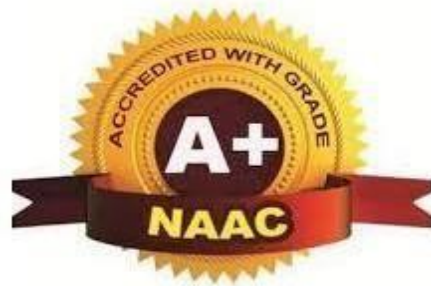




TULSIRAMJI GAIKWAD-PATIL
College of Engineering & Technology

Mohgaon, Wardha Road, Nagpur - 441 108

(An Autonomous Institute)



**DEPARTMENT OF ELECTRONICS
AND COMMUNICATION
ENGINEERING**

M.Tech Electronics Engineering (Communication)

NEP Structure & Curriculum

From

Academic Year 2026-27

Vision of Institute

To emerge as a learning Center of Excellence in the National Ethos in domains of Science, Technology and Management

Mission of Institute

[M1]: To strive for rearing standard and stature of the students by practicing high standards of professional ethics, transparency and accountability.

[M2]: To provide facilities and services to meet the challenges of Industry and Society.

[M3]: To facilitate socially responsive research, innovation and entrepreneurship.

[M4]: To ascertain holistic development of the students and staff members by inculcating knowledge and profession as work practices.

Vision of the Department

To emerge as a learning Hub and center of excellence in the domain of Electronics and Communication Engineering.

Mission of the Department

[M1]: To impart quality technical education through effective teaching learning process.

[M2]: To provide a platform for addressing societal issues and challenges encountered by industries.

[M3]: To foster a culture of research and instill innovative and entrepreneurial skills.

[M4]: To promote lifelong learning in order to foster the holistic development of students and staff through the knowledge and professional ethics.

Program Education Objectives (PEO)

[PEO1]: Demonstrate essential technical skills to identify, analyze and solve problems and design issues in Electronics and Communication Engineering.

[PEO2]: Apply field knowledge, research and professional practices to meet the requirements of industries.

[PEO3]: Imbibe lifelong learning practices and entrepreneurship skills in tune with emerging technologies.

[PEO4]: Inculcate professional ethics and managerial skills to satisfy real life problems for serving the needs of society and environment.

Program Outcomes (PO)

- 1. Engineering Knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
- 2. Problem Analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
- 3. Design/development of solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
- 4. Conduct investigations of complex problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
- 5. Modern tool usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and software tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
- 6. The engineer and society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
- 7. Environment and sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
- 8. Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
- 9. Individual and team work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
- 10. Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
- 11. Project management and finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
- 12. Lifelong learning:** Recognize the need for, and have the preparation and ability to engage in independent and lifelong learning in the broadest context of technological change.



Tulsiramji Gaikwad-Patil College of Engineering & Technology, Nagpur

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NEP Autonomy Scheme of Instructions and Syllabus

Scheme of Instructions for First Year M. Tech.

Programme in Electronics Engineering (Communication)

Semester – I (w.e.f.: AY 2026-27)







Sr. No.	Course Category	Course Code	Course Title	L	T	P	Contact Hrs/week	Credits	Exam Scheme				
									CT - 1	CT - 2	TA/CA	ESE	TOTAL
1	PCC	MEC21101	Embedded System Design & Application	4	-	-	4	4	20	20	-	60	100
2	PCC	MEC21102	Digital Communication Technology	4	-	-	4	4	20	20	-	60	100
3	PCC	MEC21103	Adaptive Signal Processing	4	-	-	4	4	20	20	-	60	100
4	PEC	MEC21105-7*	Program Elective - I	4	-	-	4	4	20	20	-	60	100
5	PEC	MEC21108-10*	Program Elective-II	4	-	-	4	4	20	20	-	60	100
6	PCC	MEC21111	Digital Communication Technology Lab	-	-	2	2	1	-	-	25	25	50
Total				20	-	2	22	21	100	100	25	325	550

L- Lecture T-Tutorial P-Practical CT1- Class Test 1 CT2- Class Test 2 TA/CA- Teacher Assessment / Continuous Assessment
ESE- End Semester Examination (For Laboratory: End Semester Performance)

*-Indicates out of the 03-course code each student has to select any one Program Elective.

Progressive Total Credits = 21

				June, 2026	2.00	Applicable for AY 2026-27
BOS Chairman	Vice-Principal/Director Academics	Director (Administration)	Principal	Date of Release	Version	



Tulsiramji Gaikwad-Patil College of Engineering & Technology, Nagpur

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**NEP Autonomy Scheme of Instructions and Syllabus
Scheme of Instructions for First Year M. Tech.**

Programme in Electronics Engineering (Communication)

Semester – II (w.e.f.: AY 2026-27)




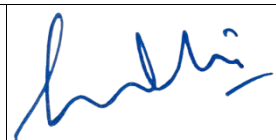


Sr. No.	Course Category	Course Code	Course Title	L	T	P	Contact Hrs/ week	Credits	Exam Scheme				
									CT - 1	CT - 2	TA /CA	ESE	TOTAL
1	PCC	MEC21201	Optical Communication System	4	-	-	4	4	20	20	-	60	100
2	PCC	MEC21203	Advanced Communication Network	4	-	-	4	4	20	20	-	60	100
3	PEC	MEC21204-06*	Program Elective - III	4	-	-	4	4	20	20	-	60	100
4	PEC	MEC21207-09*	Program Elective - IV	4	-	-	4	4	20	20	-	60	100
5	RM	MEC21210	Research Methodology	4	-	-	4	4	20	20	-	60	100
6	PCC	MEC21211	Optical Communication System Lab	-	-	2	2	1	-	-	25	25	50
Total				20	-	2	22	21	100	100	25	325	550

L- Lecture T-Tutorial P-Practical CT1- Class Test 1 CT2- Class Test 2 TA/CA- Teacher Assessment / Continuous Assessment
ESE- End Semester Examination (For Laboratory: End Semester Performance)

***-Indicates out of the 03-course code each student has to select any one Professional Elective.**

Progressive Total Credits = 21+21 = 42

				June, 2026	2.00	Applicable for AY 2026-27
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NEP Autonomy Scheme of Instructions and Syllabus

Scheme of Instructions for Second Year M. Tech.

Programme in Electronics Engineering (Communication)

Semester – III (w.e.f.: AY 2026-27)



Sr. No.	Cours Category	Course Code	Course Title	L	T	P	Contact Hrs /week	Credits	Exam Scheme				
									CT - 1	CT - 2	TA / CA	ESE	TOTAL
1	PEC	MEC22302\$	MOOCS /NPTEL Courses	-	-	-	-	3	-	-	25	75	100
2	OJT / FP	MEC32303	Project Dissertation Phase- I	-	-	30	30	15	-	-	100	100	200
Total				4	-	30	30	18	-	-	125	175	300

Note:

1. In Case, the course offered online are not completely relevant with the topic of dissertation then any course suggested by NASSCOM on recent technologies can be opted by candidate.

2. \$ Programme coordinator will provide list of 03 MOOC courses of minimum 12 weeks duration (as per availability). Students are expected to complete any one out of three courses in order to get the required credits.

L- Lecture

CT1- Class Test 1

CT2- Class Test 2




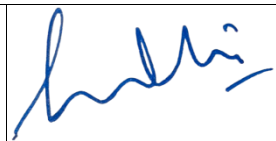
T-Tutorial

TA/CA- Teacher Assessment/Continuous Assessment

ESE- End Semester Examination (For Laboratory End Semester performance

OJT/FP-On Job Training: Internship/ Apprenticeship

Progressive Total Credits = 42+18= 60

				June, 2026	2.00	Applicable for AY 2026-27
BOS Chairman	Vice-Principal/Director Academics	Director (Administration)	Principal	Date of Release	Version	



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NEP Autonomy Scheme of Instructions and Syllabus

Scheme of Instructions for Second Year M. Tech.

Programme in Electronics Engineering (Communication)

Semester – IV (w.e.f.: AY 2026-27)







Sr. No.	Course Category	Course Code	Course Title	L	T	P	Contact Hrs /week	Credits	Exam Scheme				
									CT - 1	CT - 2	TA /CA	ESE	TOTAL
1	OJT / FP	MEC23401	Project Dissertation Phase- II	-	-	40	40	20	-	-	100	200	300
Total				-	-	40	40	20	-	-	100	200	300

Note:

TA/CA- Teacher Assessment / Continuous Assessment

ESE- End Semester Examination (For Laboratory: End Semester Performance) OJT/FP-On Job Training: Internship/ Apprenticeship

Progressive Total Credits = 60+20 = 80

				June, 2026	2.00	Applicable for AY 2026-27
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NEP Autonomy Scheme of Instructions and Syllabus

M. Tech. Programme in Electronics (Communication) Engineering





(w.e.f.: AY 2026-27)

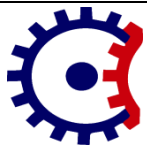
List of Program Elective Courses



Semester I		Semester I	
Course Code	Program Elective I	Course Code	Program Elective II
MEC21105	Active RF Devices and Circuits	MEC21108	Artificial Neural Networks and Application
MEC21106	Industrial Communication Systems	MEC21109	Satellite Communication
MEC21107	Telecommunication Networks	MEC21110	Advanced Wireless Communication

Semester II		Semester II	
Course Code	Program Elective III	Course Code	Program Elective IV
MEC21204	Quantum Communication	MEC21207	Free Space Optical Communication
MEC21205	Adhoc and Mesh Network	MEC21208	Deep Learning for Wireless Communication
MEC21206	Multi rate Signal Processing	MEC21209	Data Analytics for Communication System

				June, 2026	2.00	Applicable for AY 2026-27
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Wardha Road, Nagpur-441 108

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Program: M. Tech. Electronics Engineering (Communication)

Semester: I MEC21101: Embedded System Design & Application

Teaching Scheme

Theory 4 Hrs./week

Tutorial --

Total Credits 4

Duration of ESE: 3 Hrs.

Examination Scheme

CT-I 20 Marks

CT-II 20 Marks

CA --

ESE 60 Marks

Pre-Requisites: Embedded System

Total Marks 100 Marks

Course Objectives:

1. Students will analyze the need and application of ARM Microprocessors in embedded systems.
2. To organize the architecture of ARM series microprocessor.
3. To explain the fundamental of IOT and embedded systems including basic design strategy and process modeling
4. Students will understand the fundamentals of security in IOT.
5. To design case study of the embedded systems.

Course Contents

Unit I	Introduction to Embedded Systems: Introduction to Embedded Systems, Architecture of Embedded System, Design Methodology, Design Metrics, General Purpose Processor, and System On chip. Embedded system design and development: Embedded system design, Life-Cycle Models, Problem solving, The design process, Requirement identification, Formulation of requirements specification. Development tools.
Unit II	ARM7, ARM9, ARM11 Processors: Introduction to ARM processors and its versions, ARM7, ARM9 & ARM11 features, advantages & suitability in embedded application, programming in assembly language, registers, CPSR, SPSR, ARM and RISC design philosophy, ARM7 data flow model, programmers' model, modes of operations, RTOS, types of RTOS.
Unit III	Embedded IoT Platform Design Methodology: Introduction to Embedded System and Internet of Things o Embedded Systems, IoT: Definition and characteristics of IoT, Internet of Things: Vision, Emerging Trends, Purpose and requirement specification, Process specification, Domain model specification, information model specification, Service specifications, IoT level specification, Functional view specification, Operational view specification, Device and component integration, Application development
Unit IV	IoT Protocols and Security Networks: Protocol Standardization for IoT, M2M and WSN Protocols, Issues with IoT Standardization, Unified Data Standards, Protocols – IEEE 802.15.4, Modbus, Zigbee Architecture, Network layer, APS layer. Bluetooth, IEEE 802.11 ,CAN, I2C and USB,RS232,RS485.
Unit V	Embedded System Design Case Studies: Automated Meter Reading Systems (AMR), Digital Camera, Multimedia System, Electronic Control Unit (ECU) of Car and Medical Instrumentation.

Text Books			
T.1	David E.Simon, —An Embedded Software Primer , Perason Education, 2003.		
T.2	Hakima Chaouchi, — The Internet of Things Connecting Objects to the Web ISBN: 978- 1-84821-140-7, Wiley Publication		
Reference Books			
R.1	Noergaard Tammy, —Embedded Systems Architecture , Elsevier Publication.		
R.2	Vijay Madiseti, Arshdeep Bahga, “Internet of Things: A Hands-On Approach”		
Useful Links			
1	https://nptel.ac.in/courses/106/105/106105159/		
2	https://nptel.ac.in/courses/108/102/108102169/		
Course Code	Course Outcome	CL	Class Sessions
MEC21101.1	Explain the embedded system Design Metrics, Processor Technology, IC Technology, Design Technology.	4	9
MEC21101.2	Analyze the Embedded systemarchitecture and feature of ARM7, ARM9, ARM11 processor.	4	9
MEC21101.3	Implement an architectural designfor IoT for specified requirement.	3	9
MEC21101.4	Interface the advanced peripheralsto ARM based Processor	5	9
MEC21101.5	Design embedded system with available resources.	6	9


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 Department of Electronics & Comm.
 Jaisramji Gaikwad - Pant College
 of Engineering & Technology Nagpur.



Program: M. Tech. Electronics Engineering (Communication)

Semester: I **MEC21102: Digital Communication Technology**

Teaching Scheme		Examination Scheme	
Theory	4 Hrs./week	CT-I	20 Marks
Tutorial	--	CT-II	20 Marks
Total Credits	4	CA	----
Duration of ESE: 3 Hrs.		ESE	60 Marks
Pre-Requisites: Communication Engineering.		Total Marks	100 Marks

Course Objectives:

1. To analyze the representation of a signal with the help of different presentation models and how effective and useful tool in the analysis of digitally modulated signals.
2. Students will learn how digital transmission is more secure and accurately demodulate the data or information, with the help of modulation techniques. Design optimum receivers for digital modulation techniques.
3. Students will learn how to design the optimum filter with less probability of error.
4. To understand the different multicarrier modulation techniques and their algorithm.
5. To analyze different types of spread spectrum technique and transmission of digital data through various techniques and their secure reception at the demodulation.

Course Contents

Unit I	Characterization of Communication Signals and Systems: Mathematical model for communication channels and their characteristics, Characterization of Band pass signals and system, Representation of digitally modulated signals, Spectral characteristics of Digitally modulated signals, Non-linear modulation methods with Memory.
Unit II	Optimum Receiver for Signals Corrupted by AWGN Channel: Performance of the Optimum receiver for Memory less modulation, Optimum receiver for CPM signal in AWGN channel. Probability of Error for Binary and M-ary signaling in AWGN channel.
Unit III	Detection Strategies and Filter Characteristics: Baseband Reception and Probability of error, The ML & MAP detection strategies, ML detection with Zero mean AWGN, the Optimum Filter, Transfer function of Optimum filter, Matched filter, Properties of Matched filter.
Unit IV	Multicarrier systems: Orthogonal Frequency Division Multiplexing Technique, MIMO-OFDM modulation system, SISO-OFDM modulation system, Algorithm implementation IFFT/FFT of OFDM Continuous phase Modulation (CPM) schemes channel characterization.
Unit V	Spread Spectrum Signals: Direct sequence spread spectrum and CDMA systems, Performance analysis of DS-SS system in AWGN channel, Performance analysis of FH-SS system in AWGN channel.

Text Books			
T.1	Digital Communications 1995 4 th Edition J. G. Proakis McGraw Hill		
T.2	Digital Communications 1998 Simon Haykin John Wiley & Sons		
T.3	Principles of Digital Communications and Coding 1979 J. Viterbi and J. K. Omura McGraw Hill		
Reference Books			
R.1	Spread Spectrum Communications 1995. Marvin K. Simon, Jim K Omura, Robert A. Scholtz, Barry K. Levit John Wiley & Sons.		
R.2	CDMA Principles of Spread Spectrum Communications 1995. Andrew J Viterbi Addison Wesley.		
Useful Links			
1	https://nptel.ac.in/courses/117/105/117105144/		
2	https://nptel.ac.in/courses/117/105/117105077/		
Course Code	Course Outcomes	CL	Class Sessions
MEC21102.1	Analyze the principles that underline the analysis and design of digital communication systems.	4	9
MEC21102.2	Determine reliable transmission and reception of symbols over noisy channels.	3	9
MEC21102.3	Explore representation of digitally modulated signals.	3	9
MEC21102.4	Evaluate baseband reception and probability of error, the ML and MAP detection strategies	4	9
MEC21102.5	Evaluate code Acquisition and Tracking, Spread Spectrum as a Multiple Access Technique.	5	9



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Department of Electronics & Comm.
Tulsiramji Gaikwad - Patil College
of Engineering & Technology Nagpur.

**Program: M. Tech. Electronics Engineering (Communication)****Semester: I MEC21103: Adaptive Signal Processing****Teaching Scheme****Theory** 4 Hrs./week**Tutorial** --**Total Credits** **4****Duration of ESE: 3 Hrs.****Examination Scheme****CT-I** 20 Marks**CT-II** 20 Marks**CA** ----**ESE** 60 Marks**Total Marks** **100 Marks****Pre-Requisites:** Digital Signal Processing.**Course Objectives:**

1. Students will study the filter structure and its types under advance digital signal processing.
2. To explain adaptive signal processing which involves Linear optimum filtering, applications in communication systems and signal processing.
3. Students will understand types of different filters in digital processing and examine their behavior as per signal given to them, analyze the algorithm used for filtering the signal.
4. Students will Apply the knowledge of filters and determines the transmission of signal and study the detection of signal at receiving end by the use of orthogonal property.
5. Students will apply the different types of algorithms in digital signaling and their convergence with the help of RLS algorithm.

Course Contents**Unit I** **Structure for FIR system:** Direct, Cascade, Frequency Sampling, Lattice Structure for IIR system: Direct, Cascade, Parallel, Lattice & lattice-ladder Structure**Unit II** **Linear optimum filtering and Wiener filtering:** Optimum linear prediction linear filter structures, adaptive equalization, noise cancellation and beam forming. Prediction error filters.**Unit III** **Adaptive filters Levinson:** Durbin algorithm, FIR adaptive LMS algorithm. Convergence of adaptive algorithms, fast algorithms. Applications; echo canceller and equalizer.**Unit IV** **Transform domain adaptive filters:** the orthogonalization property of orthogonal transforms, The transform domain LMS algorithm.**Unit V** **Recursive least:** – squares algorithms. Convergence analysis of the RLS algorithm. Least square forward prediction, least square backward prediction, Kalman filtering. Fast RLS algorithm.**Text Books**

T.1 Haykin, S., “Adaptive Filter Theory”, Pearson Education

T.2 Widrow, B. and Stearns, S.D., “Adaptive Signal Processing”, Pearson Education.

Reference Books

R.1 Manolakis, D.G., Ingle, V.K. and Kogon, M.S., “Statistical and Adaptive Signal Processing”, Artech House.

R.2 Diniz, P.S.R., “Adaptive Filtering: Algorithms and Practical Implementation”, Kluwer.

R.3	Scharf, L.L., “Statistical Signal Processing: Detection, Estimation, and Time Series Analysis”, Addison-Wesley.		
Useful Links			
1	https://nptel.ac.in/courses/106/102/106102064/		
2	https://nptel.ac.in/courses/106/102/106102064/		
Course Code	Course Outcomes	CL	Class Sessions
MEC21103.1	Examine filter structure and its types solutions	3	9
MEC21103.2	Analyze linear filtering solutions for optimizing the cost function using Wiener filters.	4	9
MEC21103.3	Analyze convergence and stability issues using LMS algorithm and its transform domain.	5	9
MEC21103.4	Evaluate the performance Recursive Least Squares (RLS) techniques to improve convergence behavior.	4	9
MEC21103.5	Explore properties of orthogonalization transform by using mathematical perspective and Convergence analysis of the RLS algorithm	3	9



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Department of Electronics & Comm.
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Program: M. Tech. Electronics Engineering (Communication)

Semester: I MEC21105: Active RF Devices and Circuits (PE-1)

Teaching Scheme		Examination Scheme	
Theory	4 Hrs./week	CT-I	20 Marks
Tutorial	--	CT-II	20 Marks
Total Credits	4	CA	----
Duration of ESE: 3 Hrs.		ESE	60 Marks
Pre-Requisites: RF Engineering		Total Marks	100 Marks

Course Objectives:

1. Student will able to use of Smith chart to determine the various parameter of transmission line.
2. Students will able to analyze the parameters of active devices to design microwave semiconductor devices.
3. Students able to design and evaluate RF Amplifier and low noise amplifier.
4. Students will be able to design a RF mixer Circuit.
5. Students will able to design oscillators.

Course Contents

Unit I	Characteristics of passive components for RF circuits: -Passive RLC networks, Transmission lines, Two-port network modeling, S-parameter model, Smith Chart and its applications
Unit II	Active devices for RF circuits: - RF Diodes, Microwave BJT's, GaAs FET's, Low noise and power GaAs FET's, MESFET, SiGe MOSFET, GaAs, pHEMT, HBT Device parameters and their impact on circuit performance.
Unit III	RF Amplifier design: Single and Multi-stage Amplifiers. Low-pass, High pass, Band-Pass and Band-Reject Filters, Bandwidth Estimation methods. Low Noise Amplifier design: Noise types and their characterization, LNA topologies, power match vs noise match, Low Noise amplifier and Power amplifier: Class A, B, AB, C, D, E, F
Unit IV	Microwave Mixer Design: Types of mixers, Mixer theory and characteristics, SSB versus DSB mixers. Single-ended mixer and single-balanced mixer, Double balanced and image rejection mixers, In phase quadrature mixture
Unit V	Oscillators: -Oscillator versus amplifier design, Oscillation conditions, Gunn diode Modes of operation, Equivalent circuit. Design of Gunn diode oscillator, FET oscillators. Frequency tuning techniques, Phase Locked Loop (PLL), Introduction to CAD packages, Microwave integrated circuits (MIC)

Text Books

T.1	Radio Frequency and Microwave Communication Circuits Analysis and Design 2004 D. K. Misra John Wiley
T.2	Microwave Engineering 1998 D. M. Pozar John Wiley

Reference Books

R.1	Microwave Transistor Amplifiers Analysis and Design 1997. G. Gonzalez Prentice Hall
R.2	The Design of CMOS Radio-Frequency Integrated Circuits Microwave and Millimeter Wave Phase Shifters, Second Edition 1991 Thomas H. Lee S.K. Koul and B. Bhat Cambridge.
R.3	Design of Analog CMOS integrated circuits, Razavi Behzad, McGraw Hill

Useful Links

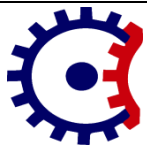
1	https://nptel.ac.in/noc/courses/noc20/SEM1/noc20-ee35/
2	https://nptel.ac.in/courses/108/107/108107142/

Course Code	Course Outcomes	CL	Class Session
MEC21105.1	Determine the various parameter of transmission line by using of Smith chart.	3	9
MEC21105.2	Analyze the parameters of active devices to design microwave semiconductor devices.	4	9
MEC21105.3	Evaluate of RF Amplifier and lownoise amplifier.	5	9
MEC21105.4	Design a RF mixer Circuit.	6	9
MEC21105.5	Design oscillators, Phase Locked Loop	6	9



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Program: M. Tech. Electronics Engineering (Communication)

Semester: I MEC21106: Industrial Communication Systems (PE-1)

Teaching Scheme

Theory 4 Hrs./week

Tutorial --

Total Credits **4**

Duration of ESE: 3 Hrs.

Examination Scheme

CT-I 20 Marks

CT-II 20 Marks

CA ----

ESE 60 Marks

Pre-Requisites: Digital Communications

Total Marks **100 Marks**

Course Objectives:

1. To introduce the basic principles of networking
2. To learn industrial protocols and the way of data processed and transferred in industrial network
3. To equip the students with the relevant knowledge to understand and solve technical problems in industrial automation systems.

Course Contents

Unit I

Fundamental of Industrial Data Communication Systems: - Review of Data Acquisition, Automation System Architecture - Hierarchical Levels, Functional Layered Models - OSI reference model, System engineering approach, Input / Output Structures, Control Unit Structure, Protocols, Communication principles and modes: network topology, transmission media, noise, cable characteristic and selection; bridges, routers and gateways, Instrumentation and control devices.

Unit II

Serial communication standards: - Standards organizations, Serial data communication interface standards, Balanced and unbalanced transmission lines, Synchronous and asynchronous communication, RS 232,422,485 standards.

Unit III

Industrial protocols: XON/OFF Signaling, Binary Synchronous Protocol (BSC), HDLC/SDLC protocol, CSMA/CD, CA protocol, OSI implementation for Industrial communications, Industrial control applications: ASCII-based protocol – ANSI – X 3.28 - 2.5.

Unit IV

HART Communication Protocol Architecture: Physical, data link, application layer, communication technique, normal and burst mode of communication, benefits of HART.

Unit V

Industrial Ethernet: 10Mbps, 100Mbps Ethernet, Gigabit Ethernet, Industrial Ethernet.

Text Books

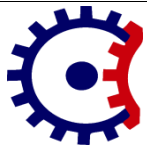
T.1

John Park, Steve Mackay, Edwin Wright, Practical Data Communications for Instrumentations and Control, 1st Edition ELSEVIER, 2003.

T.2	Deon Reynders, Steve Mackay, Edwin Wright, Practical Industrial Data Communications, 1st Edition ELSEVIER, 2005.		
Reference Books			
R.1	William C. Dunn, Fundamental of industrial instrumentation and process control, Mc Graw Hill, 2005.		
R.2	Behrouz A. Forouzan, Data Communications and Networking, 2nd Edition, Mc Grow – Hill, 2001.		
Useful Links			
1	https://nptel.ac.in/courses/117101051		
2	https://archive.nptel.ac.in/courses/108/101/108101113/		
Course Code	Course Outcomes	CL	Class Session
MEC21106.1	Analyze the need for network protocols during data exchange	4	9
MEC21106.2	Demonstrate the use of serial standards as required in an industrial plant environment.	3	9
MEC21106.3	Analyze the methods of communications.	4	9
MEC21106.4	Explain different protocols used as industrial standards.	4	9
MEC21106.5	Illustrate different Industrial Ethernet.	4	9


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Program: M. Tech. Electronics Engineering (Communication)

Semester: I MEC21107: Telecommunication Networks (PE-1)

Teaching Scheme

Theory 4 Hrs./week

Tutorial --

Total Credits 4

Duration of ESE: 3 Hrs.

Examination Scheme

CT-I 20 Marks

CT-II 20 Marks

CA ----

ESE 60 Marks

Total Marks 100 Marks

Pre-Requisites: Digital Communications

Course Objectives:

- To understand the principles of telecommunication network management.
- To gain knowledge on telecommunication network management protocols.
- To equip the students with the relevant knowledge to understand and solve technical problems in industrial automation systems.
- Student will learn network management applications.
- Student will learn web-based management and IP network management.

Course Contents

Unit I	Overview of Data Communication and Network Management: - Goals, Organization and Functions; Network Management – Architecture and Organization; Network Management Perspectives; Current Status and Future of Network Management. Network Topology, Network Node Components, Transmission Technology.
Unit II	SNMP and Network Management: - Network Management Standards, Network Management Models, Organizational Model, Information Model, Communication Model. SNMPv1 –History of SNMP, Internet Organization and Standards, SNMP Model, Organizational Model, System Overview, Information Model. SNMP Communication Model, Functional Model. SNMPv2 and SNMv3.
Unit III	Telecommunications Management Network: - TMN Conceptual Model, TMN Standards, TMN Architecture, TMN Management Service Architecture, TMN Integrated View, TMN Implementation.
Unit IV	Network Management Applications: - Configuration Management, Fault Management, Performance Management, Security Management, Service Level Management, Accounting Management, Report Management, Policy- Based Management.
Unit V	Web Based Management and IP Network Management: - Setting-UP LAN Access, SNMP configuration, Switched Port Analyzer, Web Browser / Web Server Communication. IP Network Management – Configuration, Management Information Base, Simple Network Management Protocol, IP-Based Service Implementation- Network Management Issues, OSS Architecture.

Text Books	
T.1	Mani Subramanian “Network Management – Principles and Practice”, Addison- Wesley, 2010.
T.2	Salah Aiidarons, Thomas Plevayk, "Telecommunications Network Technologies and Implementations", Eastern Economy Edition IEEE press, New Delhi, 1998.
Reference Books	
R.1	Lakshmi. G, Raman, "Fundamentals of Telecommunication Network Management", Eastern Economy Edition IEEE Press, New Delhi,1998.
R.2	J. Richard Burke, “Network Management: Concepts and Practice, A Hands-on Approach “, Pearson Education, 2008.
Useful Links	
1	https://archive.nptel.ac.in/courses/106/105/106105183/
2	https://archive.nptel.ac.in/courses/108/106/106106167/

Course Code	Course Outcomes	CL	Class Session
MEC21107.1	Explain the Data Communication and Network Management system	4	9
MEC21107.2	Analyze the SNMP and Network Management.	4	9
MEC21107.3	Analyze the Telecommunications Management Network.	4	9
MEC21107.4	Explain Network Management Applications.	4	9
MEC21107.5	Illustrate different Web Based Management and IP Network Management.	4	9



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Program: M. Tech. Electronics Engineering (Communication)

Semester: I

MEC21108: Artificial Neural Networks (ANN) and Applications (PE-II)

Teaching Scheme

Lectures 4 Hrs./week

Tutorial -

Total Credit 4

Duration of ESE: 03 Hrs.

Pre-Requisites:

Examination Scheme

CT-1 15 Marks

CT-2 15 Marks

TA 10 Marks

ESE 60 Marks

Total 100 Marks

Course Objectives:

1. **Understand** the principles of neural networks.

2. **Identify** different models of artificial neural networks.

3. **Analyze** feed-forward neural networks.

4. **Analyze** feedback neural networks.

5. **Compare** applications of artificial neural networks.

Course Contents

Unit I

Introduction: Biological neurons and memory, Structure and function of a single neuron, Artificial Neural Networks (ANN).

Unit II

Typical applications of ANNs: Classification, Clustering, Vector Quantization, Pattern Recognition, Function Approximation, Forecasting, Control, Optimization; Basic Approach of the working of ANN – Training, Learning, and Generalization

Unit III

Supervised Learning: Single-layer networks, Perceptron-Linear separability, Training algorithm, Limitations; Multi-layer Networks-Architecture, Back Propagation Algorithm (BTA) and other training algorithms, Applications. Adaptive Multi-Layer Networks-Architecture, training algorithms; Recurrent Networks; Feed-forward networks; Radial-Basis-Function (RBF) networks;

Unit IV

Unsupervised Learning: Winner-takes-all networks, Hamming networks, Magnet, Simple competitive learning, Vector-Quantization; Counter propagation networks, Adaptive Resonance Theory, Kohonen's Self-organizing Maps, Principal Component Analysis.

Unit V

Adeline and Madeline Networks: Introduction, Adeline, Madeline. Associative Memory Networks: Introduction, Algorithms for Pattern Association, Hetero Associative Memory Neural Networks, Auto Associative Memory Network, Bi-directional Associative Memory.

Text Books

T.1 Sivanandam, S Sumathi, S N Deepa; "Introduction to Neural Networks", 2nd ed. TATA McGraw HILL: 2005.

T.2 Hassoun Mohamad H., Fundamentals of Artificial Neural Networks, Phi Learning Private Limited

T.3 Artificial Neural Network Schalk off Robert J., MC GRAW HILL

Reference Books

R.1 Simon Haykin, "Neural networks A comprehensive foundations", 2nd ed., Pearson Education, 2004.

R.2 B Yegnanarayana, "Artificial neural networks", 1st ed., Prentice Hall of India P Ltd, 2005

R.3 Li Min Fu, "Neural networks in Computer intelligence", 1st ed., TMH, 2003

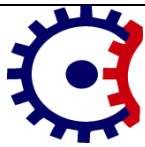
Useful Links

1	https://nptel.ac.in/courses/121/106/121106014/
2	https://nptel.ac.in/courses/108/108/108108078/

Course Code	Course Outcomes	CL	Class Session
MEC21108.1	Describe the principles of Neural Networks.	3	9
MEC21108.2	Identify different types of models of artificial neural networks.	3	9
MEC21108.3	Analyze the feed-forward neural networks.	4	9
MEC21108.4	Analyze the feedback neural networks.	4	9
MEC21108.5	Compare different applications of artificial neural networks.	4	9


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Program: M. Tech. Electronics Engineering (Communication)

Semester: I

MEC21109: Satellite Communication (PE-II)

Teaching Scheme

Examination Scheme

Lectures	4 Hrs./week	CT-1	15 Marks
Tutorial	-	CT-2	15 Marks
Total Credit	4	TA	10 Marks
Duration of ESE: 03 Hrs.		ESE	60 Marks
		Total	100 Marks

Course Objectives:

1. **Understand** earth station components, orbital mechanics, and frequency conversion including transponder hopping.
2. **Explain** transponder channelization and analyze satellite link budget parameters.
3. **Analyze** TDMA frame acquisition, synchronization, and satellite positioning.
4. **Evaluate** synchronization challenges in FH and DS systems and suggest solutions.
5. **Assess** error control and polling mechanisms in VSAT networks.

Course Contents

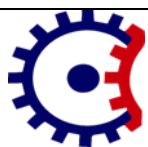
Unit I	<p>Satellite Description: Communication subsystem, Telemetry, command and ranging subsystem, altitude control subsystem, electrical power subsystem, orbital period and velocity, placement of satellite in geostationary orbit.</p> <p>Earth station: earth station antenna type, gain, pointing loss. Antenna gain to noise temperature variation G/T. G/T measurements. Antenna tracking power amplifier, low noise amplifier, Up-converter, Down converters–conversion process; transponder hopping, polarization hopping, Spurious effect of frequency conversion.</p>
Unit II	<p>Satellite transponder: Transponder model, transponder channelization, frequency plans and processing transponders.</p> <p>Satellite link: Basic link analysis, interference analysis, Rain induced attenuation, satellite link design, link with frequency reuse and link without frequency reuse, satellite multiple access system. Frequency Division Multiple Access: Principle, SPADE, FDM-FM-FDMA, Companded FDM-FM FDMA and SSB-AM-FDMA, Intermediation products in FDMA, optimized carrier-to-intermediation plus noise ration.</p>
Unit III	<p>Time Division Multiple Access: Principle, TDMA frame structure, TDMA burst structure, TDMA super frame structure, frame acquisition and synchronization. Satellite position determination, TDMA timing. Demand Assignment Multiple Access and digital speech interpolation. Erlang B formula. Type of demand assignment, DAMA characteristics, DAMA interfaces, SCPC- DAMA, digital speech interpolation. Satellite packet communication.</p>
Unit IV	<p>Satellite Spread Spectrum Communication: Direct Sequence Spread Spectrum System, Direct Sequence Code Division Multiple Access. Frequency hop spread spectrum system, frequency hop CDMA DS and FH acquisition and synchronization. Satellite on board processing.</p>
Unit V	<p>Very Small Aperture Terminal Network (VSAT) – VSAT technologies, network configurations, multi access and networking. Network error control polling VSAT network.</p> <p>Mobile Satellite Network (MSAT)- Operating environment, MSAT network concept, CDMA MSAT re-link. Worldwide timing by satellite relay.</p>

Text Books	
T.1	Timothy Pratt and Others, “Satellite Communications”, Wiley India, 2 nd edition,2010.
T.2	S. K. Raman, “Fundamentals of Satellite Communication”, Pearson Education India, 2011.
Reference Books	
1	Dennis Roddy, Satellite Communications, 4th Edition, McGraw- Hill International edition, 2006
2	Timothy Pratt, Charles Bostian, Jeremy Allnutt, Satellite Communications, 2nd Edition, Wiley India Pvt. Ltd, 2017, ISBN: 978-81-265-0833-4
Useful Links	
1	http://sdnbvc.digimat.in/nptel/courses/video/117105131/L03.html
2	http://nptel.ac.in/syllabus/117107036/

Course Code	Course Outcomes	CL	Class Session
MEC21109.1	Describe the knowledge of earth station components, Orbital Mechanics and Parameters, and components involved in frequency conversion including transponder hopping	3	9
MEC21109.2	Explain the transponder channelization methods and satellite link budget analysis, considering factors such as gain, losses, and signal strength.	4	9
MEC21109.3	Analyze the concept of TDMA frame acquisition, synchronization, and satellite position determination for seamless communication	4	9
MEC21109.4	Evaluate the challenges of synchronization in FH and DS systems and propose methods for achieving efficient synchronization.	5	9
MEC21109.5	Evaluate the importance of network error control and polling mechanisms in ensuring reliable data transmission in VSAT networks.	5	9


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Program: M. Tech. Electronics Engineering (Communication)

Semester: I

MEC21110: Advanced Wireless Communication (PE-II)

Teaching Scheme

Lectures 4 Hrs./week

Tutorial -

Total Credit 4

Duration of ESE: 03 Hrs.

Examination Scheme

CT-1 15 Marks

CT-2 15 Marks

TA 10 Marks

ESE 60 Marks

Total 100 Marks

Course Objectives:

1. Analyze optical fiber systems and wireless communication fundamentals.
2. Compare performance of digital modulation techniques over wireless channels.
3. Design OFDM systems for multicarrier data transmission.
4. Describe OFDMA systems and their applications.
5. Examine frequency hopping in OFDMA.

Course Contents

Unit I

Review of Fundamentals of Wireless Communication: Multipath fading, multipath channel models, and capacity of wireless channels.

Unit II

Performances of Digital Modulation over Wireless Channels: AGWN channels signal to noise power ratio and bit/symbol energy, error probability for BPSK, QPSK, MPSK, MPAM, MQAM- their comparison

Unit III

Multicarrier Modulation: Data transmission using multiple carriers, multicarrier modulation with overlapping sub-channels, mitigation of subcarrier fading, discrete implementation of multicarrier modulation, challenges in multicarrier systems.

Unit IV

Introduction to Wireless OFDM: OFDM principles, system model, generation of sub-carrier using IFFT, guard time, cyclic extension, windowing, OFDM parameters, OFDM signal processing, coherent and differential detection.

Unit V

OFDMA: frequency hopping in OFDMA, difference between OFDMA and MC-CDMA, OFDMA system description-channel coding, frequency synchronization, initial modulation timing and frequency offset synchronization accuracy, random frequency hopping operation, applications of OFDMA.

Text Books

1. Goldsmith, Wireless Communications, Cambridge Univ. Press, 2005
2. R. Vanne, R. Prasad, OFDM for Wireless Multimedia Communication, Artech House, 2000

Reference Books

1. M. Engels, Wireless OFDM systems, Klumer Academic Publishers, 2002

Useful Links

1. <https://www.youtube.com/watch?v=xlkLmNwiU-M>
2. <https://archive.nptel.ac.in/courses/108/106/106106167/>

Course Code	Course Outcomes	CL	Class Session
MEC21110.1	Analyze the optical fiber-based systems with the fundamentals of wireless communication.	4	9
MEC21110.2	Compare the performance of different digital modulation techniques over wireless Channels.	4	9
MEC21110.3	Design OFDM system and data transmission through multicarrier modulation.	6	9
MEC21110.4	Describe the OFDMA system, its operation and its applications.	3	9
MEC31110.5	Examine frequency hopping in OFDMA	3	9



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Program: M. Tech. Electronics Engineering (Communication)

Semester: I

MEC21111: Digital Communication Technology Lab

Teaching Scheme

Examination Scheme

Practical

2 Hrs./week

CA

25 Marks

Total Credits

1

ESE

25 Marks

Pre-Requisites: Digital Communication.

Total

50 Marks

Course Objectives:

1. Students will Explore the signal representation and estimation in communication channel
2. Students will know the concept of modulation shift keying and maximum input and maximum output concept and how securely they transmit the data with the help of secure modulation technique.
3. Students will Learn multicarrier modulation and examine transmitted signal scattered and reflected from multiple paths due to mobility of transmitter
4. Students will Understand the concept of direct sequence spread spectrum and frequency hopping spread spectrum and their technique for modulation and learn how rapidly they changing their carrier signal for radio transmission.
5. Students will design the structure of content with the help of MATLAB.

Sr. No.

List of Experiment

CO

1	Design and Analysis of Spectrum Estimators using MATLAB	CO1
2	Design and Analyze the Channel equalizer design using MATLAB	CO1
3	Design of Optimum Receiver for signals corrupted by AWGN channel.	CO2
4	Evaluate Probability of Error for Binary in AWGN channel.	CO2
5	Evaluate Probability of Error for M-ary signaling in AWGN channel.	CO3
6	Explore the Multicarrier modulation schemes i.e OFDM, MIMO, SISO in FPGA kit	CO3
7	Explore the Performance analysis of FH-SS system in AWGN channel.	CO4
8	Explore the Performance analysis of DS-SS system in AWGN channel.	CO4
9	Analyze the simulation of ML & MAP detection strategies in AWGN channel using MATLAB	CO5
10	Design Continuous phase Modulation (CPM) schemes channel characterization in FPGA kit	CO5


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