DBFZxLV9fM
3	To Study GPS Data like Latitude, Longitude & Types of Dilution of Precision using GPS Receiver	https://www.youtube.com/watch?v=xaU-43WHLPU

Course Code	**LC-MTECE-113A**					
Category	Lab Course					
Course Title	**Microprocessor and Embedded Systems Lab**					
Scheme and Credits	L	T	P	**Credits**	**Semester-I**	
	0	0	2	1		
Course Objectives	The objectives of this course are to ● Learn assembly programming for number conversion, input/output operations using 8086 microprocessor. ● Develop microcontroller programming skills to generate frequencies and interface displays using ALP. ● Write assembly programs for basic arithmetic, string manipulation, and number checks in ALP. ● Interface microcontrollers with displays and implement frequency generation and communication protocols.					
Assessment	25 Marks					
End Semester Examination	25 Marks					
Total	50 Marks					
Duration of Exam	03 Hours					

Course Outcomes: After successful completion of this course, the students will be able to

COs	**Skills Demonstrated**
CO1	Define the programming concepts of 8086 and 8051.
CO2	Interpret the 8086 and 8051 instruction set for developing the program.
CO3	Apply various interfacing peripheral chips used with microprocessors.
CO4	Analyze and compare the programme output carried out by different microprocessors and microcontrollers.

List of Experiments

Sr. No.	**Contents**
1	a) To study and understand internal architecture of 8086 through the development kit. b) To write and run an 8086 assembly language program that calculates the base-2 logarithm ($\log_2$) of a positive integer.
2	Write an ALP to convert a hexadecimal No. to decimal No. in single step execution using MASM (Microsoft Macro Assembler) Software.
3	Write an ALP to enter a word from keyboard and to display using MASM Software.
4	Write an ALP for addition of two one digit Numbers using MASM Software.
5	Write an ALP to display a string on screen using MASM Software.
6	Write an ALP reverse a string using MASM Software.
7	To study and understand the 8051 Microcontroller Kit.
8	Write an Assembly Language Program (ALP) using Keil µVision software for the 8051 microcontroller to generate a 10 KHz square wave.
9	Write an ALP using Keil µVision software for the 8051 microcontroller to generate 10 KHz and 100 KHz square waves using Timer Interrupts.
10	Write an ALP using Keil µVision software for the 8051 microcontroller to interface intelligent LCD display.
11	Write an ALP using Keil µVision software for the 8051 microcontroller to interface intelligent LED display.

12	Write an ALP using Keil µVision software for the 8051 microcontroller to check whether the No. is Palindrome.

Note: At least 10 experiments are to be performed by the students. Faculty member can add 2-3 extra experiment under topic beyond syllabus.

Useful Video Links:

Exp. No.	Topics	Links
1	To study the architecture of 8086 Kit.	https://www.youtube.com/watch?v=GZibA34SU0c
2	Write an ALP to convert a hexadecimal No. to decimal No. in single step execution.	https://www.youtube.com/watch?v=Y0Si2lYHuiE
3	To study the 8051 Microcontroller Kit.	https://www.youtube.com/watch?v=4zIabWC5lpQ
4	Write an ALP to generate 10 KHz & 100KHz frequency using interrupt.	https://www.youtube.com/watch?v=7uXxEQ_Noys
5	Write an ALP to interface intelligent LCD display.	https://www.youtube.com/watch?v=vB-43ITmRsA
6	Write an ALP to check whether the No. is Palindrome.	https://www.youtube.com/watch?v=LJfQxc56_pI

Course Code	**SM-MTECE-115A**				
Category	Lab Course				
Course Title	**Seminar-I**				
Scheme and Credits	L	T	P	**Credits**	**Semester-I**
	0	0	2	2	
Course Objectives	The objectives of this course are to ● Develop students' ability to effectively present research topics and findings by effective communication. ● Improve problem-solving and critical thinking skills of the students. ● Expose students to the latest trends and advancements by reviewing and discussing contemporary research.				
Assessment	50 Marks				
End Semester Examination	-				
Total	50 Marks				
Duration of Exam	03 Hours				

Course Outcomes: After successful completion of this course, the students will be able to

COs	Skills Demonstrated
CO1	Identify the trends and advancements in the related field.
CO2	Analyze and synthesize research literature with in-depth reviews of key studies and methodologies.
CO3	Undertake problem identification, formulation, proposing solution and analyze the impact onsociety, economy and environment.
CO4	Prepare a well-organized report employing elements of effective communication and criticalthinking.
CO5	Demonstrate a sound technical knowledge of their research field.

Overview:

This course helps M. Tech students improve their research presentation skills. It focuses on choosing a topic or research paper related to their field, reviewing it thoroughly and presenting the findings clearly and effectively.

General Guidelines:

Topic Selection	Each student is required to choose the research topic based on published review paper(s) or literature related to their relevant field. The same topic cannot be selected by multiple students.
Approval Process	The selected paper or topic must be approved by the faculty members / committee appointed by the Head of Department.
Presentation Guidelines	Each student will have 30-40 minutes for their presentation, followed by 5minutes for Q&A.
Evaluation	The presentation will be evaluated by a committee constituted by the Head of Department. The evaluation will be based on:

Parameters for the Evaluation of Seminar

Sr. No.	Parameters	Marks Allotted	Relevant COs
1	Clarity of the topic	10	**CO1**
2	Literature Survey	10	**CO2**
3	Content Relevancy	10	**CO3**
4	Presentation Skills	10	**CO4**
5	Q&A Response	10	**CO5**

Course Code	**PCC-MTECE-102A**				
Category	Professional Core Course				
Course Title	**Optical Communication**				
Scheme and Credits	L	T	P	**Credits**	**Semester-II**
	4	0	0	4	
Course Objectives	The objectives of this course are to • Understand core principles of optical fiber communication. • Learn about optical sources and detectors. • Analyze optical communication system design. • Explore advanced coherent systems and detection methods				
Assessment	40 Marks				
End Semester Examination	60 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Course Outcomes: After successful completion of this course, the students will be able to

COs	**Skills Demonstrated**
CO1	Define the fundamental concepts of optical communication systems.
CO2	Describe modes of optical fibre such as mono and multi-mode and fibre characteristics like scattering, dispersion and bending.
CO3	Demonstrate different light sources and photodiodes used in mobile communication.
CO4	Analyze various parameters of optical fibres such as attenuation, absorption, noise and bandwidth etc.

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 8 parts of 1.5 marks each from all units and remaining eight questions of 12 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit No.	**Contents**
Unit-I	**Introduction**: Elements, Advantages and Applications of optical fiber communication, elements of the fiber communication link, ray theory and electromagnetic mode theories for optical propagation, step-index and graded-index fibers and numerical aperture. **Optical fibers, Losses & Dispersion:** Attenuation, absorption, linear and nonlinear scattering losses, overall fiber dispersion losses, polarization, fiber bending losses, multimode step-index and graded-index fibers, single-mode fibers, plastic-clad and all-plastic fibers, optical fiber cables, dispersion- shifted and dispersion-flattened fibers.

Unit-II	**Optical Sources**: Introduction, LED for optical communication, Burrus-type double-heterostructure, surface-emitting LEDs, shaped-geometry, edge- emitting LEDs, LED-to-fiber launch systems, Semiconductor lasers: theory, modulation and characteristics, Fabry-Perot lasers, quantum-well lasers, and distributed-feedback lasers. **Photo Detectors**: PIN photodiodes: Theory and characteristics of PIN photodiodes, Avalanche photodiode detectors: Theory, bandwidth, and noise.
Unit-III	**Optical fiber communication System**: Optical transmitter circuit: LED and laser drive circuits, optical receiver circuit, structure, pre-amplifier, AGC, equalization, optical power budgeting, line loading, Analog systems: Analog modulation, direct modulation, subcarrier modulation, distribution system, optical TDM subcarrier multiplexing, WDM.
Unit-IV	**Coherent Systems**: Coherent receiver and their noises, homodyne and heterodyne detection techniques, polarization control, Homodyne receiver: Reusability and laser linewidth, Heterodyne receiver: Synchronous, asynchronous, and self-synchronous demodulation, phase diversity receivers.

Suggested Readings:

- Optical Fiber Communication by Gerd Keiser, TMH.
- Optical Communication by JH Franz & Jain VK, Narosa Publications.
- Optical Communication by John M. Senior, PHI.
- Optical Communications by Martin Sibley, Springer
- Optical Communication System by Satinder Bal Gupta, Ashish Goel, University Science Press
- Optical Communication System by Sapna Katiyar, S.K. Kataria and Sons

Useful Video Links:

Unit No	Topics	Links
Unit-I	Semiconductor Photo-Diodes Fiber Optic Communication Technology	https://www.youtube.com/watch?v=ougKUUM3hJA&list=PLHj96QRJ0kOhH8xoXXrOgkMf9ZOvjhqYl
Unit-II	P-N & PIN Photo detectors	https://www.youtube.com/watch?v=H5VSrybJ6XU
Unit-III	Semiconductor Photo-Diodes	https://www.youtube.com/watch?v=S9jMMALKKKs
Unit-IV	Effect of Modulation Techniques on Power Budgeting in Optical Fiber System	https://www.youtube.com/watch?v=G5i62xsSiB0

Course Code	**PCC-MTECE-104A**				
Category	Professional Core Course				
Course Title	**VLSI Design and Semiconductor Technologies**				
Scheme and Credits	L	T	P	**Credits**	**Semester-II**
	4	0	0	4	
Course Objectives	The objectives of this course are to • Learn the use of semiconductor materials for chip fabrication. • Understand MOSFETs and CMOS circuits work with their handle speed and power. • Design basic and advanced digital logic circuits using CMOS technology. • Draw circuit layouts with estimate chip area and memory design.				
Assessment	40 Marks				
End Semester Examination	60 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Course Outcomes: After successful completion of this course, the students will be able to

COs	Skills Demonstrated
CO1	Define semiconductor crystal structures, defects, and wafer fabrication processes, cleaning and doping methods.
CO2	Analyze the behavior of MOSFETs and CMOS inverters, including static and dynamic characteristics, second-order effects and delay performance.
CO3	Apply sequential elements for evaluate static and dynamic CMOS logic circuits timing and power constraints in pipelined structures.
CO4	Demonstrate the ability to design physical layouts for CMOS circuits using stick diagrams with estimate area and parasitic effects for optimization.

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 8 parts of 1.5 marks each from all units and remaining eight questions of 12 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit No.	Contents
Unit-I	**Semiconductor substrate:** Crystal structure, Crystal defects, Crystal growth, Wafer fabrication and basic properties of Silicon Wafers, Wafer cleaning, and native oxide removal, Substrates beyond Silicon, Surface reactions, Dopants, Defects in epitaxial growth, Clean Room, and Safety requirements. Diffusion, Thermal Oxidation, Ion implantation, Etching, Fabrication process (NMOS, PMOS, well process, SOI)
Unit-II	**MOS Inverters:** Structure and Operation of MOS Transistor (MOSFET), MOSFET Current-Voltage Characteristics, Second order effects, Scaling of MOS circuits and Small-Geometry Effect, MOS device models, MOS Capacitances, NMOS Inverter, CMOS Inverter-Static and switching characteristics, Delay-Time Definitions, Calculation of Delay Times, Inverter Design with Delay Constraints Estimation of Interconnect Parasitics, Power Consumption in CMOS Gates, Latch-upin CMOS circuits.
Unit-III	**Combinational & Sequential Logic Circuit Design:** Static CMOS design- ratioed logic, pass transistor logic, transmission gate logic, Transistor sizing in static CMOS, Dynamic CMOS Design, Static Latches and Registers, Dynamic Latches and Registers, Alternative Register Styles, Non bistable Sequential Circuits, Logic Style for Pipelined Structures.

Unit-IV	**Layout and stick diagram:** Layout Design Rules: Lambda and micron based design rules- stick diagram, Layer properties of various conducting layers in MOS and CMOS technology (diffusion, poly-silicon and metal), Layout design of different CMOS circuit, area estimation. **CMOS Subsystem Design:** Semiconductor memories, memory chip organization, RAM Cells, dynamic memory cell.

Suggested Readings:

- Basic VLSI Design System & Circuits by Pucknell D. A. and Eshrachain K, PHI.
- VLSI Design Techniques for Analog and Digital Circuit by Geiger, Rr, Allen P. E. Strader N. R.,MGH.
- VLSI Technology by S.M.Sze, MGH.
- Modern VLSI Design by Wolf, Pearson SZE, "VLSI Technology", TMH
- Digital VLSI Design With Verilog by John Williams, Springer
- VLSI Design by A Shanthi, A Kavitha, New Age
- Principles of CMOS VLSI Design by Neil H. E. Weste, Kamran Eshraghian, Pearson

Useful Video Links:

Unit No	Topics	Links
Unit-I	Crystal Structure of Si	https://www.youtube.com/watch?v=8zWySdeXB0M&list=PL018645397D9487AF&index=4 https://www.youtube.com/watch?v=Op1gEGWHecU&list=PL018645397D9487AF&index=5
	Defects in Crystal + Crystal growth	https://www.youtube.com/watch?v=db5nZCipJh8&list=PL018645397D9487AF&index=6
	MOSFET Fabrication for IC	https://www.youtube.com/watch?v=_gpEBYUnj6k&list=PL018645397D9487AF&index=3
Unit-II	MOS Transistor	https://www.youtube.com/watch?v=faiEVOOCe-s&list=PLLy_2iUCG87Bdulp9brz9AcvW_TnFCUmM&index=2
	CMOS Inverter	https://www.youtube.com/watch?v=ZwD1kNvzO_g&list=PLLy_2iUCG87Bdulp9brz9AcvW_TnFCUmM&index=6
Unit-III	Combinational Design	https://www.youtube.com/watch?v=m5rEKAqHyKo&list=PLLy_2iUCG87Bdulp9brz9AcvW_TnFCUmM&index=13
	Sequential Design	https://www.youtube.com/watch?v=RZo--xYfTR4&list=PLLy_2iUCG87Bdulp9brz9AcvW_TnFCUmM&index=26
Unit-IV	Stick Diagram	https://www.youtube.com/watch?v=9G-R_jy6wEU
	Concept of Memory and its Designing	https://www.youtube.com/watch?v=wayHEoHNbiE&list=PLLy_2iUCG87Bdulp9brz9AcvW_TnFCUmM&index=40

Course Code	**PEC-MTECE-112A**				
Category	Professional Elective Course				
Course Title	**Electronic System Design**				
Scheme and Credits	L	T	P	**Credits**	**Semester-II**
	4	0	0	4	
Course Objectives	The objectives of this course are to • Implement MSI/LSI circuits including arithmetic units, multiplexers and bus-oriented systems. • Design sequential circuits using flip-flops, counters, registers,and analyze clocking aspects. • Develop system controllers using ROM, PLA, PAL and understand CPLD/FPGA implementations. • Analyze asynchronous finite state machines considering races, hazards and MEV design approaches				
Assessment	40 Marks				
End Semester Examination	60 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Course Outcomes: After successful completion of this course, the students will be able to

COs	**Skills Demonstrated**
CO1	Define the fundamental components of MSI and LSI circuits, including arithmetic circuits, comparators, multiplexers, and bus-oriented structures.
CO2	Explain the working principles of sequential machines, including flip-flops, counters, shift registers, and state diagrams in synchronous circuits.
CO3	Apply the principles of system controller design to develop MSI decoders, ROM, PLA, PAL, CPLD, and FPGA-based systems.
CO4	Analyze asynchronous finite state machines, focusing on identifying and mitigating hazards, cycles, and races using excitation maps and MEV methods.

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 8 parts of 1.5 marks each from all units and remaining eight questions of 12 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit No.	**Contents**
Unit-I	**MSI and LSI Circuits And Their Applications:** Arithmetic Circuits, Comparators, Multiplexers, Code Converters, XOR And AND-OR Inverter Gates, Wired Logic, Bus Oriented Structures, Tri-State Bus System, Propagation Delay.
Unit-II	**Sequential Machines:** The Concept Of Memory, The Binary Cell, The Cell And The Bouncing Switch, Set / Reset, D, Clocked T, Clocked JK Flip Flop, Design Of Clock F/F, Conversion, Clocking Aspects, Clock Skew, State Diagram Synchronous Analysis Process, Design Steps For Traditional Synchronous Sequential Circuits, State Reduction, Design Steps For Next State Decoders, Design Of Out Put Decoders, Counters, Shift Registers and Memory.

Unit-III	**Multi Input System Controller Design:** System Controllers, Design Phases And System Documentation, Defining The System, Timing And Frequency Considerations, Functional, Position And Detailed Flow Diagram Development, MDS Diagram, Generation, Synchronizing Two System And Choosing Controller, Architecture, State Assignment, Next State Decoders And Its Maps, Output Decoders, Clock And Power Supply Requirements, MSI Decoders, Multiplexers In System Controllers, Indirect Addressed Multiplexers Configurations, Programmable System Controllers, ROM, PLA And PAL Based Design. Introduction to the CPLD & FPGA.
Unit-IV	**Asynchronous Finite State Machines:** Scope, Asynchronous Analysis, Design Of Asynchronous Machines, Cycle And Races, Plotting And Reading The Excitation Map, Hazards, Essential Hazards Map Entered Variable, MEV Approaches To Asynchronous Design, Hazards In Circuit Developed By MEV Method.

Suggested Readings:

- An Engineering Approach to Digital Design by Fletcher, PHI.
- Switching and Finite Automata Theory by Z. Kohavi, TMH.
- Digital Design by Mano, PHI.
- Verilog Digital System Design by Z Navabi, TMH
- Digital System Design with VHDL by Mark Z Wolinski, Pearson
- Digital System Design and Microprocessors by John P Hayes, TMH

Useful Video Links:

Unit No	Topics	Links
Unit-I	MSI and LSI Circuits And Their Applications	https://www.youtube.com/watch?v=XBcHnz08ZW8&list=PL803563859BF7ED8C&index=28
Unit-II	Sequential Machines	https://www.youtube.com/watch?v=MiuMYEn3dpg&list=PL803563859BF7ED8C&index=24
Unit-III	Multi Input System Controller Design	https://www.youtube.com/watch?v=XMGE_v323oA
Unit-IV	Asynchronous Finite State Machines	https://www.youtube.com/watch?v=FZAHhQ1v7B0&list=PL803563859BF7ED8C&index=23

Course Code	**PEC-MTECE-114A**				
Category	Professional Elective Course				
Course Title	**Image Processing**				
Scheme and Credits	L	T	P	**Credits**	**Semester-II**
	4	0	0	4	
Course Objectives	The objectives of this course are to • Study the fundamentals of digital image processing. • Explore image enhancement, restoration, and compression techniques using various methods. • Use Fourier and wavelet transforms in processing and analysis tasks. • Learn image segmentation, representation and Contents methods for pattern recognition and interpretation				
Assessment	40 Marks				
End Semester Examination	60 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Course Outcomes: After successful completion of this course, the students will be able to

COs	**Skills Demonstrated**
CO1	Define the fundamental concepts of digital image processing systems, including image acquisition, storage, processing, communication, and display.
CO2	Describe the principles of image transforms, enhancement techniques, and spatial and frequency domain methods to improve image quality and representation.
CO3	Apply restoration techniques, including Wiener filtering, constrained least square restoration, and image compression standards, to process degraded or redundant images.
CO4	Analyze various image segmentation methods, such as edge and boundary detection, threshold, and region-oriented segmentation, for effective representation and pattern recognition in images.

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 8 parts of 1.5 marks each from all units and remaining eight questions of 12 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit No.	**Contents**
Unit-I	**Introduction:** Elements of Digital Image Processing Systems, Image Acquisition, Storage, Processing Communication Display. **Digital Image Fundamentals**: Visual Perception, simple image models, concept of uniform and non uniform sampling & quantization, Relationships between pixels-neighbors of pixel, connectivity labeling of connected components. Relations, equivalence and Transitive closure, Distance measures, Arithmetic/ Logic operation, Imaging Geometry Basic and perspective transformation stereo imaging
Unit-II	**Image Transforms:** Discrete Fourier transform, 2-D Fourier Transforms and its properties. Fast Fourier transform and its uses. Walsh, Hadamard Discrete cosine, Heir and slant transforms hostelling their algorithms and computer implementations. **Image Enhancement**: Spatial and frequency domain methods point processing, intensity transformation, Histogram processing image substation and Averaging spatial filtering, LP, HP and homo- morphic felling, generation of spatial marks, Color image processing.

Unit-III	**Image Restoration**: Degradation model, digitalization of circulate and block circulate metrics, Algebraic approved invoice filtering, wiener filter, constrained least square restoration, Interactive restoration in spatial domain geometric transformation. **Image Compression**: Redundancy models, error free compression, Lossy compression, Image compression standards.
Unit-IV	**Image Segmentation**: Detection of Discontinuity, Edge detection, Boundary detection, Thresholding, Regional oriented segmentation use of motion in segmentation. **Representation and Contents**: Image analysis, Pattern and their classes, Decision theoretical methods, Structural methods, Interpretation.

Suggested Readings:

- Fundamentals of Digital Image Processing by Anil K Jain, PHI.
- Digital Image Processing by Rafael C. Gonzalez and Richard E. Woods, Pearson.
- Digital Image Processing & Analysis by Chanda & Majumder, PHI.
- Digital Image Processing by Wilhelm Burger, Mark James Burger, Springer
- Digital Image Processing by William K Pratt, Wiley
- Digital Image Processing by Madhuri A Joshi, PHI

Useful Video Links:

Unit No	Topics	Links
Unit-I	Digital Image Processing Systems	https://www.youtube.com/watch?v=DSGHkvQBMbs&list=PLuv3GM6-gsE08DuaC6pFUvFaDZ7EnWGX8
Unit-II	Digital image processing	https://www.youtube.com/watch?v=q0AnFKYl7sg&list=PLLDC70psjvq7765_splMFlBmM37NWnOj3
Unit-III	Image Restoration	https://www.youtube.com/watch?v=5qxrzD6ODHc
Unit-IV	Image Segmentation	https://www.youtube.com/watch?v=bYWa7AuzIUQ

Course Code	**PEC-MTECE-116A**				
Category	Professional Elective Course				
Course Title	**Advanced Mathematics for Engineers**				
Scheme and Credits	L	T	P	**Credits**	**Semester-II**
	4	0	0	4	
Course Objectives	The objectives of this course are to • Understand Fourier transform, their properties and applications in signal analysis and differential equations. • Learn Z-transform techniques, inverse evaluation, and properties for analyzing discrete-time systems and stability. • Solve linear systems using various methods. • Apply conformal mapping, variation calculus and optimization techniques engineering and mathematical modeling				
Assessment	40 Marks				
End Semester Examination	60 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Course Outcomes: After successful completion of this course, the students will be able to

COs	Skills Demonstrated
CO1	Define the fundamental concepts of Fourier and Z-Transforms, including their properties, theorems, and relationships with other transforms.
CO2	Understand and apply the methods for solving linear systems of equations, including Gaussian elimination, Crout's triangularization, and iterative approaches like Jacobi's and Gauss-Seidel methods.
CO3	Apply conformal mapping techniques and transformations, such as linear, bi-linear, and Schwarz-Christoffel transformations to solve problems in complex analysis.
CO4	Analyze problems in calculus of variations by deriving and solving Euler-Lagrange equations, and use advanced methods such as the Rayleigh-Ritz and Galerkin methods for practical applications.

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 8 parts of 1.5 marks each from all units and remaining eight questions of 12 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit No.	Contents
Unit-I	**Fourier Transforms**: Introduction, Fourier Integral Theorem, Fourier Sine and Cosine Integral, Complex form of Fourier Integrals, Fourier Transforms, Inverse Fourier Transform, Properties, Modulation Theorem, Convolution Theorem for Fourier Transforms, Parseval's Identity, Fourier Transforms of derivative of functions.
Unit-II	**Z –Transform:** Introduction, Properties of Z- Transform, Evaluation of inverse Z – Transform. **Laplace Transform:** Introduction, Properties of Laplace Transform, Relation between Fourier and Laplace transform.
Unit-III	**Matrices and Linear System of Equations:** Solution of linear simultaneous equations by Gaussian elimination and its modification, Crout's triangularization method, Iterative methods- Jacobins method, Gauss-Seidal method, Determination of Eigen values by iteration.

Unit-IV	**Conformal Mapping:** Conformal mapping, linear transformations, Bi- linear transformations, Schwarz's-Christoffel transformations. **Calculus Of Variations:** Euler-Lagrange's differential equation,The Brachistochrone problems and other applications. Isoperi-metric problem, Hamilton's Principle and Lagrange's Equation. Rayleigh-Ritz method, Galerkin method.

Suggested Readings:

- Higher Engineering Mathematics by Dr. B.S. Grewal, Khanna Publishers.
- Fourier Series and Boundary Values Problems by Churchill, McGraw Hill.
- Calculus of Variations by Galfand & Fomin, PHI.
- Complex Variables & Applications by Churchill, McGraw Hill.
- Calculus of Variations by Elsgole, Addison Wesley.

Useful Video Links:

Unit No	Topics	Links
Unit-I	Fourier Transform	https://www.youtube.com/watch?v=lkAvgVUvYvY
Unit-II	Properties of Z- Transform	https://www.youtube.com/watch?v=rGFrWzW0cjE
Unit-III	Solution of linear simultaneous equations by Gaussian elimination and its modification	https://www.youtube.com/watch?v=T4c1YCU3xr8
Unit-IV	Euler-Lagrange's differential equation	https://www.youtube.com/watch?v=aI4VvpiU5Fg

Course Code	**PEC-MTECE-118A**				
Category	Professional Elective Course				
Course Title	**Modern Wireless Networks & Technologies**				
Scheme and Credits	L	T	P	**Credits**	**Semester-II**
	4	0	0	4	
Course Objectives	The objectives of this course are to • Explain mobile radio systems, cellular concepts, and capacity strategies in wireless networks. • Describe mobile radio propagation models, signal fading, and diversity techniques. • Analyze spread spectrum and multiple access methods for mobile communication. • Evaluate wireless standards, protocols, and mobile data networking methods.				
Assessment	40 Marks				
End Semester Examination	60 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Course Outcomes: After successful completion of this course, the students will be able to

COs	Skills Demonstrated
CO1	Define various wireless mobile communication systems like Pager, cordless & telephone system.
CO2	Explain different models, standards and protocols used in wireless communication system.
CO3	Illustrate various multiple access techniques and handoffs mechanisms used in wireless communication system.
CO4	Analyze various parameters like interference, coverage, trunking & grade of services in wireless communication system.

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 8 parts of 1.5 marks each from all units and remaining eight questions of 12 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Unit No.	Contents
Unit-I	**Introduction to mobile radio systems:** Paging systems, cordless telephone system, Cellular telephone systems- Cellular concept, frequency reuse, channel assignment strategies, Interference and system capacity, trunking and grade of service, cell splitting, sectoring, microcell zone concept, HO strategies. Overview of 5G Network and Architecture.
Unit-II	**Mobile radio propagation:** Mechanism, free space path loss, log-distance path loss models, Okumara model, Hata model, PCS model, Wideband PCS microcell model, indoor propagation models, Jake's channel model, Multi path characteristics of radio waves, signal fading, Time dispersion, Doppler spread, coherence time LCR, fading statistics, diversity techniques.

Unit-III	**Introduction to spread spectrum communication, multiple access techniques used in mobile wireless communication:** FDMA/TDMA/CDMA, OFDMA, Cellular CDMA, packet radio protocols, CSMA, reservation protocols, capacity of cellular CDMA, soft HO.
Unit-IV	**Wireless systems and standards**: GSM standards, signaling and call control, mobility management, location tracing, wireless data networking, packet error modeling on fading channels, Performance analysis of link and transport layer protocols over wireless channels, mobile data networking (mobile IP), wireless data services, IS-95, GPRS.

Suggested Readings:

- Wireless Communications by Principles and practices by T. S. Rappaport, Edition - PHI 1996.
- Mobile Cellular Telecommunications, Analog and Digital Systems by William C. Y. Lee 2nd Edition, MGH-1995.
- Wireless Digital communications, Modulation and Spread Spectrum Applications by Kamilo Feher, PHI 2001.
- Mobile Communications by Jochen Schillar, Pearson Education 2009.
- Wireless Communications and Networking by William Stallings, Pearson
- Wireless Communications and Networking by Jon W. Mark, Weihua Zhuang, Pearson

Useful Video Links:

Unit No	Topics	Links
Unit-I	5G: Next Gen network	https://www.youtube.com/watch?v=mo1lNRKnayA
Unit-II	Diversity techniques	https://www.youtube.com/watch?v=zQBGYc3VzV4
Unit-III	FDMA/TDMA/CDMA, SDMA Techniques	https://www.youtube.com/watch?v=sArkTtUMDgg&t=15s
Unit-IV	GSM standards, mobility management, and location tracing	https://www.youtube.com/watch?v=MZTtY1Sz-O4

Course Code	**LC-MTECE-106A**				
Category	Lab Course				
Course Title	**VLSI Lab**				
Scheme and Credits	L	T	P	**Credits**	**Semester-II**
	0	0	2	1	
Course Objectives	The objectives of this course are to • Design CMOS Logic Circuits: Develop skills to design and simulate CMOS circuits like inverters, NAND, and NOR gates using SPICE. • Implement Complex Digital Circuits: Learn to create and simulate advanced circuits such as D-latches, half adders, and full adders using CMOS technology. • Master Layout Design: Gain hands-on experience in designing layouts for PMOS, NMOS, and CMOS gates in layout editors. • Optimize Circuit Performance: Analyze and enhance circuit performance for parameters like speed, power, and signal integrity through simulation.				
Assessment	25 Marks				
End Semester Practical Examination	25 Marks				
Total Marks	50				
Duration of Exam	3 hours				

Course Outcomes: After successful completion of this course, the students will be able to

COs	Skills Demonstrated
CO1	Examine the layout of various combinational and sequential circuits.
CO2	Demonstrate the half adder using NAND gate and full adder using half adder.
CO3	Apply the SPICE program for CMOS inverter, NAND and NOR gate.
CO4	Analyze the designing steps of the CMOS inverter with equal rise and fall time.

List of Experiments

Sr. No.	Contents
1	Write a spice programme for CMOS inverter .
2	Write a spice programme for CMOS NAND gate.
3	Write a spice programme for CMOS NOR gate.
4	Design a D-latch using NAND gates.

5	Design a half adder using NAND gates.
6	Design a full adder using half adder.
7	Design the layout for PMOS in layout editor.
8	Design the Layout for NMOS in layout editor.
9	Design the layout for CMOS inverter with equal rise and fall time in layout editor.
10	Design the layout for 2-Input NAND gate.
11	Design the layout for 2-Input NOR gate.
12	Design the layout for clocked S-R flip-flop.

Note: At least 10 experiments are to be performed by the students. Faculty member can add 2-3 extra experiment under topic beyond syllabus.

Useful Video Links

Exp No.	Topics	Links
1	Write a spice programme for CMOSinverter	https://www.youtube.com/watch?v=aeGXhmxSWRY
2	Design a D-latch using NAND gates.	https://www.youtube.com/watch?v=LPP7HScUvgk
3	Design a half adder using NAND gates.	https://www.youtube.com/watch?v=ABId0PQZBhc
4	Design the layout for PMOS in layout editor.	https://www.youtube.com/watch?v=oOblwp65WFA

Course Code	**LC-MTECE-108A**				
Category	Lab Course				
Course Title	**Optical Communication Lab**				
Scheme and Credits	L	T	P	**Credits**	**Semester-II**
	0	0	2	1	
Course Objectives	The objectives of this course are to • Understand the principles and working mechanisms of optical devices in fiber optic communication • Develop practical skills in setting up fiber optic communication links. • Analyze the performance characteristics of fiber optic components. • Explore modulation techniques in fiber optic systems.				
Assessment	25 Marks				
End Semester Practical Examination	25 Marks				
Total Marks	50				
Duration of Exam	3 hours				

Course Outcomes: After successful completion of this course, the students will be able to

COs	**Skills Demonstrated**
CO1	Identify various components used in optical communication system.
CO2	Describe the analog and digital communication links with the characteristics of light sources and photodiodes.
CO3	Show the modulation and demodulation techniques used in optical fibre communication system.
CO4	Analyze different parameters of optical fibre such as attenuation, bending and numerical aperture etc.

List of Experiments

Sr. No.	**Contents**
1	Study the working of optical devices.
2	Study of fiber-optic transmitter and detector.
3	Determination of numerical aperture of optical fiber.
4	Study of characteristics of LED.
5	Study of characteristics of LASER diode.
6	Setting a fiber-optic analog link.
7	Setting a fiber-optic digital link.
8	Study of modulation and demodulation of light source by direct amplitude modulation techniques.

9	Forming a PC-to-PC communication link using optical fiber and RS-232.
10	Setting up a fiber-optic voice link.
11	Study of modulation and demodulation of light source by PPM technique.
12	Study of modulation and demodulation of light source by PWM technique.
13	Study of propagation loss and sending loss in optical fiber.

Note: At least 10 experiments are to be performed by the students. Faculty members can add 2-3 extra experiment under topic beyond syllabus

Useful Video Links

Exp No.	Topics	Links
1	Study of optical devices.	https://www.youtube.com/watch?v=oOyMmARcVDM
2	Determination of numerical aperture of optical fiber	https://www.youtube.com/watch?v=D9op3IBtQLI
3	Study of characteristics of LED.	https://www.youtube.com/watch?v=1YewZMlQ6zo
4	Setting a fiber optic analog link.	https://www.youtube.com/watch?v=dhcOFSB7ex8

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Course Code	**SM-MTECE-110A**				
Category	Seminar				
Course Title	**Seminar-II**				
Scheme and Credits	L	T	P	**Credits**	**Semester-II**
	0	0	2	2	
Course Objectives	The objectives of this course are to • Develop students' ability to effectively present research topics and findings by effective communication. • Improve problem-solving and critical thinking skills of the students. • Expose students to the latest trends and advancements byreviewing and discussing contemporary research.				
Assessment	50 Marks				
End Semester Examination	-				
Total	50 Marks				
Duration of Exam	03 Hours				

Course Outcomes: After successful completion of this course, the students will be able to

COs	Skills Demonstrated
CO1	Identify the trends and advancements in the related field.
CO2	Analyze and synthesize research literature with in-depth reviews of key studies and methodologies.
CO3	Undertake problem identification, formulation, proposing solution and analyze the impact on society, economy and environment.
CO4	Prepare a well-organized report employing elements of effective communication and critical thinking.
CO5	Demonstrate a sound technical knowledge of their research field.

Overview:

This course helps M. Tech students improve their research presentation skills. It focuses on choosing a topic or research paper related to their field, reviewing it thoroughly and presenting the findings clearly and effectively.

General Guidelines:

Topic Selection	Each student is required to choose the research topic based on publishedreview paper(s) or literature related to their relevant field. The same topic cannot be selected by multiple students.
Approval Process	The selected paper or topic must be approved by the faculty members/ committee appointed by the Head of Department.
Presentation Guidelines	Each student will have 30-40 minutes for their presentation, followed by 5minutes for Q&A.
Evaluation	The presentation will be evaluated by a committee constituted by the Head ofDepartment. The evaluation will be based on:

Parameters for the Evaluation of Seminar

Sr. No.	Parameters	Marks Allotted	Relevant COs
1	Clarity of the topic	10	**CO1**
2	Literature Survey	10	**CO2**
3	Content Relevancy	10	**CO3**
4	Presentation Skills	10	**CO4**
5	Q&A Response	10	**CO5**