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

Scheme of Studies and Examination

M.Tech (Electronics & Communication Engineering) – 3rd 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 Core Courses	PCC-MTECE-201A	Neural Networks & Fuzzy Logic	4	0	0	4	4	40	60		100	3
2	Professional Elective Courses	Refer Annexure -II	Professional Elective Table-IV	4	0	0	4	4	40	60		100	3
3	Multidisciplinary Open Elective Courses	Refer Annexure -II	Multidisciplinary Open Elective Table-V	3	0	0	3	3	40	60		100	3
4	Mandatory Learning Courses	MLC-01A	Research Methodology and IPR	3	0	0	3	3	40	60		100	3
5	Seminar	SM-MTECE-217A	Seminar-III	0	0	2	2	2	50			50	
6	Lab Course	LC-MTECE-211A	MATLAB-Based Modelling and Simulation Lab	0	0	2	2	1	50		50	100	3
7	Project	PROJ-MTECE-213A	Project Lab	0	0	4	4	2	50		50	100	3
8	Dissertation	DISS-MTECE-215A	Dissertation (Phase-I)	0	0	4	4	2	100		-	100	3
Total								**21**	**410**	**240**		**750**	

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

Scheme of Studies and Examination

M.Tech (Electronics & Communication Engineering) – 4th 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	Dissertation	DISS-MTECE-202A	Dissertation	0	0	20	20	20	250	-	500	750	3
Total								**20**	**250**	**-**	**500**	**750**	

Annexure-II

Professional Elective (Table-IV)

SN	Course Code	Course Name
1	PEC-MTECE-203A	CDMA System
2	PEC-MTECE-205A	Next-Generation Wireless Technologies
3	PEC-MTECE-207A	RF and Microwave Circuit Design
4	PEC-MTECE-209A	Cognitive Radio
5	PEC-MTECE-211A	Markov Chain and Queuing System
6	PEC-MTECE-213A	MIMO System
7	PEC-MTECE-215A	Analog IC Design

Multidisciplinary Open Elective-II Courses (Table-V)

Sr. No.	Course Code	Course Name	Offered by Department
1	OEC-131A	Fundamental of Income Tax	Management Department
2	OEC-133A	Stress Management	Management Department
3	OEC-135A	Fundamental of Marketing	Management Department
4	OEC-137A	Business Analytics	Management Department
5	OEC-139A	Statistical Tools using SPSS	Applied Sc. & Humanities (Mathematics)
6	OEC-141A	Mathematical Techniques and Applications	Applied Sc. & Humanities (Mathematics)
7	OEC-143A	MATLAB	Electrical Engineering
8	OEC-145A	Sources of Energy - II	Electrical Engineering
9	OEC-147A	Natural and Manmade Disaster	Civil Engineering
10	OEC-149A	Optimization Techniques	Computer Sc. & Engineering
11	OEC-151A	Composite Materials	Mechanical Engineering
12	OEC-153A	Cost Management of Engineering Projects	Mechanical Engineering
13	OEC-155A	Voice and Data Network	Electronics and Communication Engineering
14	OEC-157A	IT for Professionals	Computer Sc. & Applications

Course Code	**PCC-MTECE-201A**				
Category	Professional Core Course				
Course Title	**Neural Networks & Fuzzy Logic**				
Scheme and Credits	L	T	P	**Credits**	**Semester-III**
	4	0	0	4	
Course Objectives	The objectives of this course are to: • Introduce neural network basics, historical development, neuron models, and common topologies. • Explain learning methods and models like Hopfield, Kohonen, and K-means clustering. • Explore advanced neural networks such as RBF, back propagation and ART architectures. • Apply neural networks and fuzzy logic in real-world applications and intelligent 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 and explain the fundamental concepts of neural networks and fuzzy logic, their structures, and applications.
CO2	Apply neural network models to solve real-world problems related to classification, clustering and pattern recognition.
CO3	Categorize neural network learning methods and their effectiveness for various applications.
CO4	Analyze the performance of neural network architectures and fuzzy logic systems in solving computational problems.

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:** Neural networks characteristics, history of development in neural networks principles, network architecture, biological neural network, artificial neural network terminology, model of a neuron, topology.
Unit-II	**Learning Methods & Neural network models**: Types of learning, supervised, unsupervised, reinforcement learning. knowledge, representation and acquisition. basic hop field model, basic learning laws, unsupervised learning, competitive learning, k-means clustering algorithm, Kohonen`s feature maps.
Unit-III	**Artificial Neural Networks:** Radial basis function neural networks, basic learning laws in RBF nets, recurrent back propagation. introduction to counter propagation networks, CMAC network, and ART networks. Applications of neural nets: Applications such as pattern recognition, Pattern mapping, Associative memories, speech and decision-making.
Unit-IV	**Fuzzy Logic:** Basic concepts of fuzzy logic, Fuzzy vs. Crisp set, Linguistic variables, Membership functions, Fuzzy sets & Operations of fuzzy sets, Fuzzy IF- THEN rules, Variable inference techniques, De-Fuzzification, Basic fuzzy inference algorithm, Fuzzy system design, Antilock Breaking system (ABS), Industrial applications.

Suggested Readings:

- Artificial Neural Networks by B. Yegnanarayana, PHI
- Introduction to artificial neural systems by J.M. Zurada, Jaico Pub.
- Fuzzy logic with engineering application by ROSS J.T, TMH
- Neural Networks by Simon Haykin, PHI

Useful Video Links:

Unit No	Topics	Links
Unit-I	Model of Neuron	https://youtu.be/vbNDNkvzzuk
Unit-II	K-means Clustering	https://youtu.be/ZTP6b3LaVGg
Unit-III	Radial basis function	https://youtu.be/yk_dsPu9Hmg
Unit-IV	Introduction: Fuzzy set, Logic & System	https://youtu.be/JrRWdPvG7yk

Course Code	**PEC-MTECE-203A**				
Category	Professional Elective Course				
Course Title	**CDMA System**				
Scheme and Credits	L	T	P	**Credits**	**Semester-III**
	4	0	0	4	
Course Objectives	The objectives of this course are to • Understand fundamental CDMA concepts, spread spectrum techniques, and sequence correlation functions. • Analyze error probabilities, fading effects, and performance metrics in CDMA systems. • Evaluate capacity, power control strategies, and handoff techniques in CDMA networks. • Explore advanced CDMA technologies, coding trade-offs, and multi-user 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 key concepts of CDMA systems, DSSS, FHSS, spreading sequence and their correlation functions.
CO2	Explain acquisition and tracking of spread spectrum signals and error performance of DS-CDMA over AWGN and frequency-selective fading channels.
CO3	Examine the impact of power control and handoff mechanism in improving CDMA system performance.
CO4	Analyze how coding tradeoffs, multi-carrier CDMA techniques and multi-user detection affect capacity, performance and limitations of cellular CDMA systems under varying conditions.

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 direct sequence and frequency hopped spread spectrum, spreading sequence and their correlation functions, acquisition and tracking of spread spectrum signals, multipath and RAKE receiver, CDMA in cellular communication
Unit-II	Error probability for DS-CDMA on AWGN channels, DS-CDMA on frequency selective fading, channels, Performance analysis of cellular CDMA, Orthogonal Frequency Division Multiplexing (OFDM), OFDM synchronization, Multi Carrier-CDMA, Difference between OFDMA and MC-CDMA
Unit-III	CDMA channel structure, Capacity estimation, Power control, effect of imperfect power control on DS CDMA performance, reverse link power control and forward link power control in open loop and closed loop, hard handoffs, soft Handoffs.
Unit-IV	Forward pilot channel, forward synchronization channel, reverse pilot channel, reverse access channel, spreading /coding tradeoffs, multi-carrier CDMA, IS-95 CDMA system, UMTS, multi-user detection.

Suggested Readings:

- CDMA Principles of spread spectrum communications by Andrew J. Viterbi, Addison Wesley 1995.
- The cdma 2000 system for mobile communication by Vanghi, Vieri, Pearson Education
- Communication Systems (Analog and Digital) by Sanjay Sharma, S. K. KATARIA & SONS
- Spread spectrum CDMA by Steve Lee, TMH
- CDMA system Engineering handbook by J.S. Lee and L.E. Miller, Artech house 1998.
- CDMA : 2000 : Cellular/ PCS system Implementation by Garg, Pearson

Useful Video Links:

Unit No	Topics	Links
Unit-I	Introduction to CDMA, Spread Spectrum and LFSR	https://youtu.be/TJNKoRPn-G8
Unit-II	Frequency Selective Fading	https://youtu.be/SB2ECmjwre0
Unit-III	Power control - Need, objectives and classifications	https://youtu.be/JOI1cBQ9eSc
Unit-IV	CDMA based IS 95 standard	https://youtu.be/Nu1n4kpGx8c

Course Code	**PEC-MTECE-205A**				
Category	Professional Elective Course				
Course Title	**Next-Generation Wireless Technologies**				
Scheme and Credits	L	T	P	**Credits**	**Semester-III**
	4	0	0	4	
Course Objectives	The objectives of this course are to • Understand the evolution of mobile communication from 5G and beyond technologies. • Learn advanced waveforms and multiple access techniques used in Next gen mobile comm. • Study the architecture and protocol layers of 5G networks. • Explore applications like Massive MIMO, IoT, D2D, and V2X in next-generation mobile networks.				
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 and understand the fundamental concepts and evolution of mobile generations, their deployment challenges with suitable applications.
CO2	Describe the architecture, core network components, protocols and control planes of modern mobile communication systems.
CO3	Apply multiple access techniques to design and implement mobile communication systems
CO4	Analyze the technological parameters of various mobile generations and their impact on system performance and service capabilities to address future requirement.

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 5G and Network Evolution: Overview of 3G and 4G (LTE), Introduction to 5G: Vision and Use Cases , Evolution from LTE to 5G , 5G NR and Core Network (5GCN) , Spectrum for 5G , Deployment Options and Challenges
Unit-II	5G Waveforms and Access Technologies: OFDM and OFDMA , MIMO-OFDM , Generalized Frequency Division Multiplexing (GFDM) , Universal Filtered OFDM (UF-OFDM) , Non-Orthogonal Multiple Access (NOMA) , Comparison of Multiple Access Techniques
Unit-III	5G Architecture and Protocols: 5G NR Requirements , Core Network and Radio Access Network (RAN) Overview , Radio Protocol Architecture , User Plane and Control Plane Protocols , Medium Access Control (MAC) and Physical Layer Overview , Logical and Transport Channels in 5G NR
Unit-IV	Applications: Massive MIMO and Beam forming , Device-to-Device (D2D) Communication , 5G for IoT and V2X (Vehicle-to-Everything) Communication, Overview of 6G and beyond technologies and their future applications

Suggested Readings:

- 5G Mobile Communication by Dr. S. K. Gupta, Wiley India
- Mobile Communications by SCHILLER JOCHEN**,** Pearson Education
- 5G Technology: A Comprehensive Guide by Prof. R. K. Gupta **&** Prof. A. K. Verma, Wiley India
- Mobile Communication Systems by Wesolowski, Krzysztof, Wiley India

Useful Video Links:

Unit No	Topics	Links
Unit-I	Introduction to 5G	https://youtu.be/SbYltPawklg
Unit-II	5G Technologies	https://youtu.be/krAfb0morss
Unit-III	5G Network Architecture	https://youtu.be/MdPY0UCQe2o
Unit-IV	Massive MIMO	https://youtu.be/RwZn3VEzHBc

Course Code	**PEC-MTECE-207A**				
Category	Professional Elective Course				
Course Title	**RF and Microwave Circuit Design**				
Scheme and Credits	L	T	P	**Credits**	**Semester-III**
	4	0	0	4	
Course Objectives	The objectives of this course are to • Gain insight into microwave transmission lines, impedance matching, and network analysis • Familiarize with working principles of passive microwave components • Understand about the behaviour of microwave devices and affect of noise and nonlinearity. • Explore circuit-level design of RF amplifiers, oscillators, and mixers used in communication 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 and understand the operating principles and functions of key passive microwave components with their roles in RF systems.
CO2	Apply techniques for impedance matching and network parameter evaluation, and analyze the behavior of microwave transmission lines using circuit and field models
CO3	Interpret the characteristics of microwave semiconductor devices and describe the effects of nonlinearity, noise, and distortion on system performance.
CO4	Design and analyze microwave amplifiers, oscillators, and mixers using appropriate performance metrics such as gain, stability, and noise figure.

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	**Transmission Line Theory:** Lumped element circuit model for transmission line, field analysis, Smith chart, quarter wave transformer, generator and load mismatch, impedance matching and tuning. **Microwave Network Analysis:** Impedance and equivalent voltage and current, Impedance and admittance matrix, The scattering matrix, transmission matrix, Signal flow graph.
Unit-II	**Microwave Components:** Microwave resonators, Microwave filters, power dividers and directional couplers, Ferromagnetic devices and components. Nonlinearity And Time Variance Inter-symbol interference, random process & noise, definition of sensitivity and dynamic range, conversion gain and distortion.
Unit-III	**Microwave Semiconductor Devices And Modelling:** PIN diode, Tunnel diodes, Varactor diode, Schottky diode, IMPATT and TRAPATT devices, transferred electron devices, Microwave BJTs, GaAs FETs, low noise and power GaAs FETs, MESFET, MOSFET, HEMT.
Unit-IV	**Amplifiers Design:** Power gain equations, stability, impedance matching, constant gain and noise figure circles, small signal, low noise, high power and broadband amplifier, oscillators, Mixers design.

Suggested Readings:

- Microwave and Radar Engineering by Kulkarni, M, Umesh Publication
- Microwave Devices and Circuit Design Srivastava, G, PHI Learning
- Microwave devices and circuit by Liaom Samuel Y, Pearson Education
- Microwave Engineering : Passove Circuits by Rizzi, Peter A, PHI Learning
- Microwave and Radar Engineering by Arora, Navneet , Ishan Publication

Useful Video Links:

Unit No	Topics	Links
Unit-I	Lumped element circuit model for transmission line	https://www.youtube.com/watch?v=m2I-4sQNKLw&pp=ygUyTHVtcGVkIGVsZW1lbnQgY2lyY3VpdCBtb2RlbCBmb3IgdHJhbnNtaXNzaW9uIGxpbmU%3D
Unit-II	Microwave resonators, Microwave filters	https://www.youtube.com/watch?v=2w0hRoKLr_k&list=PLc3zKsWdO93f_OQ8eUzuqbP9ODPIjKDpO
Unit-III	Microwave Semiconductor Devices And Modelling	https://www.youtube.com/watch?v=lqXoTja8Kuc&list=PLgwJf8NK-2e5sQL18mb1B9E0QlYLGMFFe
Unit-IV	Amplifiers Design: Power gain equations, stability, impedance matching	https://www.youtube.com/watch?v=RIBR5tlA94M&pp=ygUzUG93ZXIgZ2FpbiBlcXVhdGlvbnMsIHN0YWJpbGl0eSwgaW1wZWRhbmNlIG1hdGNoaW5n

Course Code	**PEC-MTECE-209A**					
Category	Professional Elective Course					
Course Title	**Cognitive Radio**					
Scheme and Credits	L	T	P	**Credits**	**Semester-III**	
	4	0	0	4		
Course Objectives	The objectives of this course are to • Introduce basic concepts, architecture, and functions of cognitive radio and dynamic spectrum access. • Know how radios find and use free spectrum with help from TV signals and maps. • Apply optimization methods for dynamic spectrum allocation and efficient spectrum use. • Explore spectrum access strategies, cognitive system architectures, and learning-based decision-making 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 and understand the architecture, key functions, and applications of cognitive radios, dynamic spectrum access, and the key concept of digital dividend.
CO2	Apply spectrum sensing methods and collaborative techniques for detecting available spectrum holes and sharing models.
CO3	Apply optimization techniques like linear, convex, and dynamic programming to solve spectrum allocation problems.
CO4	Analyze dynamic spectrum access strategies and protocols, including centralized, distributed and learning - based cognitive radio architectures.

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 Cognitive Radios: Digital dividend, cognitive radio (CR) architecture, functions of cognitive radio, dynamic spectrum access (DSA), components of cognitive radio, spectrum sensing, spectrum analysis and decision, potential applications of cognitive radio.
Unit-II	Spectrum Sensing: Spectrum sensing, detection of spectrum holes (TVWS), collaborative sensing, geo-location database and spectrum sharing business models (spectrum of commons, real time secondary spectrum market).
Unit-III	Optimization Techniques of Dynamic Spectrum Allocation: Linear programming, convex programming, non-linear programming, integer programming, dynamic programming, stochastic programming.
Unit-IV	Dynamic Spectrum Access and Management: Spectrum broker, cognitive radio architectures, centralized dynamic spectrum access, distributed dynamic spectrum access, learning algorithms and protocols.

Suggested Readings:

- Dynamic spectrum access and management in cognitive radio networks by Hossain, E., Niyato, D., & Han, Z Cambridge University Press.
- Dynamic spectrum management: From cognitive radio to blockchain and artificial intelligence by Liang, Y.-C. (2020), Springer
- Cooperative spectrum sensing and resource allocation strategies in cognitive radio networks by Fernando, X., Sultana, A., Hussain, S., & Zhao, L, Springer
- Radioactive Materials by Rao, B M, Himalaya Publishing House

Useful Video Links:

Unit No	Topics	Links
Unit-I	Cognitive Radio	https://youtu.be/SljXFf0vgvw
Unit-II	Spectrum Sensing	https://youtu.be/iorvwRwOs-s
Unit-III	Optimization Techniques of Dynamic Spectrum Allocation: Linear programming,	https://www.youtube.com/watch?v=knZrhVkZ71Q&list=PLU6SqdYcYsfLewoQPYjgg7SMBLjSV704v
Unit-IV	Spectrum broker, cognitive radio architectures, centralized dynamic spectrum access	https://www.youtube.com/watch?v=qSoVP3ZxraI

Course Code	**PEC-MTECE-211A**				
Category	Professional Elective Course				
Course Title	**Markov Chain and Queuing System**				
Scheme and Credits	L	T	P	**Credits**	**Semester-III**
	4	0	0	4	
Course Objectives	The objectives of this course are to • Understanding basic probability and theorems to explain random events and their effect on systems behaviour. • Understand Poisson processes, renewal processes and Markov chains in discrete and continuous time. • Study basic queuing models and evaluate system performance using standard measures. • Explore priority, vacation, and retrial queues and examine their effect on system performance.				
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 concepts of basic probability, nonnegative random variables, laws of large numbers, and the Central Limit Theorem to analyze stochastic systems.
CO2	Analyze renewal processes, Poisson processes, and Markov chains (discrete and continuous time), including their long-term behaviour using theoretical results such as Wald's and Blackwell's theorems.
CO3	Examine queuing systems using fundamental results like Little's Theorem, conservation laws, and solve Markovian queues using Jackson and BCMP network models.
CO4	Identify advanced queuing models including M/G/1, G/M/1, G/G/1 systems and queues with priorities, vacations and retrials, and assess their performance using analytical and numerical 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	Introduction: Review of basic probability, properties of nonnegative random variables, laws of large numbers and the Central Limit Theorem. Renewal Processes: Basic definitions, recurrence times, rewards and renewal reward theorem, point processes, Poisson process, Walds equation, Blackwell's theorem.
Unit-II	Discrete time Markov chains: definitions and properties, matrix representation, Perron-Frobenius theory. Continuous time Markov chains: basic definitions, Q-matrix, birth-death processes, quasibirth death processes. Embedded Markov processes, semi Markov processes, reversible Markov chains, Random walks.
Unit-III	Fundamental queuing results: Little's theorem, invariance of the mean delay, Conservation law.
Unit-IV	Markovian queues: Jackson and BCMP networks, numerical Algorithms. M/G/1 & G/M/1 queues and G/G/1 queues. Advanced queuing models: priority, vacation and retrials in queues.

Suggested Readings:

- Stochastic Modelling and the Theory Queues by Cliffs, Prentice Hall, 1989.
- Markov Chains by P.Bremaud, Springer-Verlag, 1999.
- Non Negative Matrices and Markov Chains by E.Seneta, Springer Series in Statistics, Springer,1981.
- Discrete Stochastic Processes by R.Gallager, Kluwer Academic Press, 1996
- Queuing Systems by L.Kleinrock, John Wiley and Sons 1976.

Useful Video Links:

Unit No	Topics	Links
Unit-I	properties of nonnegative random variables, laws of large numbers	https://www.youtube.com/watch?v=CEsyFhFrfBo
Unit-II	Perron-Frobenius theory.	https://www.youtube.com/watch?v=jMmagF4IWrY
Unit-III	Fundamental queuing results: Little's theorem	https://www.youtube.com/watch?v=VtksT_vacAc
Unit-IV	Markovian queues: Jackson and BCMP networks	https://www.youtube.com/watch?v=sH4N7c7rvsA

Course Code	**PEC-MTECE-213A**					
Category	Professional Elective Course					
Course Title	**MIMO System**					
Scheme and Credits	L	T	P	**Credits**	**Semester-III**	
	4	0	0	4		
Course Objectives	The objectives of this course are to • Understand multi-antenna systems and compare the performance of MIMO and other antenna architectures • Apply diversity techniques to improve system reliability. • Apply MIMO signal processing methods for better spectral efficiency. • Explore MIMO applications in LTE and develop skills in channel estimation for various propagation environments.					
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 principles, types, and architecture and the basic structure and operation of MIMO systems.
CO2	Compare MIMO with other multi-antenna architectures based on capacity, diversity, and multiplexing performance.
CO3	Apply space-time coding and diversity techniques such as Alamouti scheme, transmit/receive diversity, and cyclic delay diversity to improve system performance.
CO4	Analyze MIMO signal processing techniques and channel estimation methods in LTE and other wireless systems under various channel conditions.

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 Multi-antenna Systems, Motivation, Types of multi-antenna systems, MIMO vs. multi-antenna systems, Diversity, Exploiting multipath diversity, Transmit diversity, Space-time codes, The Alamouti scheme, Delay diversity, Cyclic delay diversity, Space-frequency codes, Receive diversity, The rake receiver, Combining techniques, Spatial Multiplexing, Spectral efficiency and capacity, Transmitting independent streams in parallel, Mathematical notation
Unit-II	The generic MIMO problem, Singular Value Decomposition, Eigen values and eigenvectors, Equalising MIMO systems, Disadvantages of equalising MIMO systems, Pre-distortion in MIMO systems, Disadvantages of pre-distortion in MIMO systems, Pre-coding and combining in MIMO systems, Advantages of pre-coding and combining, Disadvantages of pre-coding and combining, Channel state information. Codebooks for MIMO, Beam forming, Beam forming principles, Increased spectrum efficiency, Interference cancellation, Switched beamformer, Adaptive beam former, Narrowband beam former, Wideband beam former
Unit-III	Case study: MIMO in LTE, Codewords to layers mapping, Pre-coding for spatial multiplexing, Pre-coding for transmit diversity, Beam forming in LTE, Cyclic delay diversity based pre-coding, Pre-coding codebooks, Propagation Channels, Time & frequency channel dispersion, AWGN and multipath propagation channels, Delay spread values and time variations, Fast and slow fading environments, Complex baseband multipath channels, Narrowband and wideband channels, MIMO channel models.

Unit-IV	Channel Estimation, Channel estimation techniques, Estimation and tracking, Training based channel estimation, Blind channel estimation, Channel estimation architectures, Iterative channel estimation, MMSE channel estimation, Correlative channel sounding, Channel estimation in single carrier systems, Channel estimation for CDMA, Channel estimation for OFDM.

Suggested Readings:

- MIMO Wireless Communications : From Real-world Propagation to Space-time Code Design by Claude Oestges, Bruno Clerckx , Academic Press, 1st edition, 2010.
- Space - Time Codes and MIMO Systems by Mohinder Janakiraman, Artech House Publishers, 2004.
- Wireless Communications: Principles and Practice by Theodore S. Rappaport, PHI
- Digital Communication over Fading Channels by Marvin K. Simon and Mohamed-Slim Alouini, Wiley

Useful Video Links:

Unit No	Topics	Links
Unit-I	Introduction to Multi-antenna Systems, Motivation, Types of multi-antenna systems	https://www.youtube.com/watch?v=OA4viERrlzA&list=PLTv48TzNRhaKz0C-dCAwimXSypV_5UTxg
Unit-II	The generic MIMO problem, Singular Value Decomposition	https://www.youtube.com/watch?v=NGHBniMyteo&pp=ygU2VGhlIGdlbmVyaWMgTUlNTyBwcm9ibGVtLCBTaW5ndWxhciBWYWx1ZSBEZWNvbXBvc2l0aW9u
Unit-III	Case study: MIMO in LTE , MIMO channel models	https://www.youtube.com/watch?v=pWs_PXDD_VA&list=PLZjlBaHNchvMhWbPYNBvIytmraDtEJCAl
Unit-IV	Channel Estimation, Channel estimation techniques,	https://www.youtube.com/watch?v=1POWoBj9NX0&list=PLUM3V2jjDpWnFTJ8wSQsfDxfeHpqqi21W

Course Code	**PEC-MTECE-215A**				
Category	Professional Elective Course				
Course Title	**Analog IC Design**				
Scheme and Credits	L	T	P	**Credits**	**Semester-III**
	4	0	0	4	
Course Objectives	The objectives of this course are to • Understand MOS device physics and modeling for analog circuit design. • Design and analyze analog building blocks like amplifiers and current mirrors. • Evaluate frequency response and key performance metrics of analog circuits. • Design operational amplifiers with feedback ensuring stability and efficiency.				
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 principles of MOS device physics, amplifier stages, current mirrors, operational amplifiers, and feedback topologies used in analog integrated circuits.
CO2	Explain the behavior of analog circuits by analyzing MOS models, amplifier configurations, biasing schemes, and frequency response characteristics.
CO3	Examine analog circuits such as current mirrors, operational amplifiers, and multistage amplifiers using MOS technologies with appropriate biasing and compensation techniques.
CO4	Analyze the impact of device mismatches, feedback mechanisms, gain enhancement methods, and performance parameters on overall circuit 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:** Basic MOS device physics-General considerations, MOS current-voltage characteristics, Transconductance, Second order effects, MOS small signal models. **Single Stage Amplifiers:** Basic concepts, Common source stage, Source follower, Common gate stage, Cascode stage, Folded cascode. **Differential Amplifiers**: Single ended and differential ended operation, Basic differential pair, Common mode Response, Differential pair with MOS loads, Gilbert cell.
Unit-II	**Current Mirrors:** Basic current mirrors, Cascode current mirrors, Widlar current mirror, Wilson Current mirror, Active current mirrors, Low current biasing, Supply insensitive biasing, Temperature insensitive biasing, Impact of device mismatch. **Frequency Response of Amplifiers:** Amplifier transfer function, Miller effect, Common source stage, Source followers, Common gate stage, Cascade stage, Differential pair amplifier.
Unit-III	**Operational Amplifiers:** Performance characteristics, Design of one-stage and two stage op amps, Gain boosting, MOS telescopic-cascode operational amplifiers, MOS folded cascode amplifier, Common mode feedback, Input range limitations, Slew rate, Power supply rejection, Noise in op amps, Buffered op amps, Stability and frequency compensation.

Unit-IV	**Feedback Amplifiers:** General considerations, Feedback topologies, effect of loading. **Nonlinear Circuits:** Multipliers, Comparators, VCO circuit design, Charge pump circuits, Phase locked loop (PLL), Delay locked loop (DLL), Digital to analog (D/A) and Analog to Digital (A/D) converters.

Suggested Readings:

- B.Razavi, "Design of Analog CMOS Integrated Circuits", 2nd Edition, McGraw Hill Edition 2016.
- Paul. R.Gray and Robert G. Meyer, "Analysis and Design of Analog Integrated Circuits", Wiley, 5th Edition, 2009.
- R. Jacob Baker, "CMOS Circuit Design, Layout, and Simulation", 3rd Edition, Wiley, 2010.
- T. C. Carusone, D. A. Johns and K. Martin, "Analog Integrated Circuit Design", 2nd Edition, Wiley, 2012
- P.E.Allen and D.R. Holberg, "CMOS Analog Circuit Design", 3rd Edition, Oxford University Press, 2011.

Useful Video Links:

Unit No	Topics	Links
Unit-I	Introduction to MOSFET	https://www.youtube.com/watch?v=sfXsyOA0L5Y&list=PLdlPA9pGVVtZ7abJ1MAJc71S2ta-OnGux&index=2
	Common source amplifier	https://www.youtube.com/watch?v=dJf6vqAKOAQ&list=PLdlPA9pGVVtZ7abJ1MAJc71S2ta-OnGux&index=3
Unit-II	MOSFET Current mirrors	https://www.youtube.com/watch?v=SqnCGvtvDq0&list=PLdlPA9pGVVtZ7abJ1MAJc71S2ta-OnGux&index=4
	Noise, Offset, Slew Rate	https://www.youtube.com/watch?v=L-8F1CHaXqA&list=PLbMVogVj5nJRlMz5diOg9wBizaU6-egJc&index=35
Unit-III	Cascode amplifier	https://www.youtube.com/watch?v=2UlNiFPbG2c&list=PLdlPA9pGVVtZ7abJ1MAJc71S2ta-OnGux&index=5
	One Stage Op amp	https://www.youtube.com/watch?v=NlD9KDBVaM0&list=PLdlPA9pGVVtZ7abJ1MAJc71S2ta-OnGux&index=17
	Telescopic Stage Op amp	https://www.youtube.com/watch?v=Py6xFtWGZu0&list=PLdlPA9pGVVtZ7abJ1MAJc71S2ta-OnGux&index=26
Unit-IV	Effect of Loading in Feedback	https://www.youtube.com/watch?v=NRYMrheAAJI&t=945s
	Frequency compensation	https://www.youtube.com/watch?v=B0zpK8srBwA

Course Code	**MLC-01A**				
Category	Mandatory Learning Course				
Course Title	**Research Methodology and IPR**				
Scheme and Credits	L	T	P	**Credits**	**Semester-III**
	3	0	0	**3**	
Course Objectives	The objectives of this course are: • To enable students to identify and define research problems, formulate objectives and apply appropriate investigative approaches in research methodology. • To impart knowledge of data sources, data collection methods, data processing and the application of statistical tools for research analysis. • To develop awareness of research ethics, plagiarism issues and effective practices in technical writing, report preparation, and research documentation. • To provide a comprehensive understanding of intellectual property rights, patent procedures, technology transfer and international frameworks for innovation protection.				
Assessment	40 Marks				
End Semester Examination	60 Marks				
Total Marks	100				
Duration of Exam	03 Hours				

Course Outcomes: After studying this course, the students will be able to

COs	Skills Demonstrated
CO1	Identify research problems, objectives, and data sources based on fundamental research methodology principles.
CO2	Explain intellectual property rights, patent procedures, and international frameworks for technology transfer and innovation protection.
CO3	Apply research ethics to prepare plagiarism-free technical reports, research papers, and proposals using effective writing and presentation techniques.
CO4	Analyze research data through classification and tabulation to extract meaningful patterns and conclusions using statistical tools and methods.

Unit No.	Contents
Unit-I	Meaning of research problem, Sources of research problem, Criteria Characteristics of a good research problem, Errors in selecting a research problem, Scope and objectives of research problem, Approaches of investigation of solutions for research problem, data collection, analysis, interpretation, Necessary instrumentations
Unit-II	Effective literature studies approaches, analysis, Plagiarism, Research ethics, Effective technical writing, how to write the report, Paper, Developing a Research Proposal, Format of research proposal, a presentation and assessment by a review committee.
Unit-III	Sampling Methods, Need, Meaning & Type of Sample, Sources of Data, Primary and Secondary, Classification and Tabulation of Data Processing, Analysis and Interpretation of Data, Chi Square Test, significance of statistics in Socio-legal Research, Use of Computer in the Research field work and report writing.
Unit-IV	Nature of Intellectual Property: Patents, Designs, Trade and Copyright. Process of Patenting and Development: technological research, innovation, patenting, and development. International Scenario: International cooperation on Intellectual Property, Procedure for grants of patents, Patenting under PCT.Patent Rights: Scope of Patent Rights, Licensing and transfer of technology.

Suggested Readings:

- Research Methodology: Methods and Techniques (4th ed.) by Kothari, C. R., & Garg, G, New Age International Publishers.
- Research Methodology: A Step-by-Step Guide for Beginners (4th ed.). by Kumar, R, SAGE Publications India. ISBN: 978-9351501337
- Intellectual Property: The Law of Trademarks, Copyrights, Patents, and Trade Secrets (6th ed.) by Bouchoux, D. E, Cengage Learning.
- Intellectual Property Rights Under WTO by T. Ramappa, S. Chand.

Unit No	Topics	Links
Unit-I	Defining/formulating research problem Research types, descriptive, analytical, action, empirical, research methodology	https://www.youtube.com/watch?v=oTc4_zjmev0 https://www.youtube.com/watch?v=tjDBPRoyDJA
Unit-II	Types of Plagiarism Research Ethics	https://www.youtube.com/watch?v=5--ssYqyWoE https://www.youtube.com/watch?v=4tRCov8pVgQ
Unit-III	Primary data and Secondary Data. Sampling techniques	https://www.youtube.com/watch?v=caUiRsg5M6k https://www.youtube.com/watch?v=sKtoW5cXt14
Unit-IV	Patent Trademarks and Copyrights. What is Patent? Patent Filing Procedure in India	https://www.youtube.com/watch?v=XQ8tRdcr0xQ https://www.youtube.com/watch?v=azMNhrkRzww

Course Code	**SM-MTECE-217A**				
Category	Seminar				
Course Title	**Seminar-III**				
Scheme and Credits	L	T	P	**Credits**	**Semester-III**
	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**

Course Code	**LC-MTECE-211A**				
Category	Lab Courses				
Course Title	**MATLAB-Based Modelling and Simulation Lab**				
Scheme and Credits	L	T	P	**Credits**	**Semester-III**
	0	0	2	1	
Course Objectives	The objectives of this course are to • Introduce MATLAB environment features, interface components, and basic programming structure. • Develop understanding of MATLAB-based arithmetic, vector, and matrix operations. • Apply MATLAB commands to create plots, visualizations, and graphical user interfaces. • Utilize MATLAB toolboxes and Simulink for solving real-world engineering problems.				
Assessment	50 Marks				
End Semester Examination	50 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 and understand the main features of the MATLAB development environment.
CO2	Describe the arithmetic operations, vector product and different matrix operations using MATLAB.
CO3	Apply various commands to create and edit different plots and graphics user interface (GUI).
CO4	Solve, simulate, and analyze various circuits related to the field of Electronics and Communication using the MATLAB environment.

LIST OF EXPERIMENTS

Sr. No.	Contents
1	To perform basic matrix operations and visualize data using 2D and 3D plots in MATLAB
2	Write a Program for generation of unit impulse, unit step, ramp, exponential, sinusoidal and cosine sequence.
3	Write a Program for computing inverse Z-transform of a rational transfer function.
4	Write a Program for linear convolution
5	Determine the execution time of the FFT function.
6	Demonstrate the effectiveness of high-speed convolution FFT algorithm
7	Write a program to compute the Signal Energy and Power Using MATLAB
8	Write a Program for computing Discrete Fourier Transform
9	Simulate the effect of coefficient quantization on the frequency response of a direct form IIR digital filter.
10	Simulate the effect of coefficient quantization on the frequency response of a Direct form FIR digital filter.
11	Design a Butterworth Low pass IIR filter using Bilinear Z-transform method.
12	Design FIR Low pass filter and High pass filter using Rectangular window.
13	Transform an analog filter in to a digital filter using Impulse Invariant method.

14	Implement a Cascade and Parallel form realization of IIR Filter and write a MATLAB Program to convert Cascade and Parallel form to direct form.
15	Write a MATLAB program that converts a direct form FIR filter structure to Frequency Sampling form FIR.

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	Introduction to matlab toolboxes:	https://www.youtube.com/watch?v=hu5uFbkGJF8&pp=ygUhSU5UUk9EVUNUSU9OIFRPIE1BVExBQiBUT09MQk9YRVM6
2	Convolution (Using Matlab)	https://www.youtube.com/watch?v=8_EwCR9hC
3	MATLAB programming and simulink basics	https://www.youtube.com/watch?v=5A9sEaEt3Z4&list=PLcgIaTuuWp3kWI8d1C1wZDl0SfQDxm-CK
4	Graphics using matlab	https://www.youtube.com/watch?v=X5fBmNEo46c&list=PLho7ncbqgQbvgt0rlMKi2vnqf_d3jXprc

Course Code	**DISS-MTECE-215A**				
Category	Dissertation				
Course Title	**Dissertation (Phase-1)**				
Scheme and Credits	L	T	P	**Credits**	**Semester-III**
	0	0	4	2	
Course Objectives	The objectives of this course are to • Introduce students to identifying relevant research topics in Electronics and Communication Engineering. • Explain the research process, including literature review, documentation, and structured writing. • Develop proficiency in using research tools, reference management, and academic writing techniques. • Enhance ability to analyze, synthesize, and present research findings in a chosen domain.				
Assessment	100 Marks				
End Semester Examination					
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	Identify the research topic/area relevant to the field of Electronics and Communication Engineering to carry out independent research.
CO2	Understand the research process, literature review, result formulation and writing conclusions with reference to existing literature.
CO3	Apply appropriate tools, references and writing skills for effective report writing related to research work.
CO4	Analyze and synthesize research findings to the agreed area of research carried out.
CO5	Evaluate the research methods and available knowledge to propose appropriate solutions to the specific research problem.
CO6	Design engineering solutions by developing improved results, properly documenting them in a thesis or report, and publishing them in journals or conferences.

Each student will undertake their dissertation under the supervision of one or more supervisors. The dissertation topic must be approved by a committee constituted by the Head of the concerned Department.

Students are required to deliver two seminar presentations: the first, at the beginning of Dissertation Phase-I, to outline the scope of the work and finalize the topic; the second, towards the end of the semester, to present the progress and work completed during the semester.

The committee will evaluate both presentations and award sessional marks out of 100. Students who fail to secure the minimum passing marks must improve their grade before proceeding to the 4th semester. Failure to do so will require the student to repeat Dissertation Phase-I in the next regular 3rd semester.

Course Code	**PROJ-MTECE-215A**					
Category	Project					
Course Title	**Project Lab**					
Scheme and Credits	L	T	P	**Credits**	**Semester-III**	
	0	0	4	2		
Course Objectives	The objectives of this course are to • Identify suitable research topics in Electronics and Communication Engineering for independent investigation. • Understand research methodologies, documentation, and referencing aligned with existing literature. • Develop technical writing skills using appropriate tools, formats, and referencing techniques. • Analyze, interpret, and synthesize research findings within a defined research scope or topic.					
Assessment	50 Marks					
End Semester Examination	50 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	Identify complex engineering problems relevant to project work based on domain knowledge and real-world challenges.
CO2	Describe the workflow, technical background, and tools required for planning and executing engineering projects.
CO3	Apply appropriate methods, tools, and techniques to carry out project development and prepare technical documentation.
CO4	Analyze the key stages of project development to ensure systematic execution and identify performance issues.
CO5	Evaluate alternative approaches and select suitable methodologies to achieve optimal and feasible project outcomes.
CO6	Design innovative and practical engineering solutions to address societal and industrial needs.

Each student is required to carry out a hardware-based project and submit a project report on a topic related to Electronics Engineering or an interdisciplinary area. The project title and objectives should be chosen by the student in consultation with their allocated Project Guide. The student must present their project in the form of a viva-voce in front of a Project Evaluation Committee. The Head of Department will constitute this committee for evaluation.

Evaluation Criteria (Total: 50 marks)

Sr. No.	Evaluation Parameter	Marks
1	**Problem Definition and Relevancy** — clarity of problem, significance and alignment with discipline	5
2	**Proposed Solution and Implementation** — functionality, originality, technical depth	5
3	**Project Benefit and Impact** — benefits to society, industry, and environment	10
4	**Cost-Effectiveness and Practical Viability** — consideration of cost, resources, and practicality	10
5	**Presentation and Communication Skills (Viva-voce)** — ability to explain, answer questions, confidence, and depth of knowledge	10
6	**Project Report Quality** — clarity, completeness, format, and technical content	10

Course Code	**DISS-MTECE-202A**				
Category	Lab Courses				
Course Title	Dissertation				
Scheme and Credits	L	T	P	**Credits**	**Semester-IV**
	0	0	20	20	
Course Objectives	The objectives of this course are to • Introduce research fundamentals and help identify relevant topics in Electronics and Communication Engineering. • Understand structured research methodology, literature review, and documentation of results and conclusions. • Develop skills in using research tools, technical writing, referencing, and report formatting. • Analyze, evaluate, and present research findings through effective report or thesis preparation.				
Assessment	250 Marks				
End Semester Examination	500 Marks				
Total	750 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 research topic/area relevant to the field of Electronics and Communication Engineering to carry out independent research.
CO2	Understand the research process, literature review, result formulation and writing conclusions with reference to existing literature.
CO3	Apply appropriate tools, references and writing skills for effective report writing related to research work.
CO4	Analyze and synthesize research findings to the agreed area of research carried out.
CO5	Evaluate the research methods and available knowledge to propose appropriate solutions to the specific research problem.
CO6	Design engineering solutions by developing improved results, properly documenting them in a thesis or report, and publishing them in journals or conferences.

Dissertation Stage-1 will continue as the final dissertation in the 4th semester. Sessional marks, out of 250, will be awarded by an internal committee constituted by the Head of the Department. The assessment will be based on presentations, reports, and related materials submitted to the committee. Failure to appear before the committee will result in disqualification from submitting the dissertation.

If a student scores less than 40% in the sessional assessment, they must revise and resubmit the dissertation after incorporating all required corrections and improvements. The revised dissertation will be evaluated in the next academic session.

At the end of the semester, each student is required to submit three soft-bound copies of their Master's dissertation to the office of the Head of the Department. One copy will be retained for departmental records, one will be provided to the supervisor, and one will be sent by mail to the external examiner, following their appointment and notification from the university.

The dissertation will be evaluated by a committee consisting of the Head of the Department, the dissertation supervisor(s), and one external examiner. The external examiner will be appointed by the Chairman of the Board of Studies. If the appointed examiner is unable to attend, the Director of the Institute, upon the recommendation of the Head of the Department, is authorized to appoint a substitute examiner from another institution or the parent institute.

Students must defend their dissertation through a presentation before the evaluation committee, which will assign marks accordingly.

Note:

- The scheme for awarding grades will be provided by the department to the examiner(s).
- The plagiarism of the dissertation report must be below 10%; otherwise, the report will not be accepted.
- Each student must publish at least one research paper related to their dissertation work in a peer-reviewed journal, IEEE conference, or SCOPUS/SCI-indexed journal before the final submission of Dissertation Stage-2.
- The student must follow the guidelines for the Dissertation report.