Department of Electronics and Telecommunication Engineering
M.E. Semester II
Choice Based Credit Grading Scheme (CBCGS 2024)
Proposed Syllabus under Autonomy Scheme

M. E. (Communication Technology & Management)							**SEM:** II		
Course Name: Antennas and Radiating Systems							**Course Code:** PCC-CTMME201		
Teaching Scheme (Program Specific)					**Examination Scheme (Formative/ Summative)**				
Modes of Teaching / Learning / Weightage					**Modes of Continuous Assessment / Evaluation**				
Hours Per Week					**Theory (100)**		**Practical/Oral (25)**	**Term Work (25)**	**Total**
Theory	**Tutorial**	**Practical**	**Contact Hours**	**Credits**	**IA**	**ESE**	**PR/OR**	**TW**	**100**
3	--	--	3	3	25	75	--	--	
IA: In-Semester Assessment - Paper Duration – 1.5 Hours **ESE: End Semester Examination - Paper Duration - 3 Hours** **The weightage of marks for continuous evaluation of Term work/Report:** Formative (40%), Timely completion of practical (40%) and Attendance / Learning Attitude (20%)									
Prerequisite: Under graduate subjects related to Communication.									

Course Objective: At the end of this course, students should be able to

- Explain types of antenna with fundamental parameters of antennas.
- Analyze the Linear Array antennas with two elements and N elements.
- Explain the Aperture Antennas.
- Analyze the rectangular and circular Microstrip antennas.
- Explain the Reflector Antennas.

Course Outcomes: At the end of this course, students will be able to

Sr. No.	Course Outcomes	Cognitive levels as per Bloom's Taxonomy
1	Compute the far field distance, radiation pattern and gain of an antenna for given current distribution.	L1, L2, L3
2	Estimate the input impedance, efficiency and ease of match for antennas.	L1, L2, L3
3	Compute the array factor for an array of identical antennas.	L1, L2, L3, L4
4	Design antennas and antenna arrays for various desired radiation pattern characteristics.	L1, L2, L3, L4

Detailed Syllabus:

Module No.	Topics	Hrs.	Cognitive levels as per Bloom's Taxonomy
1	Types of Antennas: Wire antennas, Aperture antennas, Micro strip antennas, Array antennas Reflector antennas, Lens antennas, Radiation Mechanism, Current distribution on thin wire antenna. Fundamental Parameters of Antennas: Radiation Pattern, Radiation Power Density, Radiation Intensity, Directivity, Gain, Antenna efficiency, Beam efficiency, Bandwidth, Polarization, Input Impedance, radiation efficiency, Antenna Vector effective length, Friis Transmission equation, Antenna Temperature.	08	L1, L2
2	Linear Wire Antennas: Infinitesimal dipole, Small dipole, Region separation, Finite length dipole, half wave dipole, Ground effects. Loop Antennas: Small Circular loop, Circular Loop of constant current, Circular loop with non uniform current.	08	L1, L2, L3
3	Linear Arrays: Two element array, N Element array: Uniform Amplitude and spacing, Broadside and End fire array, Super directivity, Planar array, Design consideration.	07	L1, L2, L3, L4
4	Aperture Antennas: Huygen's Field Equivalence principle, radiation equations, Rectangular Aperture, Circular Aperture. Horn Antennas: E-Plane, H-plane Spectral horns, Pyramidal and Conical horns.	08	L1, L2
5	Micro strip Antennas: Basic Characteristics, Feeding mechanisms, Method of analysis, Rectangular Patch, Circular Patch.	08	L1, L2, L3, L4
6	Reflector Antennas: Plane reflector, parabolic reflector, Cassegrain reflectors, Introduction to MIMO.	06	L1, L2, L3
	Total	**45**	

Books and Reference:

Sr. No.	Title	Authors	Publisher	Edition	Year
1	Antenna Theory Analysis and Design	Constantine A. Balanis	John Wiley & Sons	Fourth Edition	2016
2	Antennas for All Applications		Tata McGraw-Hill	Second Edition	2002

3	Antenna Engineering hand book	R.C.Johnson and H.Jasik	McGraw-Hill	First Edition	1984
4	Micro-strip antennas	I.J.Bhal and P.Bhartia,	Pearson Publication	Second Edition	1980

Online Resources:

S. No.	Website Name	URL	Modules Covered
1	NPTEL	https://archive.nptel.ac.in/courses/108/101/108101092/	M1-M6

Formative Assessment: Continuous assessment of the student has to be conducted weekly either by administering a class test/assignment/live problems/course project/Multiple Choice Questions/Quiz.
Mid Semester Assessment: The **Mid Semester Assessment** is to be conducted when minimum 40% syllabus is completed in the form of a test of 25 marks. Duration of this exam shall be one and half hour.
The marks assigned out of 25 will be the weighted average of Formative Assessment and mid semester assessment.

End Semester Assessment:
Some guidelines for setting up the question paper. Minimum 90% syllabus should be covered in question papers of end semester examination. In a question paper weightage of each module will be proportional to number of respective lecture hours as mention in the syllabus.

1. Question paper will comprise of total six questions.
2. All question carries equal weightage of 15 marks.
3. Only five question need to be solved.
4. Duration of this exam shall be three hours.

Department of Electronics and Telecommunication Engineering
M.E. Semester II
Choice Based Credit Grading Scheme (CBCGS 2024)
Proposed Syllabus under Autonomy Scheme

M. E. (Communication Technology & Management)							**M.E. (SEM: II)**		
Course Name: Telecom Billing and Revenue Management							**Course Code:** PCC-CTMME202		
Teaching Scheme (Program Specific)					**Examination Scheme (Formative/ Summative)**				
Modes of Teaching / Learning / Weightage					**Modes of Continuous Assessment / Evaluation**				
Hours Per Week					**Theory (100)**		**Practical/Oral/ Presentation**	**Term Work**	**Total**
Theory	**Tutorial**	**Practical**	**Contact Hours**	**Credits**	**IA**	**ESE**	**PR/OR**	**TW**	**100**
3	-	-	3	3	25	75	-	-	
IA: In-Semester Assessment - Paper Duration – 1.5 Hours **ESE: End Semester Examination - Paper Duration - 3 Hours** **The weightage of marks for continuous evaluation of Term work/Report:** Formative (40%), Timely completion of practical (40%) and Attendance / Learning Attitude (20%)									
Prerequisite: Under graduate subjects related to Telecom Networks.									

Course Objective: Course aims to provide better understanding of Telecom Billing architecture, Billing Process and Project Management.

Course Outcomes: Upon completion of the course students will be able to:

Sr. No.	Course Outcomes	Cognitive levels as per Bloom's Taxonomy
1	Understand the Telecom Billing Architecture	L1, L2
2	Understand about various Tariff and Bill Structure	L1, L2, L3
3	Understand the concepts behind Indian Telecom Service Providers & Real Time Billing Process	L1, L2, L3, L4, L5
4	Gain knowledge on Telecom Product & Project Management	L1, L2, L3, L4, L5

Detailed Syllabus:

Module No	Topics	Hrs	Cognitive levels as per Bloom's Taxonomy
1	**Billing Introduction** Telecommunications History, Bell Telephone Company, Indian Telecom Companies & Service Providers, TRAI-Regulations,	08	L1, L2

	Introduction to Billing, North American Numbering Plan, Re-Engineering, Convergent Billing, Billing Management, Competition, Business Model, Global and Functional Resources, Resource Pooling, Input, Output and Processing, Wholesale vs Retail services, Billing Architecture.		
2	**Billing Systems** Billing Types, Electronic Bill Presentation and Payment, Billable Charges, Billable Events, Payment Management, Account Management, Tax and Fee Management, Credit Classification, Packages and Promotions, Rate Plan, Consumer vs Complex Ordering, Billing Cycle, Invoicing and Rating Engine, Billing Reconciliation, Call Detail Record(CDR), CDR Attributes & Processing.	10	L1, L2, L3
3	**Billing Strategies and Customer Care** Packaging Strategies, Service Negotiation Session, Self Service Ordering, Industry Standards, Technology Barriers, Customer Relationship Management (CRM), CRM Strategies, Service Order Processing, Segmentation, Predictable Marketing, Customer care, Knowledge Management, Business Partner Software, Call Center Software, Resource Allocation, Quality of Service, Customer Life Cycle, Telecommunications Auditing, Analysis of Real Time Billing and Payments.	08	L1, L2, L3, L4, L5
4	**Telecom Product Management** Product Marketing strategies, Offer & Bundle Management, Tools, Auditing, Sales Negotiation and Account Management Software, Support Levels, Customer Retention, Decision Support Systems, Dynamic Building of Services, Configuration Methodology, Affiliate Products, Dynamic Product Definitions, Enterprise Product Tools	08	L1, L2, L3
5	**Telecom Project Management** Establishing a Process, Promoting excellence, Stakeholders, Project Managers, Project Management Process and Responsibilities, Project Managers, Proper Talent Organization, Capability Maturity Model	06	L1, L2, L3, L4
6	**Effective Revenue Management Solutions** Robust Software Services, Planning, Problem Analysis, Logical Separation, Programming Phase, Integration Testing, Effective Revenue Management Solutions for Real Time Service Providers	05	L1, L2, L3, L4, L5
	Total Hours	**45**	

Books and References:

Sr. No.	Title	Authors	Publisher	Edition	Year

1	Telecommunication Billing	Bell A.T.	Virtualbookworm.com	Second Edition	2005
2	Introduction to Telecom Billing, Usage Events, Call Detail Records, and Billing Cycles	Avi Ofrane, Lawrence Harte	Althos	Second Edition	2006
3	Telecommunications Billing Systems	Jane M Hunter, Maud Thiebaud	McGraw-Hill	First Edition	2002
4	Telecommunications Essentials, The Complete Global Source	Lillian Goleniewski	Pearson Publication	Second Edition	2007
5	The Telecom Handbook: Understanding Telephone Systems & Services	Jane Laino	CMP Books	First Edition	2002
6	Telecommunications Cost Management	Brian Dimarsico, Thomas Phelps IV, William A. Yarberry Jr.	Auerbach Publications	Second Edition	2003

Online Resources:

S. No.	Website Name	URL	Modules Covered
1	Comarch telecommunications	https://www.comarch.com/telecommunications/oss-solutions/network-inventory-management/?gad_source=1&gclid=Cj0KCQjwh7K1BhCZARIsAKOrVqHLDko0qttooNemzoax2Vkox682-qKZ8No7CA5yFLqynusTj04H0vsaAiXaEALw_wcB&gclsrc=aw.ds	M1-M6

Department of Electronics and Telecommunication Engineering
M.E. Semester II
Choice Based Credit Grading Scheme (CBCGS 2024)
Proposed Syllabus under Autonomy Scheme

M. E. (Communication Technology & Management)							**SEM: II**		
Course Name: Professional Elective -3 (Satellite Communication)							**Course Code:** PEC- CTMME2011		
Teaching Scheme (Program Specific)					**Examination Scheme (Formative/ Summative)**				
Modes of Teaching / Learning / Weightage					**Modes of Continuous Assessment / Evaluation**				
Hours Per Week					**Theory (100)**		**Practical/Oral (25)**	**Term Work (25)**	**Total**
Theory	**Tutorial**	**Practical**	**Contact Hours**	**Credits**	**IA**	**ESE**	**PR/OR**	**TW**	**100**
3	-	-	3	3	25	75	--	--	
IA: In Semester Assessment- Paper Duration – 1.5 Hours **ESE: End Semester Evaluation- Paper Duration - 3 Hours** **The weightage of marks for continuous evaluation of Term work/Report: Formative (40%), Timely completion of practical (40%) and Attendance/Learning Attitude (20%)**									
Prerequisite: Principles of Communication, Digital Communication, Computer Networks									

Course Objective:

At the end of this course, students should be able to describe the architecture of satellite systems. To explain various aspects related to satellite systems. To design link budget for the given parameters and conditions.

Course Outcomes:

At the end of this course, students will be able to

Sr. No.	Course Outcomes	Cognitive levels as per Bloom's Taxonomy
1	Visualize the architecture of satellite systems as a means of high speed, high range communication system.	L1, L2
2	State various aspects related to satellite systems such as orbital equations, sub-systems in a satellite, link budget, modulation and multiple access schemes	L1, L2, L3
3	Solve numerical problems related to orbital motion and design of link budget for the given parameters and conditions	L1, L2, L3, L4, L5

Detailed Syllabus:

Module No.	Topics	Hrs.	Cognitive levels as per Bloom's Taxonomy
1	Architecture of Satellite Communication System: Principles and architecture of satellite Communication, Brief history of Satellite systems, advantages, disadvantages, applications, and frequency bands used for satellite communication and their advantages/drawbacks	08 hrs	L1, L2
2	Orbital Analysis: Orbital equations, Kepler's laws of planetary motion, Apogee and Perigee for an elliptical orbit, evaluation of velocity, orbital period, angular velocity etc of a satellite, concepts of Solar day and Sidereal day.	07 hrs	L1, L2, L3
3	Satellite sub-systems: Architecture and Roles of various sub-systems of a satellite system such as Telemetry, tracking, command and monitoring (TTC & M), Attitude and orbit control system (AOCS), Communication sub-system, power sub-systems, antenna sub-system.	07 hrs	L1, L2
4	Typical Phenomena in Satellite Communication: Solar Eclipse on satellite, its effects, remedies for Eclipse, Sun Transit Outage phenomena, its effects and remedies, Doppler frequency shift phenomena and expression for Doppler shift.	08 hrs	L1, L2, L3
5	Satellite link budget: Flux density and received signal power equations, Calculation of System noise temperature for satellite receiver, noise power calculation, Drafting of satellite link budget and C/N ratio calculations in clear air and rainy conditions, Case study of Personal Communication system (satellite telephony) using LEO.	08 hrs	L1, L2, L3, L4
6	Modulation and Multiple Access Schemes used in satellite communication. Typical case studies of VSAT, DBS-TV satellites and few recent communication satellites launched by NASA/ ISRO. GPS.	07 hrs	L1, L2
	Total Hours	**45**	

Books and Reference:

S. No	Title	Authors	Publisher	Edition	Year
1	Satellite Communications	Timothy Pratt	Wiley India	Second Edition	2010
2	Fundamentals of Satellite Communication	S. K. Raman	Pearson Education India	--	2011
3	Satellite Communication	Dennis Roddy	McGraw Hill	Fourth edition	2009
4	Digital Satellite Communications	Tri T. Ha	Tata McGraw Hill	--	2008
5	Satellite Communications Systems : systems, techniques and technology	G. Maral, M. Bousquet, Z. Sun	John Willy and sons	5th edition	

Online Resources:

S. No.	Website Name	URL	Modules Covered
1	tutorialspoint .com	https://www.tutorialspoint.com/satellite_communication	M1-M6
2	NPTEL	https://archive.nptel.ac.in/courses/117/105/117105131/	M1- M6

Department of Electronics and Telecommunication Engineering
M.E. Semester II
Choice Based Credit Grading Scheme (CBCGS 2024)
Proposed Syllabus under Autonomy Scheme

M. E. (Communication Technology & Management)							**SEM: II**		
Course Name: Professional Elective -3 (RF MEMS)							**Course Code:** PEC- CTMME2012		
Teaching Scheme (Program Specific)					**Examination Scheme (Formative/ Summative)**				
Modes of Teaching / Learning / Weightage					**Modes of Continuous Assessment / Evaluation**				
Hours Per Week					**Theory (100)**		**Practical/Oral (25)**	**Term Work (25)**	**Total**
Theory	**Tutorial**	**Practical**	**Contact Hours**	**Credits**	**IA**	**ESE**	**PR/OR**	**TW**	**100**
3	-	-	3	3	25	75	--	--	
IA: In Semester Assessment- Paper Duration – 1.5 Hours **ESE: End Semester Evaluation- Paper Duration - 3 Hours** **The weightage of marks for continuous evaluation of Term work/Report: Formative (40%), Timely completion of practical (40%) and Attendance/Learning Attitude (20%)**									
Prerequisite: Basic Electronic Devices, Basics of Engineering Physics, Solid State physics									

Course Objective: The objective of the course is to familiarize the students with with Micro Electro Mechanical Systems (MEMS) which contains components of size less than 1mm. MEMS achieves most of the engineering functions by electromechanical or electrochemical means. In general a sensor, an actuator and a signal transduction unit form the MEMS device. Automotive, aerospace, health care are some of the areas where MEMS found its applications. This course also aims at modeling of various RF MEMS components and Bio MEMS.

Course Outcomes: Upon completion of the course students will be able to:

Sr No.	Course Outcomes	Cognitive levels of attainment as per Bloom's Taxonomy
1	Understand the operations of micro devices, micro systems and their applications	L1, L2
2	Design the micro devices, micro systems using the MEMS fabrication process	L1, L2, L3
3	Select one or more suitable MEMS/NEMS integration and packaging approaches for a given application.	L1, L2, L3, L4
4	Understand the fundamental working principle of bio-molecule sensing/sensors, and apply this knowledge to design solutions to probe biomedical and biology systems.	L1, L2, L3

Detailed Syllabus:

Module No.	Topics	Hrs.	Cognitive levels ofattainment as per Bloom's Taxonomy
1	**Introduction** Microoscale systems, Overview of Microelectromechanical Systems, Introduction to Design of MEMS, Applications of Microelectromechanical systems, Microelectromechanical devices and structures, Definitions, Materials for MEMS: Silicon, Silicon Compounds, Polymers, Metals.	6	L1, L2
2	**MEMS Fabrication Technologies** Microsystem fabrication processes: Photolithography, Ion Implantation, Diffusion, Oxidation. Thin film depositions: LPCVD, Sputtering, Evaporation, Electroplating; Etching techniques: Dry and wet etching, electrochemical etching; Micromachining: Bulk Micromachining, Surface Micromachining, High Aspect-Ratio (LIGA and LIGA-like) Technology; Packaging: Microsystems packaging, Essential packaging technologies, Selection of packaging materials	8	L1, L2
3	**Micro Sensors and Actuators** MEMS Sensors: Design of Acoustic wave sensors, resonant sensor, Vibratory gyroscope, Capacitive and Piezo Resistive Pressure sensors- engineering mechanics behind these Microsensors. Case study: Piezo-resistive pressure sensor. MicroActuators - Design of Actuators: Actuation using thermal forces, Actuation using shape memory Alloys, Actuation using piezoelectric crystals, Actuation using Electrostatic forces (Parallel plate, Torsion bar, Comb drive actuators), Micromechanical Motors and pumps. Case study: Comb drive actuators	9	L1, L2
4	**MEMS Switches** Introduction to MEMS switches; Capacitive shunt and series switches: Physical description, circuit model and electromagnetic modelling; Techniques of MEMS switch fabrication and packaging; Design of MEMS switches.	8	L1, L2
5	**RF and Bio MEMS** Introduction to RF MEMS technologies: Need for RF MEMS components in communications, space and defense applications, Materials and fabrication technologies, Special considerations in RF MEMS design. Case studies: Micro-switches BioMEMS-Drug delivery, Electronic nose, Bio chip.	8	L1, L2
	RF Filters and Phase Shifters		

6	Modeling of mechanical filters, micromachined filters, surface acoustic wave filters, micromachined filters for millimeter wave frequencies; Various types of MEMS phase shifters; Ferroelectric phase shifters. MEMS Varactor, MEMS Resonators.	6	L1, L2, L3
	Total Hours	**45**	

Books and References:

S. No	Title	Authors	Publisher	Edition	Year
1	Fundamentals of Micro fabrication	Marc Madou.	CRC press	Second Edition	2002
2	Micro system Design	Stephen D. Senturia	Springer New York, NY	First Edition	2000
3	MEMS and Microsystems Design and Manufacture	Tai Ran, Hsu	Tata McGraw Hill	Third Edition	2004
4	Foundations of MEMS	Chang Liu	Pearson education India limited	Second Edition	2006
5	MEMS and NEMS: Systems, Devices, and Structures	Sergey Edward Lyshevski	CRC Press	First Edition	2018
6	RF MEMS and their Applications	Varadan, V.K., Vinoy, K.J. and Jose	John Wiley & Sons	First Edition	2002

Online Resources:

S. No.	Website Name	URL	Modules Covered
1	NPTEL	https://archive.nptel.ac.in/courses/117/105/11710508	M1-M5
2	https://ocw.mit.edu/courses	https://ocw.mit.edu/courses/6-777j-design-and-fabrication-of-microelectromechanical-devices-spring-2007/65d3a76aacbabdcd217a60421ded87f0_07lecture21	M3, M6

Lagdu Singh Charitable Trust's (Regd.)
THAKUR COLLEGE OF ENGINEERING & TECHNOLOGY
Autonomous College Affiliated to University of Mumbai
Approved by All India Council for Technical Education(AICTE) and Government of Maharashtra(GoM)
Conferred Autonomous Status by University Grants Commission (UGC) for 10 years w.e.f. A.Y 2019-20
Amongst Top 200 Colleges in the Country, Ranked 193rd in NIRF India Ranking 2019 in Engineering College category
• ISO 9001:2015 Certified • Programmes Accredited by National Board of Accreditation (NBA), New Delhi
• Institute Accredited by National Assessment and Accreditation Council (NAAC), Bangalore

Department of Electronics and Telecommunication Engineering
M.E. Semester II
Choice Based Credit Grading Scheme (CBCGS 2024)
Proposed Syllabus under Autonomy Scheme

M. E. (Communication Technology & Management)							**SEM: II**		
Course Name: Professional Elective -3 (Voice and Data Networks)							**Course Code:** PEC- CTMME2013		
Teaching Scheme (Program Specific)					**Examination Scheme (Formative/ Summative)**				
Modes of Teaching / Learning / Weightage					**Modes of Continuous Assessment / Evaluation**				
Hours Per Week					**Theory (100)**		**Practical/Oral/ Presentation**	**Term Work**	**Total**
Theory	**Tutorial**	**Practical**	**Contact Hours**	**Credits**	**IA**	**ESE**	**PR/OR**	**TW**	**100**
3	-	-	3	3	25	75	-	-	
IA: In-Semester Assessment - Paper Duration – 1.5 Hours **ESE: End Semester Examination - Paper Duration - 3 Hours** **The weightage of marks for continuous evaluation of Term work/Report:** Formative (40%), Timely completion of practical (40%) and Attendance / Learning Attitude (20%)									
Prerequisite: Under graduate subjects related to Communication, Computer Networks.									

Course Objective:

At the end of this course, students shall be able to understand issues in design of voice and data networks. To illustrate layered voice and data networks and design data link layer, network layer and transport layer with understanding of the protocols. To describe network extensions and next generation architectures.

Course Outcomes:

At the end of this course, students will be able to

Sr. No.	Course Outcomes	Cognitive levels of attainment as per Bloom's Taxonomy
1	Understand different Protocol, algorithms, trade-offs rationale	L1,L2
2	Understand different Routing, transport, DNS resolutions	L1,L2,L3,L4
3	Analyze different Network extensions and next generation architectures	L1,L2,L3,L4
4	Analyze different Queuing Models of Networks	L1,L2,L3,L4,L5
5	Analyze the services and features of various protocol layers in data networks	L1,L2,L3,L4,L5,L6
6	Identify the basic security threats of a network	L1,L2,L3,L4,L5,L6

Detailed Syllabus:

Module No.	Topics	Hrs.	Cognitive levels as per Bloom's Taxonomy
1	Network Design Issues, Network Performance Issues, Network Terminology, centralized and distributed approaches for networks design, Issues in design of voice and data networks.	**7**	L1,L2
2	Layered and Layer less Communication, Cross layer design of Networks, Voice Networks (wired and wireless) and Switching, Circuit Switching and Packet Switching, Statistical Multiplexing.	**7**	L1,L2,L3
3	Data Networks and their Design, Link layer design- Link adaptation, Link Layer Protocols, Retransmission. Mechanisms (ARQ), Hybrid ARQ (HARQ), Go Back N, Selective Repeat protocols and their analysis.	**8**	L1,L2,L3,L4,L5
4	Queuing Models of Networks , Traffic Models , Little's Theorem, Markov chains, M/M/1 and other Markov systems, Multiple Access Protocols , Aloha System , Carrier Sensing , Examples of Local area networks,	**7**	L1,L2,L3,L4,L5
5	Inter-networking, Bridging, Global Internet , IP protocol and addressing , Sub netting , Classless Inter domain Routing (CIDR) , IP address lookup , Routing in Internet. End to End Protocols, TCP and UDP. Congestion Control , Additive Increase/Multiplicative Decrease , Slow Start, Fast Retransmit/ Fast Recovery,	**8**	L1,L2,L3,L4,L5, L6
6	Congestion avoidance, RED TCP Throughput Analysis, Quality of Service in Packet Networks. Network Calculus, Packet Scheduling Algorithms.	**8**	L1,L2, ,L3,L4,L5,L6
	Total Hours	**45**	

Books and References:

Sr. No	Title	Authors	Publisher	Edition	Year
1	Data Networks	D. Bertsekas and R. Gallager	Prentice Hall	Second	1992
2	Computer Networks: A Systems Approach",	L. Peterson and B. S. Davie	Morgan Kaufman	Fifth	2011

3	Communication Networking: An analytical approach	Kumar, D. Manjunath and J. Kuri	Morgan Kaufman	First	2004
4	Communications Network: A First Course	Walrand Leifer	McGraw Hill	Second	2002
5	Queueing Systems, Volume I: Theory	Leonard Kleinrock,	John Wiley & Sons2013	First	1975
6	Telecommunication Network Design Algorithms	Aaron Kershenbaum	McGraw Hill	Second	1993
7	Design and Analysis of Computer Communication Networks	Vijay Ahuja	McGraw Hill	Second	

Online References:

Sr. No.	Website Name	URL	Modules Covered
1	https://www.coursera.org/projects/telecom-customer-churn-prediction	Machine Learning for Telecom Customers Churn Prediction	M1,M2,M3,
2	https://nptel.ac.in	https://nptel.ac.in/courses/106105082	M4,M5,M6
3	https://ncti.com	https://ncti.com/understanding-voice-and-data-networks/	M1,M2,M3,M4,M5,M6
4	https://www.udemy.com/	https://www.udemy.com/course/data-networking-101/?couponCode=ST4MT73124	M3,M4

Department of Electronics and Telecommunication Engineering
M.E. Semester II
Choice Based Credit Grading Scheme (CBCGS 2024)
Proposed Syllabus under Autonomy Scheme

M. E. (Communication Technology & Management)							**SEM**: II		
Course Name: Professional Elective-3 (Advanced Computer Architecture)							**Course Code:** PEC- CTMME2014		
Teaching Scheme (Program Specific)					**Examination Scheme (Formative/ Summative)**				
Modes of Teaching / Learning / Weightage					**Modes of Continuous Assessment / Evaluation**				
Hours Per Week					**Theory (100)**		**Practical/Oral/ Presentation**	**Term Work**	**Total**
Theory	**Tutorial**	**Practical**	**Contact Hours**	**Credits**	**IA**	**ESE**	**PR/OR**	**TW**	**100**
3	-	-	3	3	25	75	-	-	
IA: In-Semester Assessment - Paper Duration – 1.5 Hours **ESE: End Semester Examination - Paper Duration - 3 Hours** **The weightage of marks for continuous evaluation of Term work/Report:** Formative (40%), Timely completion of practical (40%) and Attendance / Learning Attitude (20%)									
Prerequisite: Under graduate subjects related to Computer Architecture.									

Course Objective:

This course helps students to Understand, identify and formalize architectural level characterization of P-DSP hardware, Design, programming (assembly and C), and testing code using Code Composer Studio environment, Apply DSP hardware for Control, Audio and Video Signal processing applications and Understand major areas and challenges in DSP based embedded systems

Course Outcomes:

At the end of this course, students will be able to

Sr. No.	Course Outcomes	Cognitive levels as per Bloom's Taxonomy
1	Understand parallelism and pipelining concepts, the design aspects and challenges	L1,L2
2	Evaluate the issues in vector and array processors	L1,L2,L3,L4
3	Study and analyze the high performance scalable multithreaded and multiprocessor systems	L1,L2,L3,L4
4	Understand and analyze Multiprocessor Architecture	L1,L2,L3,L4
5	Understand and analyze Multithreaded Architecture	L1,L2,L3,L4
6	Understand and analyze Parallel algorithms for multiprocessors	L1,L2,L3,L4

Detailed Syllabus:

Module No.	Topics	Hrs.
1	Parallel Processing and Pipelining Processing- Architectural Classification, Applications of parallel processing, Instruction level Parallelism and Thread Level Parallelism, Explicitly Parallel Instruction Computing (EPIC) Architecture	**08hrs**
2	Pipeline Architecture-Principles and implementation of Pipelining, Classification of pipelining processors, Design aspect of Arithmetic and Instruction pipelining, Pipelining hazards and resolving techniques, Data buffering techniques, Advanced pipelining techniques, Software pipelining, VLIW (Very Long Instruction Word)	**08hrs**
3	Vector and Array Processor- Issues in Vector Processing, Vector performance modeling, SIMD Computer Organization, Static Vs Dynamic network, Parallel Algorithms for Array Processors: Matrix Multiplication.	
4	Multiprocessor Architecture - Loosely and Tightly coupled multiprocessors, Inter Processor communication network, Time shared bus, Multiport Memory Model, Memory contention and arbitration techniques, Cache coherency and bus snooping, Massively Parallel Processors (MPP).	**10hrs**
5	Multithreaded Architecture- Multithreaded processors, Latency hiding techniques, Principles of multithreading, Issues and solutions, Parallel Programming Techniques: Message passing program development.	**08hrs**
6	Parallel algorithms for multiprocessors- Classification and performance of parallel algorithms, operating systems for multiprocessors systems, Message passing libraries for parallel programming interface, PVM (in distributed memory system), Message Passing Interfaces (MPI).	**04 hrs**

Books and References:

Sr. No	Title	Authors	Publisher	Edition	Year
1	Digital Speech Processing, Synthesis and Recognition	SadaokiFuru	Taylor & Francis	Second	2000
2	Digital Processing of Speech Signals	Rabiner and Schafer	Pearson Education	Fifth	1979
3	Introduction to Audio Processing	MG Christensen	Springer	Second	2019

Online References:

Sr.No	Website Name	URL	Modules Covered
1.	https://www.udemy.com/	https://www.udemy.com/course/advance-computer-architecture-and organization/?couponCode=IND21PM	M1,M2,M3

2.	https://nptel.ac.in	https://onlinecourses.nptel.ac.in/noc23_cs07/preview	M1,M2,M3, M4,M5,M6
3.	https://www.coursera.org	https://www.coursera.org/learn/comparch	M1,M2,M3, M4,M5,M6

Department of Electronics and Telecommunication Engineering
M.E. Semester II
Choice Based Credit Grading Scheme (CBCGS 2024)
Proposed Syllabus under Autonomy Scheme

<table>
<tr><td colspan="6">M. E. (Communication Technology & Management)</td><td colspan="4">SEM: II</td></tr>
<tr><td colspan="6">Course Name: Professional Elective - 3 (IOT and Applications)</td><td colspan="4">Course Code: PEC- CTMME2015</td></tr>
<tr><td colspan="5">Teaching Scheme (Program Specific)</td><td colspan="5">Examination Scheme (Formative/ Summative)</td></tr>
<tr><td colspan="5">Modes of Teaching / Learning / Weightage</td><td colspan="5">Modes of Continuous Assessment / Evaluation</td></tr>
<tr><td colspan="5">Hours Per Week</td><td colspan="2">Theory (100)</td><td>Practical/Oral/ Presentation</td><td>Term Work</td><td>Total</td></tr>
<tr><td>Theory</td><td>Tutorial</td><td>Practical</td><td>Contact Hours</td><td>Credits</td><td>IA</td><td>ESE</td><td>PR/OR</td><td>TW</td><td rowspan="2">100</td></tr>
<tr><td>3</td><td>-</td><td>-</td><td>3</td><td>3</td><td>25</td><td>75</td><td>-</td><td>-</td></tr>
<tr><td colspan="10">IA: In-Semester Assessment - Paper Duration – 1.5 Hours
ESE: End Semester Examination - Paper Duration - 3 Hours
The weightage of marks for continuous evaluation of Term work/Report: Formative (40%), Timely completion of practical (40%) and Attendance / Learning Attitude (20%)</td></tr>
<tr><td colspan="10">Prerequisite: Under graduate subjects related to Computer Architecture.</td></tr>
</table>

Course Objective:

This course helps students to understand the concept of IOT and M2M, Study IOT architecture and applications in various fields and Study the security and privacy issues in IOT.

Course Outcomes:

At the end of this course, students will be able to

Sr. No.	Course Outcomes	Cognitive levels as per Bloom's Taxonomy
1	Understand the concept of IOT and M2M	L1,L2
2	Study IOT architecture and applications in various fields	L1,L2,L3
3	Study and analyze the security and privacy issues in IOT	L1,L2,L3,L4

Detailed Syllabus:

Module No.	Topics	Hrs.	Cognitive levels as per Bloom's Taxonomy
1	IoT& Web Technology The Internet of Things Today, Time for Convergence, Towards the IoT Universe, Internet of Things Vision, IoT Strategic Research and Innovation Directions, IoT Applications, Future Internet Technologies, Infrastructure, Networks and Communication, Processes, Data Management, Security, Privacy & Trust, Device Level Energy Issues, IoT Related Standardization, Recommendations on Research Topics.	**07hrs**	L1,L2
2	M2M to IoT – A Basic Perspective– Introduction, Some Definitions, M2M Value Chains, IoT Value Chains, An emerging industrial structure for IoT, The international driven global value chain and global information monopolies. M2M to IoT-An Architectural Overview– Building an architecture, Main design principles and needed capabilities, An IoT architecture outline, standards considerations.	**09hrs**	L1,L2,L3
3	IoT Architecture -State of the Art – Introduction, State of the art, Architecture Reference Model- Introduction, Reference Model and architecture, IoT reference Model, IoT Reference Architecture-Introduction, Functional View, Information View, Deployment and Operational View, Other Relevant architectural views.	**04hrs**	L1,L2,L3
4	IoT Applications for Value Creations Introduction, IoT applications for industry: Future Factory Concepts, Brownfield IoT, Smart Objects, Smart Applications, Four Aspects in your Business to Master IoT, Value Creation from Big Data and Serialization, IoT for Retailing Industry, IoT For Oil and Gas Industry, Opinions on IoT Application and Value for Industry, Home Management, eHealth.	**09hrs**	L1,L2,L3
5	Internet of Things Privacy, Security and Governance Introduction, Overview of Governance, Privacy and Security Issues	**10hrs**	L1,L2,L3, L4
6	Contribution from FP7 Projects, Security, Privacy and Trust in IoT-Data-Platforms for Smart Cities, First Steps Towards a Secure Platform, Smartie Approach. Data Aggregation for the IoT in Smart Cities, Security	**09 hrs**	L1,L2,L3 ,L4
	Total Hours	**45**	

Books and References:

Sr. No	Title	Authors	Publisher	Edition	Year

1	Internet of Things (A Hands-on-Approach)	Vijay Madisetti and Arshdeep Bahga	VPT	1st	2014
2	Rethinking the Internet of Things: A Scalable Approach to Connecting Everything	Francis daCosta	Apress Publications	1st	2013
3	Getting Started with the Internet of Things	CunoPfister,	O Reilly Media	--	2011

Online References:

Sr. No.	Website Name	URL	Modules Covered
1	Udemy	Internet of Things (IoT) Fundamentals Certification Training | Udemy	M1, M3, M4, M5, M6
2	NPTEL	https://onlinecourses.nptel.ac.in/noc21_cs17	M1 - M6
3	Coursera	Introduction to the Internet of Things and Embedded Systems | Coursera/	M1 - M6

Department of Electronics and Telecommunication Engineering
M.E. Semester II
Choice Based Credit Grading Scheme (CBCGS 2024)
Proposed Syllabus under Autonomy Scheme

<table>
<tr><td colspan="8">M. E. (Communication Technology & Management)</td><td colspan="3">SEM: II</td></tr>
<tr><td colspan="8">Course Name: Professional Elective- 3 (Audio Processing)</td><td colspan="3">Course Code: PEC- CTMME2016</td></tr>
<tr><td colspan="5">Teaching Scheme (Program Specific)</td><td colspan="6">Examination Scheme (Formative/ Summative)</td></tr>
<tr><td colspan="5">Modes of Teaching / Learning / Weightage</td><td colspan="6">Modes of Continuous Assessment / Evaluation</td></tr>
<tr><td colspan="5" rowspan="2">Hours Per Week</td><td colspan="2">Theory (100)</td><td>Practical/Oral/ Presentation</td><td>Term Work</td><td>Total</td></tr>
<tr><td>Theory</td><td>Tutorial</td><td>Practical</td><td>Contact Hours</td><td>Credits</td><td>IA</td><td>ESE</td><td>PR/OR</td><td>TW</td><td>100</td></tr>
<tr><td>3</td><td>-</td><td>-</td><td>3</td><td>3</td><td>25</td><td>75</td><td>-</td><td>-</td><td></td></tr>
<tr><td colspan="10">IA: In-Semester Assessment - Paper Duration – 1.5 Hours
ESE: End Semester Examination - Paper Duration - 3 Hours
The weightage of marks for continuous evaluation of Term work/Report: Formative (40%), Timely completion of practical (40%) and Attendance / Learning Attitude (20%)</td></tr>
<tr><td colspan="10">Prerequisite: Under graduate subjects related to Signal Processing.</td></tr>
</table>

Course Objectives:

This course helps students to understand different characteristics of Speech, Identify and analyze different speech analysis system and Write algorithms for Recognition of speech.

Course Outcomes:

At the end of this course, students will be able to explain:

Sr. No.	Course Outcomes	Cognitive levels as per Bloom's Taxonomy
1	Understand different characteristics of Speech	L1,L2
2	Identify and analyze different speech analysis system	L1,L2,L3,L4
3	Analyze different Linear Predictive Coding	L1,L2,L3,L4
4	Analyze different speech analysis and synthesis systems	L1,L2,L3
5	Design speech recognition system and identify implementation issues	L1,L2,L3,L4,L6
6	Understand models for automatic speech recognition	L1,L2,L3,L4,L5

Detailed Syllabus:

Module No.	Topics	Hrs.	Cognitive levels as per Bloom's Taxonomy
1	Principle Characteristics of Speech: Linguistic information, Speech and Hearing, Speech production mechanism, Acoustic characteristic of speech Statistical Characteristics of speech. Speech production models, Linear Separable equivalent circuit model, Vocal Tract and Vocal Cord Model.	**08hrs**	L1,L2
2	Speech Analysis and Synthesis Systems: Digitization, Sampling, Quantization and coding, Spectral Analysis, Spectral structure of speech, Autocorrelation and Short Time Fourier transform, Window function, Sound Spectrogram, Mel frequency Cepstral Coefficients, Filter bank and Zero Crossing Analysis, Analysis –by-Synthesis, Pitch Extraction.	**07hrs**	L1,L2,L3
3	Linear Predictive Coding Analysis: Principle of LPC analysis, Maximum likelihood spectral estimation, Source parameter estimation from residual signals, LPC Encoder and Decoder, PARCOR analysis and Synthesis, Line Spectral Pairs, LSP analysis and Synthesis.	**05hrs**	L1,L2,L3.L4
4	Speech Coding: Reversible coding, Irreversible coding and Information rate distortion theory, coding in time domain: PCM, ADPCM, Adaptive Predictive coding, coding in Frequency domain: Sub band coding, Adaptive transform coding, Vector Quantization, Code Excited Linear Predictive Coding (CELP).	**08hrs**	L1,L2,L3
5	Speech Recognition: Principles of speech recognition, Speech period detection, Spectral distance measure, Structure of word recognition system, Dynamic Time Warping (DTW), Theory and implementation of Hidden Markov Model (HMM).	**08hrs**	L1,L2,L3,L4 ,L6
6	Speaker recognition: Human and Computer speaker recognition Principles Text dependent and Text Independent speaker recognition systems. Applications of speech Processing.	**09hrs**	L1,L2,L3, L4,L5
	Total Hours	**45**	

Books and References:

Sr. No	Title	Authors	Publisher	Edition	Year
1	Digital Speech Processing, Synthesis and Recognition	SadaokiFuru	Taylor & Francis	Second	2000
2	Digital Processing of Speech Signals	Rabiner and Schafer	Pearson Education	Fifth	1979

3	Introduction to Audio Processing	MG Christensen	Springer	Second	2019

Online References:

Sr. No.	Website Name	URL	Modules Covered
1	https://www.coursera.org	https://www.coursera.org/learn/audio-signal-processing	M1,M2,M3,
2	https://online.stanford.edu/	https://online.stanford.edu/courses/soh s-ymusic0001-audio-signal-processing-music-applications	M4,M5,M6
3	https://www.udemy.com/	https://www.udemy.com/topic/signal-processing/	M1,M2,M3,M4,M5,M6

Department of Electronics and Telecommunication Engineering
M.E. Semester II
Choice Based Credit Grading Scheme (CBCGS 2024)
Proposed Syllabus under Autonomy Scheme

M. E. (Communication Technology & Management)							**SEM: II**		
Course Name: Professional Elective - 3 (Management Information System)							**Course Code:** PEC- CTMME2017		
Teaching Scheme (Program Specific)					**Examination Scheme (Formative/ Summative)**				
Modes of Teaching / Learning / Weightage					**Modes of Continuous Assessment / Evaluation**				
Hours Per Week					**Theory (100)**		**Practical/Oral/ Presentation**	**Term Work**	**Total**
Theory	**Tutorial**	**Practical**	**Contact Hours**	**Credits**	**IA**	**ESE**	**PR/OR**	**TW**	**100**
3	-	-	3	3	25	75	-	-	
IA: In-Semester Assessment - Paper Duration – 1.5 Hours **ESE: End Semester Examination - Paper Duration - 3 Hours** **The weightage of marks for continuous evaluation of Term work/Report:** Formative (40%), Timely completion of practical (40%) and Attendance / Learning Attitude (20%)									
Prerequisite: No prerequisites									

Course Objective: The course intends to deliver the role of Management in Information Systems to understand the impact of these systems within an organization to improve business performance and decision making. It analyzes typicalfunctional information systems, principal tools and technologies for accessing information from databases & interpreting Ethical issues & Privacy for the same.

Course Outcomes: Upon completion of the course students will be able to:

Sr. No.	**Course Outcomes**	**Cognitive levels of attainment as perBloom's Taxonomy**
1	Explain how information systems Transform Business	L1, L2
2	Understand about Data and Knowledge Management	L1, L2, L3
3	Analyze the Ethical issues and Privacy in Information Systems	L1, L2, L3, L4
4	Understand the principal tools and technologies for accessing information fromdatabases to improve business performance and decision making	L1, L2, L3
5	Analyze the types of systems used for enterprise-wide knowledge management andhow they provide value for businesses	L1, L2, L3, L4
6	Analyze the impact of information systems have on an organization	L1, L2, L3, L4

Detailed Syllabus:

Module No.	Topics	Hrs	Cognitive levels of attainment as per Bloom's Taxonomy
1	**Introduction To Information Systems (IS)** Computer Based Information Systems, Impact of IT on organizations, Importance of IS to Society. Organizational Strategy, Competitive Advantages and IS	6	L1, L2
2	**Data and Knowledge Management** Database Approach, Big Data, Data warehouse and Data Marts, Knowledge Management Business intelligence (BI): Managers and Decision Making, BI for Data analysis and Presenting Results	8	L1, L2, L3
3	**Ethical issues and Privacy** Information Security. Threat to IS, and Security Controls	7	L1, L2, L3, L4
4	**Social Computing (SC)** Web 2.0 and 3.0, SC in business-shopping, Marketing, Operational and Analytic CRM, E-business and E-commerce – B2B B2C. Mobile commerce.	8	L1, L2, L3
5	**Wired and Wireless Technology** Computer Networks Wired and Wireless Technology, Pervasive computing, Cloud computing model.	7	L1, L2, L3, L4
6	**Information System within Organization** Transaction Processing Systems, Functional Area Information System, ERP and ERP support of Business Process. Acquiring Information Systems and Applications: Various System development life cycle models	8	L1, L2, L3, L4
	Total Hours	**45**	

Books and References:

Sr. No.	Title	Authors	Publisher	Edition	Year
1.	Management Information Systems	Kelly Rainer, Brad Prince	Wiley	Sixth Edition	2011
2.	Management Information Systems	K.C. Laudon and J.P. Laudon	Prentice Hall	Tenth Edition	2007
3.	Managing Information Systems: Strategy and Organization	D. Boddy, A. Boonstra	Prentice Hall	Tenth Edition	2008

Online References:

Sr. No	Website Name	URL	Modules Covered
1	https://www.tutorialspoint.com/index.htm	https://www.tutorialspoint.com/management_information_system/	M1
2	https://www.tutorialspoint.com/index.htm	https://www.tutorialspoint.com/management_information_system/in formati on_need_objective.htm	M2
3	https://www.tutorialspoint.com/index.htm	https://www.tutorialspoint.com/management_information_system/m is_secu rity_and_ethical_issues.htm	M3
4	https://www.tutorialspoint.com/index.htm	https://www.tutorialspoint.com/management_information_system/sy stem_d evelopment_life_cycle.htm	M4
5	https://pressbooks.com/	https://bus206.pressbooks.com/chapter/chapter-13-future-trends-in-information-systems/	M5
6	https://www.tutorialspoint.com/index.htm	https://www.tutorialspoint.com/management_information_system/b usiness continuity_planning.htm	M6

Department of Electronics and Telecommunication Engineering
M.E. Semester II
Choice Based Credit Grading Scheme (CBCGS 2024)
Proposed Syllabus under Autonomy Scheme

M. E. (Communication Technology & Management)									**SEM: II**
Course Name: Professional Elective -3 (Design Thinking and Innovation Management)									**Course Code:** PEC- CTMME2018
Teaching Scheme (Program Specific)					**Examination Scheme (Formative/ Summative)**				
Modes of Teaching / Learning / Weightage					**Modes of Continuous Assessment / Evaluation**				
Hours Per Week					**Theory (100)**		**Practical/Oral/ Presentation**	**Term Work**	**Total**
Theory	**Tutorial**	**Practical**	**Contact Hours**	**Credits**	**IA**	**ESE**	**PR/OR**	**TW**	**100**
3	-	-	3	3	25	75	-	-	
IA: In-Semester Assessment - Paper Duration – 1.5 Hours **ESE: End Semester Examination - Paper Duration - 3 Hours** **The weightage of marks for continuous evaluation of Term work/Report:** Formative (40%), Timely completion of practical (40%) and Attendance / Learning Attitude (20%)									
Prerequisite: Not required									

Course Objective: This course introduces students to the principles and practices of design thinking and innovation management. It explores methods for identifying user needs, generating creative solutions, and managing the innovation process within organizations.

Course Outcomes: Upon completion of the course students will be able to:

Sr. No.	Course Outcomes	Cognitive levels of attainment as per Bloom's Taxonomy
1	Understand the key principles and stages of design thinking.	L1,L2
2	Develop skills in empathy, ideation, prototyping, and testing	L1,L2,L3,L4
3	Learn to manage innovation processes within organizations.	L1,L2,L3,L4
4	Apply standard problem-solving heuristics to aid in problem solving.	L1,L2,L3,L4,L5,L6
5	Apply design thinking to improve on existing products in IT	L1,L2,L3,L4,L5,L6
6	Foster a culture of innovation and creativity in teams	L1,L2,L3,L4,L5, L6

Detailed Syllabus:

Module No.	Topics	Hrs.	Cognitive levels of attainment as per Bloom's Taxonomy
1	**Design Thinking Introduction, Team Formation, Documentation and Canvas** Introduction , Need of Design Thinking, Traditional Problem Solving versus Design Thinking, phases of Design Thinking, Tools for Design Thinking, Relevance of Design and Design Thinking in Engineering, Team Formation, Documentation and Canvas Team Building Domain Selection (Society/Industry project), Log Books-need, types of log book, preparation of log book, Importance of Documentation, Strategy Design,	7	L1,L2
2	**Design Thinking Exercise** Formation of Team and aspects for the selection, Domain selection, Observation exercise, Design activities through Canvas, Brainstorming for the problem, Users Interview conduction, generation of records via Logbooks, Importance of iteration in the design process	8	L1,L2,L3,L4
3	**Problem Solving Skills Introduction** Developing logical thinking. Introduction to Problem Solving in Computer Science domain, Errors in reasoning; verbal reasoning; analogy problems lateral thinking, Problem Solving Techniques Deductive and hypothetical reasoning; computational problem solving; generating, implementing, and evaluating solutions; interpersonal problem solving, Group Activities based assignments related to problem solving skills will be given for better understanding and development of problem solving skills	8	L1,L2,L3,,L4
4	**Tools for Design Thinking** Theory and practice in Design thinking – Exploring work of Designers across globe – MVP or Prototyping, Real-Time design interaction capture and analysis – Enabling efficient collaboration in digital space – Empathy for design – Collaboration in distributed Design	7	L1,L2,L3,L4,L5,L6
5	**Design Thinking in IT** Design Thinking to Business Process modeling – Agile in Virtual collaboration environment – Scenario based Prototyping, Strategies for integrating design thinking into business processes	7	L1,L2,L3,L4,L5,L6

6	**Design Thinking For strategic innovations** DT for strategic innovations – Growth – Story telling- Predictability – Strategic Foresight - Change – Sense Making- Maintenance Relevance – Value redefinition - Extreme Competition – experience design - Standardization– Humanization - Creative Culture – Rapid prototyping, Strategy and Organization – Business Model design.	8	L1,L2,L3,L4,L5,L6
	Total Hours	**45**	

Books and References:

Sr. No	Title	Authors	Publisher	Edition	Year
1	Strategies for Creative Problem Solving	H. S. Fogler and S. E. LeBlanc	Pearson,	Second	2008
2	Problem Solving & Comprehension	A. Whimbey and J. Lochhead	Lawrence Erlbaum,Mahwah,	Sixth	1999
3	The Design of Business: Why Design Thinking is the Next Competitive Advantage	Roger Martin	Harvard BusinessPress	First	2009
4	Design Thinking: Understand – Improve – Apply	Hasso Plattner, Christoph Meinel and Larry Leifer	Springer, 2011 (UnitIII)	First	2011
5	Design Thinking for Strategic Innovation: What They Can't Teach You at Business orDesign School. (Unit IV).	Idris Mootee	John Wiley & Sons2013	First	2013
6	Effective Problem Solving	M. Levine	Prentice Hall	Second	1994

Online References:

Sr. No.	Website Name	URL	Modules Covered
1	https://www.coursera. org	https://www.coursera.org/learn/uva-darden-design-thinkinginnovation	M1,M2,M3,
2	http://www.cs.odu.edu	http://www.cs.odu.edu/~cs381/cs381content/proble m_solving/problem_solving.html	M4,M5,M6
3	https://www.cs.vt.edu	https://www.cs.vt.edu/undergraduate/courses/CS2104	M1,M2,M3,M4,M5,M6
4	https://ryanstutorials.net	https://ryanstutorials.net/problem-solving-skills/	M3,M4
5	https://dschool.stanford.edu	https://dschool.stanford.edu/.../designresources/.../ModeGuideBOOTCAMP2010L.pdf	M1,M2,M3,M5
6	https://dschool.stanford.edu	https://dschool.stanford.edu/use-our-methods/	M4,M5,M6
7	https://www.interaction-design.org	https://www.interaction-design.org/literature/article/5-stages-in-the-design-thinking-process	M1,M2,M5,M6
8	http://www.creativity atwork.com	http://www.creativityatwork.com/design-thinking-strategy-for-innovation/49	M1,M2,M5,M6
9	https://www.nngroup.com	https://www.nngroup.com/articles/design-thinking/	M1,M2,M3,M4,M6
10	www.designthinkingformobility.org	www.designthinkingformobility.org/wp-content/.../10/NapkinPitch_Worksheet.pdf	M4,M5,M6

Department of Electronics and Telecommunication Engineering
M.E. Semester II
Choice Based Credit Grading Scheme (CBCGS 2024)
Proposed Syllabus under Autonomy Scheme

M. E. (Electronics & Telecommunication Engineering)							**SEM: II**		
Course Name: Program Elective-3 (Random Process and Statistical Methods)							**Course Code:** PEC- CTMME2019		
Teaching Scheme (Program Specific)					**Examination Scheme (Formative/ Summative)**				
Modes of Teaching / Learning / Weightage					**Modes of Continuous Assessment / Evaluation**				
Hours Per Week					**Theory (100)**		**Practical/Oral/ Presentation**	**Term Work**	**Total**
Theory	**Tutorial**	**Practical**	**Contact Hours**	**Credits**	**IA**	**ESE**	**PR/OR**	**TW**	**100**
3	-	-	3	3	25	75	-	-	
IA: In-Semester Assessment - Paper Duration – 1.5 Hours **ESE: End Semester Examination - Paper Duration - 3 Hours** **The weightage of marks for continuous evaluation of Term work/Report:** Formative (40%), Timely completion of practical (40%) and Attendance / Learning Attitude (20%)									
Prerequisite: Engineering Mathematics									

Course Objective: Course aims to introduce the students to the idea of random variables, distribution and random process, an important mathematical tool in signal processing. The queuing theory concepts are also introduced.

Course Outcomes: Upon completion of the course students will be able to:

Sr. No.	Course Outcomes	Cognitive levels of attainment as per Bloom's Taxonomy
1	Obtain fundamental knowledge of the basic probability concepts and standard distributions which can describe real life phenomena.	L1, L2
2	Acquire skills in handling situations involving more than one random variable and functions of random variables.	L1, L2, L3
3	Understand & characterize phenomena which evolve w.r.t. time in a probabilistic manner.	L1, L2, L3, L4, L5
4	Obtain fundamental knowledge of the basic probability	L1, L2, L3, L4, L5
5	Apply basic characteristic features of a queuing system and acquire skills in analysing queuing models.	L1, L2, L3, L4, L5

Detailed Syllabus:

Module No	Topics	Hrs	Cognitive levels of attainment as per Bloom's Taxonomy
1	**Probability and Random Variables** Introduction to probability theory, Random variables, Moments, Moment Generating Functions and their properties, commonly used continuous and discrete distributions and their properties, functions of a random variable.	08	L1, L2
2	**Two-Dimensional Random Variables** Joint distributions, Marginal and Conditional distributions, Covariate, Correlation and regression, Transformation of random variables, Central Limit Theorem.	10	L1, L2, L3
3	**Random Process and Markov Chain** Classification, Stationary process, Markov process, Poisson process, birth and death process, Markov chains, Transition probabilities, Limiting distributions, Steady state and transient analysis.	08	L1, L2, L3, L4, L5
4	**Simulation Random Number Generation** Pseudo random numbers, Methods of generation and testing, methods for generating conditions and discrete distributions, Monto Carlo techniques	08	L1, L2, L3
5	**Queueing Theory** Markovian models-M/M/1, M/M/C, finite and infinite capacity-M/M/∞ queues, Finite source model, M/G/1 queue (steady state solutions only).	06	L1, L2, L3, L4
6	**Networks and Flows in Queueing** Pollaczek-Khintchine formula, Special cases, Networks and Flows, Flow cuts, Max flow min theorems-Perfect square.	05	L1, L2, L3, L4, L5
	Total Hours	**45**	

Books and References:

Sr. No.	Title	Authors	Publisher	Edition	Year
1	Stochastic Processes	Ross S.M.	John Wiley & Sons	Third Edition	2010
2	Stochastic Processes	Medhi J.	New Age International	Third Edition	2012
3	Operations Research- An Introduction	Taha H.A.	Pearson Education Asia	Seventh Edition	2012
4	Statistics and Random Processes	Veerarajan. T.	Tata McGraw Hill	Second Edition	2003
5	Probability, Statistics and Queueing Theory	Allen. A.O.	Academic Press	First Edition	1981
6	"Introduction to Probability Models	Sheldon M. Ross	Academic press	Seventh Edition	2002

Online References:

Sr. No.	Website Name	URL	Modules Covered
1	https://onlinecourses.nptel.ac.in/	Introduction to Probability Theory and Stochastic Processes - Course (nptel.ac.in)	M1-M6
2	https://onlinecourses.nptel.ac.in/	Probability Foundations for Electrical Engineers - Course (nptel.ac.in)	M1-M6

Choice Based Credit Grading Scheme (CBCGS 2024)
Proposed Syllabus under Autonomy Scheme

M. E. (Communication Technology & Management)							**SEM**: II		
Course Name: Program Elective-4 (Markov Chains and Queueing Systems)							**Course Code:** PEC-CTMME2021		
Teaching Scheme (Program Specific)					**Examination Scheme (Formative/ Summative)**				
Modes of Teaching / Learning / Weightage					**Modes of Continuous Assessment / Evaluation**				
Hours Per Week					**Theory (100)**		**Practical/Oral/ Presentation**	**Term Work**	**Total**
Theory	**Tutorial**	**Practical**	**Contact Hours**	**Credits**	**IA**	**ESE**	**PR/OR**	**TW**	**100**
3	-	-	3	3	25	75	-	-	
IA: In-Semester Assessment - Paper Duration – 1.5 Hours **ESE: End Semester Examination - Paper Duration - 3 Hours** **The weightage of marks for continuous evaluation of Term work/Report:** Formative (40%), Timely completion of practical (40%) and Attendance / Learning Attitude (20%)									
Prerequisite: Probability Theory									

Course Objective:

At the end of this course, students should be able to understand basic probability concepts and Renewal Processes, to illustrate continuous time and discrete time Markov chains and to explain fundamental queuing models and advanced queuing models

Course Outcomes:

At the end of this course, students will be able to

Sr. No.	**Course Outcomes**	**Cognitive levels as per Bloom's Taxonomy**
1	Explain the concepts of probability theory	L1, L2
2	Illustrate Renewal Processes along with basic definitions point processes, Poisson process, Walds equation, Blackwell's theorem.	L1, L2
3	Understand Markov Chains and regenerative processes used in modelling a wide variety of systems and phenomena.	L1, L2, L3
4	Model a system as queuing system with some aspect of the queue governed by a random process.	L1, L2, L3
5	Understand telecommunication systems modelling using Markov chains with special emphasis on developing queuing models.	L1, L2, L3
6	Discuss about advanced queuing models	L1, L2, L3, L4

Detailed Syllabus:

Module No.	Topics	Hrs.	Cognitive levels as per Bloom's Taxonomy
1	Introduction: Review of basic probability, properties of nonnegative random variables, laws of large numbers and the Central Limit Theorem.	08hrs	L1, L2
2	Renewal Processes: Basic definitions, recurrence times, rewards and renewal reward theorem, point processes, Poisson process, Walds equation, Blackwell's theorem.	07hrs	L1, L2
3	Discrete time Markov chains: definitions and properties, matrix representation, Perron- Frobenius theory.	07hrs	L1, L2, L3
4	Continuous time Markov chains: basic definitions, Q-matrix, birth-death processes, quasi birth death processes. Embedded Markov processes, semi Markov processes, reversible Markov chains, Random walks.	08hrs	L1, L2, L3
5	Fundamental queuing results: Little's theorem, invariance of the mean delay, Conservation law. Markovian queues: Jackson and BCMP networks, numerical Algorithms. M/G/1 & G/M/1 queues and G/G/1 queues.	09hrs	L1, L2, L3
6	Advanced queuing models: priority, vacation and retrials in queues.	06hrs	L1, L2, L3, L4
	Total Hours	**45**	

Books and References:

Sr. No.	Title	Authors	Publisher	Edition	Year
1	Stochastic Modelling and the Theory Queues	Cliff	Prentice Hall	--	1989
2	Markov Chains	P.Bremaud	Springer-Verlag	--	1999
3	Non Negative Matrices and Markov Chains	E.Seneta.	Springer Series in Statistics	--	1981
4	Discrete Stochastic Processes	R.Gallager	Kluwer Academic Press	--	1996

5	Probability, Statistics and Queueing Theory	Allen. A.O.	Academic Press	First Edition	1981
6	Queuing Systems	L.Kleinrock	John Wiley and Sons	--	1976

Online References:

Sr. No.	Website Name	URL	Modules Covered
1	NPTEL	Introduction To Queueing Theory - Course (nptel.ac.in)	M1, M2, M3
2	NPTEL	Stochastic Processes - Course (nptel.ac.in)	M4, M5, M6

Department of Electronics and Telecommunication Engineering
M.E. Semester II
Choice Based Credit Grading Scheme (CBCGS 2024)
Proposed Syllabus under Autonomy Scheme

M. E. (Communication Technology & Management)							SEM: II		
Course Name: Program Elective-4 (MIMO System)							Course Code: PEC- CTMME2022		
Teaching Scheme (Program Specific)					Examination Scheme (Formative/ Summative)				
Modes of Teaching / Learning / Weightage					Modes of Continuous Assessment / Evaluation				
Hours Per Week					Theory (100)		Practical/Oral/ Presentation	Term Work	Total
Theory	Tutorial	Practical	Contact Hours	Credits	IA	ESE	PR/OR	TW	100
3	-	-	3	3	25	75	-	-	
IA: In-Semester Assessment - Paper Duration – 1.5 Hours ESE: End Semester Examination - Paper Duration - 3 Hours **The weightage of marks for continuous evaluation of Term work/Report:** Formative (40%), Timely completion of practical (40%) and Attendance / Learning Attitude (20%)									
Prerequisite: Undergraduate subjects related to Antenna & Wave Propagation and Communication									

Course Objective:

At the end of this course, students shall be able to understand MIMO for multi-carrier, multi-user communication. To describe generic MIMO problems and Pre-coding and combining in MIMO systems. To illustrate introduction to MIMO in 4G (LTE, LTE-Advanced, WiMAX).To analyze mathematical model of MIMO systems.

Course Outcome: At the end of this course, students will be able to

Sr. No.	Course Outcomes	Cognitive levels as per Bloom's Taxonomy
1	Explain diversity and Spatial Multiplexing in MIMO	L1, L2
2	Illustrate space time coding for MIMO	L1, L2
3	Describe generic MIMO problem and Pre-coding and combining in MIMO systems	L1, L2
4	Classify between different beam forming techniques.	L1, L2
5	Apply concepts of MIMO in 4G (LTE, LTE-Advanced, WiMAX).	L1, L2, L3
6	Analyze mathematical modeling of MIMO.	L1, L2, L3, L4

Detailed Syllabus:

Module No.	Topics	Hrs.	Cognitive levels as per Bloom's Taxonomy
1	Introduction to Multi-antenna Systems, Motivation, Types of multi- antenna systems, MIMO vs. multi-antenna systems.	06hrs	L1, L2
2	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	08hrs	L1, L2
3	The generic MIMO problem, Singular Value Decomposition, Eigen values and eigenvectors, Equalizing MIMO systems, Disadvantages of equalizing 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.	08hrs	L1, L2
4	Codebooks for MIMO, Beamforming, Beamforming principles, Increased spectrum efficiency, Interference cancellation, Switched beam former, Adaptive beam former, Narrowband beam former, Wideband beam former	07hrs	L1, L2
5	Case study: MIMO in LTE, Code words to layers mapping, Pre-coding for spatial multiplexing, Pre-coding for transmit diversity, Beamforming 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	08hrs	L1, L2, L3
6	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.	08hrs	L1, L2, L3, L4
	Total Hours	**45**	

Books and References:

Sr. No.	Title	Authors	Publisher	Edition	Year

1	MIMO Wireless Communications : From Real-world Propagation to Space-time Code Design	Claude Oestges, Bruno Clerckx	Academic Press	1st Edition	2010
2	Space - Time Codes and MIMO Systems	Mohinder Janakiraman	Artech House Publishers	Second Edition	2004

Online References:

Sr. No.	Website Name	URL	Modules Covered
1	NPTEL	Principles of Modern CDMA/ MIMO/ OFDM Wireless Communications - Course (nptel.ac.in)	M4, M5, M6
2	Coursera	Foundations of Advanced Wireless Communication	M1, M2, M3

Department of Electronics and Telecommunication Engineering
M.E. Semester II
Choice Based Credit Grading Scheme (CBCGS 2024)
Proposed Syllabus under Autonomy Scheme

M. E. (Communication Technology & Management)							**SEM: II**		
Course Name: Program Elective-4 (Programmable Networks – SDN, NFV)							**Course Code:** PEC- CTMME2023		
Teaching Scheme (Program Specific)					**Examination Scheme (Formative/ Summative)**				
Modes of Teaching / Learning / Weightage					**Modes of Continuous Assessment / Evaluation**				
Hours Per Week					**Theory (100)**		**Practical/Oral/ Presentation**	**Term Work**	**Total**
Theory	**Tutorial**	**Practical**	**Contact Hours**	**Credits**	**IA**	**ESE**	**PR/OR**	**TW**	**100**
3	-	-	3	3	25	75	-	-	
IA: In-Semester Assessment - Paper Duration – 1.5 Hours **ESE: End Semester Examination - Paper Duration - 3 Hours** **The weightage of marks for continuous evaluation of Term work/Report:** Formative (40%), Timely completion of practical (40%) and Attendance / Learning Attitude (20%)									
Prerequisites: Principles of Communication, Digital Communication, Computer Networks and Application, Fiber optic, Satellite Communication, Mobile Communication									

Course Objective:

At the end of this course, students shall be able to describe concepts in Programmable Networks like Software Defined Networking and implement protocols and applications in SDN and NFV.

Course Outcomes: Upon completion of the course students will be able to:

Sr. No.	Course Outcomes	Cognitive levels of attainment as perBloom's Taxonomy
1	Understand advanced concepts in Programmable Networks	L1, L2
2	Understand Software Defined Networking, an emerging Internet architectural framework.	L1, L2, L3
3	Implement the main concepts, architectures, algorithms, protocols and applications in SDN and NFV.	L1, L2, L3, L4
4	Implement virtualization of network.	L1, L2, L3, L4, L5
5	Apply basic network topologies for SDN	L1, L2, L3, L4, L5

Detailed Syllabus:

Module No	Topics	Hrs	Cognitive levels of attainment as per Bloom's Taxonomy
1	**Introduction to Programmable Networks** History and Evolution of Software Defined Networking (SDN), Fundamental Characteristics of SDN, Separation of Control Plane and Data Plane, Active Networking.	08	L1, L2
2	**Open Flow Protocol** Control and Data Plane Separation: Concepts, Advantages and Disadvantages, the basics of Open Flow protocol.	10	L1, L2, L3
3	**Network Virtualization** Concepts, Applications, Existing Network Virtualization Framework, Mininet A simulation environment for SDN	08	L1, L2, L3, L4, L5
4	**Control Plane** Overview, Existing SDN Controllers including Floodlight and Open Daylight projects. Customization of Control Plane: Switching and Firewall Implementation using SDN Concepts. Data Plane: Software-based and Hardware-based; Programmable Network Hardware.	08	L1, L2, L3
5	**Programming SDNs** Northbound Application Programming Interface, Current Languages and Tools, Composition of SDNs. Network Functions Virtualization (NFV) and Software Defined Networks: Concepts, Implementation and Applications.	06	L1, L2, L3, L4
6	**Data Center Networks** Packet, Optical and Wireless Architectures, Network Topologies. Use Cases of SDNs: Data Centers, Internet Exchange Points, Backbone Networks, Home Networks, Traffic Engineering.	05	L1, L2, L3, L4, L5
	Total Hours	**45**	

Books and References:

Sr. No.	Title	Author	Publisher	Edition	Year
1	SDN: Software Defined Network, An Authoritative Review of Network Programmability Technologies	Thomas D. Nadeau, Ken Gray	O'Reilly Media	3rd	2013

2	Software Defined Network: A Comprehensive Approach	Paul Gorannson	Morgan Kauffman Publications	3rd	2016
3	Network Innovation through Open Flow and SDN: Principles and Design	Fei Hu	CRC Press	2nd	2014
4	SDN and OpenFlow for Beginners	Vivek Tiwari	Amazon Digital Services	2nd	2013

Online References:

Sr. No.	Website Name	URL	Modules Covered
1	Open Networking Foundation (ONF)	https://www.opennetworking.org	M1-M6
2	OpenFlow standards	http://www.openflow.org	M1-M6

Department of Electronics and Telecommunication Engineering
M.E. Semester II
Choice Based Credit Grading Scheme (CBCGS 2024)
Proposed Syllabus under Autonomy Scheme

M. E. (Communication Technology & Management)							**SEM: II**		
Course Name: Program Elective-4 (Multispectral Signal Analysis)							**Course Code:** PEC- CTMME2024		
Teaching Scheme (Program Specific)					**Examination Scheme (Formative/ Summative)**				
Modes of Teaching / Learning / Weightage					**Modes of Continuous Assessment / Evaluation**				
Hours Per Week					**Theory (100)**		**Practical/Oral/ Presentation**	**Term Work**	**Total**
Theory	**Tutorial**	**Practical**	**Contact Hours**	**Credits**	**IA**	**ESE**	**PR/OR**	**TW**	**100**
3	-	-	3	3	25	75	-	-	
IA: In-Semester Assessment - Paper Duration – 1.5 Hours **ESE: End Semester Examination - Paper Duration - 3 Hours** **The weightage of marks for continuous evaluation of Term work/Report:** Formative (40%), Timely completion of practical (40%) and Attendance / Learning Attitude (20%)									
Prerequisites: Undergraduate courses related to Signal Processing									

Course Objectives:

This course helps students to understand and select appropriate hyper spectral data for a particular application, understand basic concepts of data acquisition and image processing tasks required for multi and hyper spectral data analysis, and learn techniques for classification and analysis of multi and hyper spectral data

Course Outcomes:

At the end of this course, students will be able to

Sr. No.	Course Outcomes	Cognitive levels as per Bloom's Taxonomy
1	Select appropriate hyperspectral data for a particular application.	L1, L2
2	Understand basic concepts of data acquisition and image processing tasks required for multi and hyper-spectral data analysis.	L1, L2

3	Retrieve and analyze the Mutual Information using histogram estimation Methods	L1, L2, L3, L4
4	Learn techniques for classification and analysis of multi and hyperspectral data	L1, L2, L3
5	Explain Support Vector Machines, processes, and applications.	L1, L2, L3
6	Describe different Markov Random Field Models	L1, L2, L3, L4

Detailed Syllabus:

Module No.	Topics	Hrs.	Cognitive levels as per Bloom's Taxonomy
1	Hyperspectral Sensors and Applications: Introduction, Multi-spectral Scanning Systems (MSS), Hyperspectral Systems, Airborne sensors, Space-borne sensors, Ground Spectroscopy, Software for Hyperspectral Processing, Applications, Atmosphere and Hydrosphere, Vegetation, Soils and Geology, Environmental Hazards and Anthropogenic Activity	**07hrs**	L1, L2
2	Overview of Image Processing: Introduction, Image File Formats, Image Distortion and Rectification, Radiometric Distortion, Geometric Distortion and Rectification, Image Registration, Image Enhancement, Point Operations, Geometric Operation, Image Classification, Supervised Classification, Unsupervised Classification, Crisp Classification Algorithms, Fuzzy Classification Algorithms, Classification Accuracy Assessment, Image Change Detection, Image Fusion, Automatic Target Recognition	**07hrs**	L1, L2
3	Mutual Information:A Similarity Measure for Intensity Based Image Registration: Introduction, Mutual Information Similarity Measure,Joint Histogram Estimation Methods, Two-Step Joint Histogram Estimation, One-Step Joint Histogram Estimation, Interpolation Induced Artifacts, Generalized Partial Volume Estimation of Joint Histograms, Optimization Issues in the Maximization of MI	**06hrs**	L1, L2, L3, L4
4	Independent Component Analysis: Introduction, Concept of ICA, ICA Algorithms, Preprocessing using PCA, Information Minimization Solution for ICA, ICA Solution through Non-Gaussianity Maximization, Application of ICA to Hyperspectral Imagery, Feature Extraction Based Model, Linear Mixture Model Based Model, An ICA algorithm for Hyperspectral Image Processing, Applications using ICA.	**08hrs**	L1, L2, L3

5	Support Vector Machines : Introduction, Statistical Learning Theory, Empirical Risk Minimization, Structural Risk Minimization, Design of Support Vector Machines, Linearly Separable Case, Linearly Non-Separable Case, Non-Linear Support Vector Machines, SVMs for Multiclass Classification, One Against the Rest Classification, Pair wise Classification, Classification based on Decision Directed Acyclic Graph and Decision Tree Structure, Multiclass Objective Function, optimization Methods , Applications using SVM.	**09hrs**	L1, L2, L3
6	Markov Random Field Models: Introduction, MRF and Gibbs Distribution, Random Field and Neighborhood ,Cliques, Potential and Gibbs Distributions, MRF Modeling in Remote Sensing Applications, Optimization Algorithms, Simulated Annealing, Metropolis Algorithm, Iterated Conditional Modes Algorithm	**08hrs**	L1, L2, L3, L4
	Total Hours	**45**	

Books and References:

Sr. No.	Title	Authors	Publisher	Edition	Year
1	Advanced Image Processing Techniques for Remotely Sensed Hyperspectral Data	Pramod K. Varshney, Manoj K. Arora	Springer	1st Edition	2013
2	Multi-spectral Imaging– from Astronomy to Microscopy – from Radio waves to Gamma rays	S. Svanberg	Springer Verlag	Second Edition	2009

Online References:

Sr. No.	Website Name	URL	Modules Covered
1	NPTEL	Signals and Systems - Course (nptel.ac.in)	M1, M2, M3
2	Coursera	Foundations of Wavelets and Multirate Digital Signal Processing - Course (nptel.ac.in)	M4, M5, M6

Department of Electronics and Telecommunication Engineering
M.E. Semester II
Choice Based Credit Grading Scheme (CBCGS 2024)
Proposed Syllabus under Autonomy Scheme

M. E. (Communication Technology & Management)							**SEM**: II		
Course Name: Program Elective-4 (**Digital Design and Verification**)							**Course Code:** PEC- CTMME2025		
Teaching Scheme (Program Specific)					**Examination Scheme (Formative/ Summative)**				
Modes of Teaching / Learning / Weightage					**Modes of Continuous Assessment / Evaluation**				
Hours Per Week					**Theory (100)**		**Practical/Oral/ Presentation**	**Term Work**	**Total**
Theory	**Tutorial**	**Practical**	**Contact Hours**	**Credits**	**IA**	**ESE**	**PR/OR**	**TW**	**100**
3	-	-	3	3	25	75	-	-	
IA: In-Semester Assessment - Paper Duration – 1.5 Hours **ESE: End Semester Examination - Paper Duration - 3 Hours** **The weightage of marks for continuous evaluation of Term work/Report:** Formative (40%), Timely completion of practical (40%) and Attendance / Learning Attitude (20%)									
Prerequisites: Undergraduate courses related to Signal Processing									

Course Objectives:

This course helps students to understand Familiarity of Front end design and verification techniques and create reusable test environments, Verify increasingly complex designs more efficiently and effectively and Use EDA tools like Cadence, Mentor Graphics.

Course Outcomes: Upon completion of the course students will be able to:

Sr. No.	Course Outcomes	Cognitive levels of attainment as per Bloom's Taxonomy
1	Understand front end design and verification techniques and create reusable test environments	L1,L2
2	Understand & verify increasingly complex designs more efficiently and effectively	L1,L2,L3,L4
3	Analyze EDA tools like Cadence, Mentor Graphics	L1,L2,L3,L4
4	Understand and analyze current challenges in physical design	L1,L2,L3,L4
5	Understand and analyze Programmable Logic Devices	L1,L2,L3,L4
6	Understand and analyze IP and Prototyping	L1,L2,L3,L4

Detailed Syllabus:

Module No.	Topics	Hrs.	Cognitive levels of attainment as per Bloom's Taxonomy
1	Revision of basic Digital systems: Combinational Circuits, Sequential Circuits, Logic families, Synchronous FSM and asynchronous design, Metastability, Clock distribution and issues, basic building blocks like PWM module, pre-fetch unit, programmable counter, FIFO, Booth's multiplier, ALU, Barrel shifter etc.	**08hrs**	L1,L2
2	Verilog/VHDL Comparisons and Guidelines, Verilog: HDL fundamentals, simulation, and test- bench design, Examples of Verilog codes for combinational and sequential logic, Verilog AMS	**07hrs**	L1,L2,L3,L4
3	System Verilog and Verification: Verification guidelines, Data types, procedural statements and routines, connecting the test bench and design, Assertions, Basic OOP concepts, Randomization, Introduction to basic scripting language: Perl, Tcl/Tk	**05hrs**	L1,L2,L3,L4
4	Current challenges in physical design: Roots of challenges, Delays: Wire load models Generic PD flow, Challenges in PD flow at different steps, SI Challenge - Noise & Crosstalk, IR Drop, Process effects: Process Antenna Effect & Electromigration	**08hrs**	L1,L2,L3,L4
5	Programmable Logic Devices: Introduction, Evolution: PROM, PLA, PAL, Architecture of PAL's, Applications, Programming PLD's, FPGA with technology: Antifuse, SRAM, EPROM, MUX, FPGA structures, and ASIC Design Flows, Programmable Interconnections, Coarse grained reconfigurable devices	**09hrs**	L1,L2,L3,L4
6	IP and Prototyping: IP in various forms: RTL Source code, Encrypted Source code, Soft IP, Netlist, Physical IP, and Use of external hard IP during prototyping, Case studies, and Speed issues. Testing of logic circuits: Fault models, BIST, JTAG interface	**11hrs**	L1,L2,L3,L4
	Total Hours	**45**	

Books and References:

Sr. No	Title	Authors	Publisher	Edition	Year
1	HDL Chip Design: A Practical Guide for Designing, Synthesizing & Simulating ASICs & FPGAs Using VHDL or Verilog	Douglas Smith	Doone publications	--	1998
2	Verilog HDL: A guide to Digital Design and Synthesis	Samir Palnitkar	Prentice Hall	Second	2003
3	FPGA based Prototyping Methodology Manual	Doug Amos, Austin Lesea, Rene Richter	Synopsys Press	Second	2011
4	Introduction to Reconfigurable Computing, Architectures, Algorithms and Applications	Christophe Bobda	Springer	Second	2007
5	Writing Testbenches: Functional Verification of HDL Models	Janick Bergeron	Springer	Second	2003

Online References:

Sr. No.	Website Name	URL	Modules Covered
1	https:// nptel.ac.in /	https://archive.nptel.ac.in/noc/courses/noc16/SEM2/noc16-ec08/	M4,M5,M6
2	https://www.udemy.com/	https://www.udemy.com/course/verilog-hdl-fundamentals-for-digital-design-and-verification	M1,M2,M3,M4,M5,M6

Department of Electronics and Telecommunication Engineering
M.E. Semester II
Choice Based Credit Grading Scheme (CBCGS 2024)
Proposed Syllabus under Autonomy Scheme

M. E. (Communication Technology & Management)							**SEM: II**		
Course Name: Program Elective-4 (**Biomedical Signal Processing**)							**Course Code:** PEC- CTMME2026		
Teaching Scheme (Program Specific)					**Examination Scheme (Formative/ Summative)**				
Modes of Teaching / Learning / Weightage					**Modes of Continuous Assessment / Evaluation**				
Hours Per Week					**Theory (100)**		**Practical/Oral/ Presentation**	**Term Work**	**Total**
Theory	**Tutorial**	**Practical**	**Contact Hours**	**Credits**	**IA**	**ESE**	**PR/OR**	**TW**	**100**
3	-	-	3	3	25	75	-	-	
IA: In-Semester Assessment - Paper Duration – 1.5 Hours **ESE: End Semester Examination - Paper Duration - 3 Hours** **The weightage of marks for continuous evaluation of Term work/Report:** Formative (40%), Timely completion of practical (40%) and Attendance / Learning Attitude (20%)									
Prerequisites: Undergraduate courses related to Signal Processing									

Course Objectives:

This course helps students to understand different types of biomedical signal, Identify and analyze different biomedical signals and find applications related to biomedical signal processing

Course Outcomes: Upon completion of the course students will be able to:

SN	Course Outcomes	Cognitive levels of attainment as per Bloom's Taxonomy
1	Understand basic bioelectric signals of human body coming from muscle cell	L1, L2
2	Understand various transducers and electrodes as well as the principle and working of various cardiovascular parameters for bioelectric signals	L1, L2, L3
3	Understand various mathematical analysis for Biomedical signal processing	L1, L2, L3
4	Understand basic Classification of signals and noise for Biomedical signal processing	L1, L2, L3
5	Apply Principal component analysis for Biomedical signal processing	L1, L2, L3,L4,L5
6	Apply Pattern classification for biomedical signals	L1, L2, L3,L4,L5

Detailed Syllabus:

Module No.	Topics	Hrs.	Cognitive levels of attainment as

			per Bloom's Taxonomy
1	Acquisition, Generation of Bio-signals, Origin of bio-signals, Types of bio-signals, Study of diagnostically significant bio-signal parameters	**05**	L1, L2
2	Electrodes for bio-physiological sensing and conditioning, Electrode-electrolyte interface, polarization, electrode skin interface and motion artifact, biomaterial used for electrode, Types of electrodes (body surface, internal, array of electrodes, microelectrodes), Practical aspects of using electrodes, Acquisition of bio-signals (signal conditioning) and Signal conversion (ADC's DAC's) Processing, Digital filtering	**07**	L1, L2, L3
3	Biomedical signal processing by Fourier analysis, Biomedical signal processing by wavelet (time- frequency) analysis, Analysis (Computation of signal parameters that are diagnostically significant)	**05**	L1, L2, L3
4	Classification of signals and noise, Spectral analysis of deterministic, stationary random signals and non-stationary signals, Coherent treatment of various biomedical signal processing methods and applications.	**08**	L1, L2, L3
5	Principal component analysis, Correlation and regression, Analysis of chaotic signals Application areas of Bio–Signals analysis Multiresolution analysis(MRA) and wavelets, Principal component analysis(PCA), Independent component analysis(ICA)	**09**	L1, L2, L3, L4, L5
6	Pattern classification–supervised and unsupervised classification, Neural networks, Support vector Machines, Hidden Markov models. Examples of biomedical signal classification examples.	**11**	L1, L2, L3, L4, L5
	Total Hours	**45**	

Books and References:

Sr. No.	Title	Authors	Publisher	Edition	Year
1	Biomedical Digital Signal Processing	W. J. Tompkins	Prentice Hall	Second	1993
2	Biomedical Signal Processing and Signal Modeling	Eugene N Bruce	John Wiley & Son's publication	Second	2001
3	Biomedical Engineering and Design Handbook, Volume I	Myer Kutz	McGraw Hill	First	2009.
4	Biomedical Signal Processing	D C Reddy	McGraw Hill	Second	2005
5	Practical Biomedical Signal Analysis Using MATLAB	Katarzyn J. Blinowska, JaroslawZygierewicz	CRC Press	First	2011
6	Biomedical Instrumentation and Measurement	Leslie Cromwell, Fred Weibell and Erich A Pfeiffer	PHI	**Second**	1980
7	Handbook of Biomedical Instrumentation	R. S. Khandpur	Tata McGraw Hill	**Second**	2004

8	Principles of Applied Biomedical Instrumentation‖	L. E. Baker L. A. Geddes	John Wiley and Sons	Third	1991
9	Introduction to Biomedical Equipment Design	Carr and Brown	John Wiley	Fourth	2001

Online References:

Sr. No.	Website Name	URL	Modules Covered
1	Engineering Notes Handwritten PYQ | LectureNotes	Notes Biomedical Instrumentation BI by Verified Writer | LectureNotes	M1, M2, M3,M4,M5
2	https://www.udemy.com/	https://www.udemy.com/course/biomedical-signal-processing	M1, M2, M3,M4
3	https://onlinecourses.nptel.ac.in/	https://onlinecourses.nptel.ac.in/noc20_ee41/preview	M1, M2, M3,M4,M5,M6

Department of Electronics and Telecommunication Engineering
M.E. Semester II
Choice Based Credit Grading Scheme (CBCGS 2024)
Proposed Syllabus under Autonomy Scheme

M. E. (Communication Technology & Management)							**SEM**: II		
Course Name: Program Elective-4 (Digital Transformation)							**Course Code:** PEC- CTMME2027		
Teaching Scheme (Program Specific)					**Examination Scheme (Formative/ Summative)**				
Modes of Teaching / Learning / Weightage					**Modes of Continuous Assessment / Evaluation**				
Hours Per Week					**Theory (100)**		**Practical/Oral/ Presentation**	**Term Work**	**Total**
Theory	**Tutorial**	**Practical**	**Contact Hours**	**Credits**	**IA**	**ESE**	**PR/OR**	**TW**	**100**
3	-	-	3	3	25	75	-	-	
IA: In-Semester Assessment - Paper Duration – 1.5 Hours **ESE: End Semester Examination - Paper Duration - 3 Hours** **The weightage of marks for continuous evaluation of Term work/Report:** Formative (40%), Timely completion of practical (40%) and Attendance / Learning Attitude (20%)									

Course Objective:

To explore the key drivers and trends that are leading to digital transformation across industries. Develop strategies for integrating digital technologies into business operations and learn how to create a digital transformation roadmap aligned with organizational goals and objectives.

Course Outcomes: Students should be able to:

SN	Course Outcomes	Cognitive levels of attainment as per Bloom's Taxonomy
1	Demonstrate a thorough understanding of the key concepts, trends, and drivers of digital transformation.	L1,L4
2	Develop and articulate a clear digital transformation strategy that aligns with organizational objectives.	L3, L4
3	Identify and evaluate emerging technologies and their potential applications within an organization.	L1, L2, L3, L4
4	Apply appropriate digital tools and technologies to solve business problems.	L3, L4,L5
5	Exhibit leadership skills necessary for driving digital transformation.	L1, L2, L3
6	Utilize digital tools to enhance customer engagement and satisfaction.	L4,L5

Detailed Syllabus

Module No.	Topics	Hrs	Cognitive levels of attainment as per Bloom's Taxonomy
	161		
1	**Sense Digital**	**04**	**L1, L2**

	Understanding Disruptive Technologies & Digital Transformation Digitalization amidst Deglobalization Discovering the Self Amidst Change, Self-Assessment, aided by faculty. Our personality traits say about our openness to change, Problem Framing Amidst Ambiguity & Uncertainty Platform Businesses in India		
2	**Digital Thinking** Economics of Digital: Digital and information goods, Bundling and Unbundling, Information Pricing Strategies, Monetizing digital services. Demystifying Deep Tech and the Pillars of Digital Business: Cloud Big Data, Machine Learning, and AI as vectors of digital business capability, Applications of AI and Generative AI in Buisness Customer-Centricity in the Digital Age	**08**	**L1, L2, L3**
3	**Digital Crafting** Succeeding with Digital Products: Design and user experience, A/B testing, Ethical Aspects of Design Strategic Thinking and Digital Business Models: Fundamentals of Business Strategy, Business Agility through Digital, Digital Business Models, Digital Platforms Ecosystems Network Effects.	**10**	**L1, L2, L3, L4**
4	**Recrafting Marketing in the Digital Era** Digital Marketing Analytics, Integrating traditional and digital marketing, Omnichannel Strategy, Digital Marketing, Mass Personalization, Customer Experience & Engagement Marketing	**10**	**L1. L2, L3, L4**
5	**Act Digital** Engaging the Self Amidst Change: Self-Assessment, aided by faculty, How do we leverage what we have to become TKBLs? Managing Change, Embracing the Digital Mindset, Rewiring the Firm DNA, Transitioning with Digital Partners	**04**	**L1, L2, L3,**
6	**Strategic Leadership for Enterprise Growth** Driving Disruption: The Challenger's Perspective, Renewing through Disruption: The Incumbent's Perspective, Organizational Ambidexterity, Strategic Choice in the Age of AI **The Agile Organization**	**03**	**L1, L2**
	Total	**39**	

Books and References:

SN	Title	Authors	Publisher	Edition	Year

1	Digital Transformation: Survive and Thrive in an Era of Mass Extinction	Thomas M. Siebel	RosettaBooks	First	2019
2	Leading Digital: Turning Technology into Business Transformation	George Westerman, Didier Bonnet, Andrew McAfee	Harvard Business Review Press	First	2014

Online References:

Sr.No.	Website Name	URL	Modules Covered
1	iimcal	https://iimcal.talentsprint.com/dbl/mobile/?utm_source=g_search&utm_medium=paid_google&utm_campaign=iimc-dbl-g_search-performance-leadership-broad&utm_content=iimc-dbl-g_search-performance-leadership-broad_leadership&utm_term=digital%20transformation%20course&gad_source=1&gclid=CjwKCAjwm_SzBhAsEiwAXE2Cv9NQuBGnF3Tk5160HFveMUIqEfa96jrZVYtFkFg3ztN-NTFF0P0R-xoCh_kQAvD_BwE	M1-M6

Department of Electronics and Telecommunication Engineering
M.E. Semester II
Choice Based Credit Grading Scheme (CBCGS 2024)
Proposed Syllabus under Autonomy Scheme

M. E. (Communication Technology & Management)							**SEM: II**		
Course Name: Program Elective-4 (Financial Management)							**Course Code:** PEC- CTMME2028		
Teaching Scheme (Program Specific)					**Examination Scheme (Formative/ Summative)**				
Modes of Teaching / Learning / Weightage					**Modes of Continuous Assessment / Evaluation**				
Hours Per Week					**Theory (100)**		**Practical/Oral/ Presentation**	**Term Work**	**Total**
Theory	**Tutorial**	**Practical**	**Contact Hours**	**Credits**	**IA**	**ESE**	**PR/OR**	**TW**	**100**
3	-	-	3	3	25	75	-	-	
IA: In-Semester Assessment - Paper Duration – 1.5 Hours **ESE: End Semester Examination - Paper Duration - 3 Hours** **The weightage of marks for continuous evaluation of Term work/Report:** Formative (40%), Timely completion of practical (40%) and Attendance / Learning Attitude (20%)									

Course Objectives: The course intends to give an overview of Indian financial system, instruments and market along with basic concepts of value of money, returns and risks, corporate finance, working capital and its management. It also exhibit knowledge about sources of finance, capital structure, dividend policy.

Course Outcomes: Upon completion of the course students will be able to:

Sr. No.	Course Outcomes	Cognitive levels of attainment as per Bloom's Taxonomy Levels
1	Understand Indian Financial System with respect to financial Instruments, financial markets and institutions	L1,L2
2	Understand the concepts of Returns and risks along with time value of money	L1, L2,L3
3	Understand Corporate Finance and perform financial ratio analysis	L1, L2,L3
4	Importance of Capital Budgeting	L1,L2,L3,L4
5	Identify Sources of Finance and capital structure	L1,L2,L3,L4
6	Analyze the Dividend Policy concepts for financial decisions	L1,L2,L3,L4

Detailed Syllabus:

Module No.	Topics	Hrs.	Cognitive levels of attainment as per Bloom's Taxonomy
1	**Overview of Indian Financial System** Characteristics, Components and Functions of Financial System. **Financial Instruments:** Meaning, Characteristics and Classification of Basic Financial Instruments — Equity Shares, Preference Shares, Bonds- Debentures, Certificates of Deposit, and Treasury Bills. **Financial Markets:** Meaning, Characteristics and Classification of Financial Markets — Capital Market, Money Market and Foreign Currency Market **Financial Institutions:** Meaning, Characteristics and Classification of Financial Institutions — Commercial Banks, Investment-Merchant Banks and Stock Exchanges	08	L1,L2
2	**Concepts of Returns and Risks** Measurement of Historical Returns and Expected Returns of a Single Security and a Two-security Portfolio; Measurement of Historical Risk and Expected Risk of a Single Security and a Two-security Portfolio. **Time Value of Money:** Future Value of a Lump Sum, Ordinary Annuity, and Annuity Due; Present Value of a Lump Sum, Ordinary Annuity, and Annuity Due; Continuous Compounding and Continuous Discounting	08	L1, L2,L3
3	**Overview of Corporate Finance** Objectives of Corporate Finance; Functions of Corporate Finance—Investment Decision, Financing Decision, and Dividend Decision. **Financial Ratio Analysis:** Overview of Financial Statements—Balance Sheet, Profit and Loss Account, and Cash Flow Statement; Purpose of Financial Ratio Analysis; Liquidity Ratios; Efficiency or Activity Ratios; Profitability Ratios; Capital Structure Ratios; Stock Market Ratios; Limitations of Ratio Analysis.	08	L1, L2,L3
4	**Capital Budgeting** Meaning and Importance of Capital Budgeting; Inputs for Capital Budgeting Decisions; Investment Appraisal Criterion—Accounting Rate of Return, Payback Period, Discounted Payback Period, Net Present Value(NPV), Profitability Index, Internal Rate of Return (IRR), and Modified Internal Rate of Return (MIRR) **Working Capital Management:** Concepts of Meaning Working Capital; Importance of Working Capital	10	L1,L2,L 3 , L4

	Management; Factors Affecting an Entity's Working Capital Needs; Estimation of Working Capital Requirements; Management of Inventories; Management of Receivables; and Management of Cash and Marketable Securities		
5	**Sources of Finance** Long Term Sources—Equity, Debt, and Hybrids; Mezzanine Finance; Sources of Short Term Finance—Trade Credit, Bank Finance, Commercial Paper; Project Finance. **Capital Structure:** Factors Affecting an Entity 's Capital Structure; Overview of Capital Structure Theories and Approaches — Net Income Approach, Net Operating Income Approach; Traditional Approach, and Modigliani-Miller Approach. Relation between Capital Structure and Corporate Value; Concept of Optimal Capital Structure	07	L1,L2,L 3 , L4
6	**Dividend Policy** Meaning and Importance of Dividend Policy; Factors Affecting an Entity's Dividend Decision; Overview of Dividend Policy Theories and Approaches—Gordon's Approach, Walter's Approach, and Modigliani-Miller Approach	04	L1, L2, L3,L4

Books and References:

S. No.	Title	Authors	Publisher	Edition	Year
1	Fundamentals of Financial Management	Eugene F. Brigham and Joel F. Houston	Cengage Publications, New Delhi	Thirteeth Edition	2015
2	Analysis for Financial Management	Robert C. Higgins	McGraw Hill Education	Tenth Edition	2013
3	Indian Financial System	M. Y. Khan	McGraw Hill Education, New Delhi	Ninth Edition	2015
4	Financial Management	I. M. Pandey	S. Chand (G/L) & Company Limited, New Delhi	Eleventh Edition	2015

Online References:

S. No.	Website Name	URL	Modules Covered
1	www.splessons.com	https://www.splessons.com/lesson/indian-financial-system-overview/	M1,M3
2	finance.zacks.com	https://finance.zacks.com/concepts-return-investment-risk-3049.html	M2
3	www.edupristine.com	https://www.edupristine.com/blog/capital-budgeting	M4
4	efinancemanagement.com	https://efinancemanagement.com/sources-of-finance	M5
5	www.Business managementideas.com	https://www.businessmanagementideas.com/financial-management/dividends/meaning-and-types-of-dividend-policy-financial-management/3968	M6

Department of Electronics and Telecommunication Engineering
M.E. Semester II
Choice Based Credit Grading Scheme (CBCGS 2024)
Proposed Syllabus under Autonomy Scheme

M. E. (Communication Technology & Management)									**SEM: II**
Course Name: Program Elective-4 (Production Management)									**Course Code :** PEC- CTMME2029
Teaching Scheme (Program Specific)					**Examination Scheme (Formative/ Summative)**				
Modes of Teaching / Learning / Weightage					**Modes of Continuous Assessment / Evaluation**				
Hours Per Week					**Theory (100)**		**Practical/Oral(25)**	**Term Work (25)**	**Total**
Theory	**Tutorial**	**Practical**	**Contact Hours**	**Credits**	**IA**	**ESE**	**PR/OR**	**TW**	
3	-	-	3	3	25	75	-	-	**100**
IA: In-Semester Assessment - Paper Duration – 1 Hours ESE: End Semester Examination - Paper Duration - 3 Hours **The weightage of marks for continuous evaluation of Term work/Report:** Formative (40%), Timely completion of practical (40%) and Attendance / Learning Attitude (20%)									
Prerequisite: Industrial Management, Basic Economics									

Course Objective: To understand the role of production management in the overall business strategy, learn about different production processes and their management. To develop skills to design, plan, and control production systems and analyze and improve production operations for efficiency and effectiveness. Also, to gain knowledge about the latest trends and technologies in production management.

Course Outcomes : Upon completion of the course students will be able to:

Sr. No.	**Course Outcomes**	**Cognitive levels ofattainment as perBloom's Taxonomy**
1	Explain the significance of production management in business. Understand the basic concepts and significance of production management and identify different types of production systems and their applications.	L1, L2
2	Design and manage production systems. Develop effective production plans and apply various scheduling techniques and inventory management methods.	L1, L2, L3
3	Apply production planning and control techniques. Design efficient production systems and analyze and improve production processes for better efficiency.	L3, L4, L6
4	Analyze production processes and recommend improvements. Understand the principles of quality management and apply various quality control techniques in production.	L1, L2, L3, L6
5	Analyze the types of systems used for enterprise-wide knowledge management andhow they provide value for businesses. Plan and manage	L1, L2, L3, L4

	maintenance activities.	
6	Analyze the modern production technologies and practices.	L1, L2, L3, L4

Detailed Syllabus:

Module No.	Topics	Hrs	Cognitive levels of attainment as per Bloom's Taxonomy
1	**Introduction to Production Management** Definition and Importance of Production Management, Objectives and Functions of Production Management, Types of Production Systems (Job, Batch, Mass, and Continuous Production), Role of Production Manager	8	L1, L2
2	**Production Planning and Control** Objectives and Importance of Production Planning and Control (PPC), Steps in Production Planning and Control, Capacity Planning and Scheduling, Inventory Management	8	L1, L2, L3
3	**Design of Production Systems** Product Design and Process Selection, Facility Layout Planning, Work Study and Method Study, Ergonomics in Production	7	L1, L2, L3, L4
4	**Quality Management** Introduction to Quality Management, Total Quality Management (TQM), Statistical Quality Control (SQC), Six Sigma and Lean Manufacturing	7	L1, L2, L3
5	**Maintenance Management** Importance of Maintenance Management, Types of Maintenance (Preventive, Predictive, and Corrective), Maintenance Planning and Scheduling, Reliability-Centered Maintenance (RCM)	8	L1, L2, L3, L4
6	**Modern Trends in Production Management** Just-In-Time (JIT) Production, Agile Manufacturing, Computer-Integrated Manufacturing (CIM), Industry 4.0 and Smart Manufacturing	7	L1, L2, L3, L4
	Total Hours	45	

Books and References:

Sr. No.	Title	Authors	Publisher	Edition	Year
1.	Operations Management: Sustainability and Supply Chain Management	Jay Heizer, Barry Render, Chuck Munson	Pearson	12th Edition	2021
2.	Production and Operations Analysis	Steven Nahmias, Tava	Waveland	Seventh	2017

		Lennon Olsen	Press	Edition	
3.	Manufacturing Planning and Control for Supply Chain Management	F. Robert Jacobs, William L. Berry, D. Clay Whybark, Thomas E. Vollmann	McGraw-Hill	Sixth Edition	2018

Online References:

Sr. No	Website Name	URL	Modules Covered
1	MIT OpenCourseWare:	Introduction to Operations Management	M1-M6
2	**Coursera**: Operations Management by Wharton School of the University of Pennsylvania	https://www.coursera.com	M1-M6
3	**edX**: MicroMasters Program in Supply Chain Management by MITx	https://edX.com	M3

Department of Electronics and Telecommunication Engineering
M.E. Semester II
Choice Based Credit Grading Scheme (CBCGS 2024)
Proposed Syllabus under Autonomy Scheme

ME (Electronics and Telecommunication Engineering)							SEM : II		
Course Name : Computational Lab III: Antennas and Radiating Laboratory							Course Code : LC-CTMME201		
Teaching Scheme (Program Specific)					Examination Scheme (Formative/ Summative)				
Modes of Teaching / Learning / Weightage					Modes of Continuous Assessment / Evaluation				
Hours Per Week					Theory (100)		Practical/Oral (25)	Term Work (50)	Total
Theory	Tutorial	Practical	Contact Hours	Credits	IA	ESE	PR/OR	TW	
-	-	4	4	2	-	-	25	25	50
IA- In-Semester Assessment - Paper Duration – 1.5 Hours ESE- End Semester Examination - 3 Hours									

Each Laboratory assignment will be done by an individual student. The Faculty teaching core subject will be required to propose the respective Laboratory assignments. These will be essentially hands-on practical /Case Study

Suggested list of Assignments:

1. Simulation of half wave dipole antenna.
2. Simulation of change of the radius and length of dipole wire on frequency of resonance of antenna.
3. Simulation of quarter wave, full wave antenna and comparison of their parameters.
4. Simulation of monopole antenna with and without ground plane.
5. Study the effect of the height of the monopole antenna on the radiation characteristics of the antenna.
6. Simulation of a half wave dipole antenna array.
7. Study the effect of change in distance between elements of array on radiation pattern of dipole array.
8. Study the effect of the variation of phase difference 'beta' between the elements of the array on the radiation pattern of the dipole array.
9. Case study.

Department of Electronics and Telecommunication Engineering
M.E. Semester II
Choice Based Credit Grading Scheme (CBCGS 2024)
Proposed Syllabus under Autonomy Scheme

ME (Electronics and Telecommunication Engineering)							SEM : II		
Course Name : Computational Lab IV: Telecom Network							Course Code : LC-CTMME202		
Teaching Scheme (Program Specific)					Examination Scheme (Formative/ Summative)				
Modes of Teaching / Learning / Weightage					Modes of Continuous Assessment / Evaluation				
Hours Per Week					Theory (100)		Practical/Oral (25)	Term Work (50)	Total
Theory	Tutorial	Practical	Contact Hours	Credits	IA	ESE	PR/OR	TW	50
-	-	4	4	2	-	-	25	25	
IA- In-Semester Assessment - Paper Duration – 1.5 Hours ESE- End Semester Examination - 3 Hours									

Each Laboratory assignment will be done by an individual student. The Faculty teaching core subject will be required to propose the respective Laboratory assignments. These will be essentially hands-on practical /Case Study **Suggested list of Assignments:**

Practical Number	Type of Experiment	Practical/ Experiment Topic	Hrs.	RBT Levels
1	Basic Experiments	To study the architecture and organization of telecom network.	2	Apply (A)
2		Study the interdependence between network node components and transmission components.	2	Apply (A)
3	Design Experiments	To observe the standards used in communication lab.	2	Apply (A)
4		To manage fault in the telecom network.	2	Apply (A)
5		To measure the performance of each component in a telecom network.	2	Analyze (An)
6		To study various GSM AT Commands their use for different applications	2	Analyze (An)
7	Tutorial	Tutorial 1 (Web Based network).	2	Understand (U)
8		Tutorial 2 (IP network management).	2	Understand (U)

09	**Mini/Minor Projects/ Seminar/ Case Studies**	To learn and manage a telecom network.	8	Create (C)