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||Jai Sri Gurudev||

Sri Adichunchanagiri Shikshana Trust (R.)

SJC INSTITUTE OF TECHNOLOGY

An Autonomous Institution under VTU from 2024-25

AICTE Approved, Accredited by NAAC with A+ Grade & NBA (CSE, ISE, ECE, ME & CV), NIRF(151-300) in 2023,Gold Rated by QS I-Gauge

P.B. No.20, B.B Road, Chikkaballapur - 562 101, Karnataka

Estd : 1986

I & II Semester
Scheme & Syllabus of M.Tech Programme
Digital Communication and Networking
(2024 Scheme)

Core Values

Spiritual, **J**udicious, **C**ommitment, **I**ntegrity, **T**rustworthy



NATIONAL INSTITUTIONAL RANKING FRAMEWORK 151-300

INSTITUTION'S INNOVATION COUNCIL (Ministry of HRD Initiative) 4-Star Rating



Estd : 1986

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Scheme of Teaching and Examinations

M.Tech in Electronics and Communication Engineering

(Specialization in Digital Communication and Networking)

Choice Based Credit System (CBCS) and Outcome Based Education (OBE)

I SEMESTER (Core Courses related to main Engineering Stream)

Sl. No.	Course Type	Course Code	Course Title	Teaching Hours per Week			Examination				Credits
				Theory	Practical/ Seminar	Tutorial/SDA	Duration in hours	CIE Marks	SEE Marks	Total Marks	
				L	P	T/SDA					
1	PCC	MEC101	Advanced Machine Learning and Deep Learning	3	0	0	03	50	50	100	3
2	IPCC	MEC102	Advanced Embedded Systems	3	2	0	03	50	50	100	4
3	PCC	MEC103	Digital Circuits & Logic Design	3	0	0	03	50	50	100	3
4	PEC	MEC114	Professional Elective I	3	0	0	03	50	50	100	3
5	PEC	MEC115	Professional Elective II	3	0	0	03	50	50	100	3
6	PECL	MECL116x	Lab Elective	0	4	0	03	50	50	100	2
7	NCMC	MRMI107	Research Methodology and IPR (Online)	Online Courses (online.vtu.ac.in)							PP
								300	**300**	**600**	**18**

Professional Elective I		**Professional Elective II**	
MEC114A	ASIC Design	MEC115A	System Verilog
MEC114B	Advanced Computer Networking	MEC115B	Advanced Wireless Communication
MEC114C	Advanced Signal Processing	MEC115C	Multimedia & Applications
MEC114D	Power Converters	MEC115D	Process Control
Lab Elective			
MECL116A	Advanced Machine Learning and Deep Learning Lab	MECL116B	Electronics and Communication Lab

Note: **BSC**- Basic Science Courses, **PCC**: Professional core. **IPCC**- Integrated Professional Core Courses, **PCC(PB):** Professional Core Courses (Project Based), **PCCL**- Professional Core Course lab, **NCMC**- None Credit Mandatory Course, **L-** Lecture**, P-** Practical**, T/SDA-** Tutorial **/** Skill Development Activities(Hours are for Interaction between faculty and students) **MRMI107** - Research Methodology and IPR (**Online**) for the students who have **not studied** this course in the Undergraduate level. This course is not counted for vertical progression, Students have to qualify for the award of the master's degree.

M- Master program **xx** – **ME** for Mechanical Engineering Stream, **CV** for Civil Engineering Stream, **EE** – Electrical & Electronics Engineering Stream, **EC-** Electronics and Communication Engineering Stream, **CS**- Computer Science and Engineering, **BA**- Business Administration **AR**- Architecture- etc.

BSC: Basic Science Courses: Courses like Mathematics/ Science are the prerequisite courses that the concerned engineering stream board of Studies will decide. **PCC: Professional Core Course:** Courses related to the stream of engineering, which will

have both CIE and SEE components, students have to qualify in the course for the award of the degree. **Integrated Professional Core Course (IPCC)**: Refers to a Professional Theory Core Course Integrated with practicals of the same course. The IPCC's theory part shall be evaluated by CIE and SEE. The practical part shall be evaluated by only CIE (no SEE). However, questions from the practical part of IPCC shall be included in the SEE question paper. **Project Based Learning Course (PCC(PB):** Project Based Learning course is a professional core Course only Students have to complete a project out of learning from the course and SEE will be viva voce on project work. **PCCL: Professional Core Course Laboratory:** Practical courses whose CIE will be evaluated by the class teacher and SEE will be evaluated by the two examiners.

Skill development activities: Under Skill development activities in a concerning course, the students should

1. Interact with industry (small, medium, and large).
2. Involve in research/testing/projects to understand their problems and help creative and innovative methods to solve the problem.
3. Involve in case studies and field visits/ fieldwork.
4. Accustom to the use of standards/codes etc., to narrow the gap between academia and industry.
5. Handle advanced instruments to enhance technical talent.
6. Gain confidence in the modelling of systems and algorithms for transient and steady-state operations, thermal study, etc.
7. Work on different software/s (tools) to simulate, analyze and authenticate the output to interpret and conclude.

All activities should enhance student's abilities to employment and/or self-employment opportunities, management skills, Statistical analysis, fiscal expertise, etc. Students and the course instructor/s are to be involved either individually or in groups to interact together to enhance the learning and application skills of the study they have undertaken. The students with the help of the course teacher can take up relevant technical –activities that will enhance their skills. The prepared report shall be evaluated for CIE marks.

MRMI107 - Research Methodology and IPR- None Credit Mandatory Course (NCMC) if students have not studied this course in their undergraduate program then he /she has to take this course at **http://online.vtu.ac.in** and to qualify for this course is compulsory before completion of the minimum duration of the program (Two years), however, this course will not be considered for vertical progression.

POs for the PG Course "Digital Communication & Networking"		
Sl. No	**POs**	**Description**
1	**PO1**	An ability to independently carry out research/investigation and development work to solve practical problems
2	**PO2**	An ability to write and present a substantial technical report/document
3	**PO3**	Students should be able to demonstrate a degree of mastery over the area as per the specialization of the program. The mastery should be at a level higher than the requirements in the appropriate bachelor program
4	**PO4**	Proficiency to create, select, apply appropriate techniques, resources and modern tools to solve complex engineering activities with an understanding of their limitations.
5	**PO5**	Competency to apply professional ethics, responsibilities, and norms to contribute to sustainable development.
6	**PO6**	Capability to identify the need for continuous learning and independently enhance knowledge in digital communication and networking.

Semester: I						
ADVANCED MACHINE LEARNING AND DEEP LEARNING **Stream: ECE (Digital Communication & Networking)**						
Course Code	**:**	**MEC101**		**Credits**	**:**	3
Hours/Week(L:T:P)	**:**	3:0:0		**CIE**	**:**	50 Marks
Total Hours	**:**	40L		**SEE**	**:**	50 Marks
Course Type	**:**	Core		**SEE Duration**	**:**	3 Hours

Prerequisites:	
Courses	Python Application Programming
Knowledge on Fundamental Concepts	Python Programming Concepts
Knowledge on Connected Tools (If any)	

Course Learning Objectives: This course will enable the students to	
CLO1	Comprehend the fundamental concepts of machine learning and its applications
CLO2	Interpret the concepts of classification and clustering techniques.
CLO3	Develop a deep understanding of convolutional neural networks (CNNs) and their architecture.
CLO4	Apply deep learning techniques to large-scale datasets and real-world problems
CLO5	Evaluate and optimize machine learning and deep learning models for performance improvements in complex applications.

Module - 1	**08 Hrs**
Supervised Learning: Classification and Regression, Generalization, Overfitting and Underfitting, Supervised Machine Learning Algorithms. **Text Book 1: Chapter 2**	
Module - 2	**08 Hrs**
Unsupervised Learning and Preprocessing: Preprocessing and Scaling, Dimensionality Reduction, Feature Extraction, and Manifold Learning, Clustering **Text Book 1: Chapter 3**	
Module - 3	**08 Hrs**
Convolutional Neural Networks: The operation, Pooling, Convolution and Pooling as an infinitely strong prior, Variants of the basic functions, efficient algorithms, Random or Unsupervised Features, Neuroscientific Basis for Convolutional Networks. **Text Book 2: Chapter 9**	
Module - 4	**08 Hrs**
Recurrent Neural Networks: RNN, Bidirectional RNN, Encoder-Decoder Sequence to sequence architecture, Deep Recurrent Networks, Recursive Neural Networks, The Long Short-Term Memory and other Gated RNNs, Optimization for Long Term Dependencies. **Text Book 2: Chapter 10**	
Module - 5	**08 Hrs**
Applications: Large-Scale Deep Learning, Computer Vision, Speech Recognition, Natural Language Processing, Other Applications. **Text Book 2: Chapter 12**	

Course Outcomes: After completing the course, the students will be able to	
CO1	Demonstrate a comprehensive understanding of machine learning and deep learning fundamentals and their applications.
CO2	Apply various machine learning algorithms and deep learning architectures to solve complex problems.
CO3	Develop and implement machine learning models using appropriate programming languages and tools.
CO4	Analyze and evaluate the performance of machine learning and deep learning models using appropriate metrics.
CO5	Design and implement optimized machine learning and deep learning solutions for practical and research applications, utilizing advanced techniques for model improvement.

Text Books	
1	Introduction to Machine Learning with Python by Andreas C. Müller & Sarah Guido, Publisher(s): O'Reilly Media, Inc.2016, ISBN: 9781449369897
2	Deep Learning - Goodfellow, Bengio and Courville, Publisher: MIT Press , 2016 ISBN: 978-0262035613

Reference Books	
1	Fundamentals of Deep Learning - Nikhil Budama, Publisher: O'Reilly Media ,2017 Paperback: 978-1491925614 eBook: 978-1491925607
2	Neural Networks and Deep Learning - Charu Aggarwal, Publisher: Springer 2018 ISBN 978-3319944623
3	Hands-on Deep Learning Algorithms with Python - Sudharsan Ravichandran, Publisher: Packt Publishing, 2019, ISBN: 978-1789347999

Skill Development Activities Suggested
• Individual or group projects to apply learned concepts to real-world problems. • Regular coding assignments to reinforce theoretical concepts. • Experimentation with different libraries and frameworks (e.g., TensorFlow, PyTorch, Scikit-learn). • Guest lectures from industry experts to provide insights into current trends.

Web links and Video Lectures (e - Resources)	
1	NPTEL: **Machine Learning And Deep Learning - Fundamentals And Applications** https://onlinecourses.nptel.ac.in/noc23_ee87/preview
2	**"Introduction to Machine Learning"** https://www.youtube.com/watch?v=UzxYlbK2c7E
3	**"Introduction to Deep Learning" by MIT** https://www.youtube.com/watch?v=7sB052Pz0sQ

CO - PO MAPPING

CO-PO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**
CO1	**3**	**2**	**3**	**2**	**1**	**2**
CO2	**3**	**2**	**3**	**3**	**1**	**2**
CO3	**3**	**2**	**3**	**3**	**1**	**2**
CO4	**3**	**2**	**3**	**3**	**1**	**3**
CO5	**3**	**2**	**3**	**3**	**2**	**3**

Semester: I						
ADVANCED EMBEDDED SYSTEM **Stream: ECE (Digital Communication & Networking)**						
Course Code	**:**	MEC102		**Credits**	**:**	04
Hours/Week (L:T:P)	**:**	3:2:0		**CIE**	**:**	50 Marks
Total Hours	**:**	40 hours Theory +10 hours Lab		**SEE**	**:**	50 Marks
Course Type	**:**	Integrated		**SEE Duration**	**:**	3 Hours

Prerequisites:	
Courses	Basic Embedded Systems.
Knowledge on Fundamental Concepts	Basic Electronics and Digital Logic, Microprocessors and Microcontrollers, Programming Languages (C/C++ and Assembly).
Knowledge on Connected Tools (If any)	

Course Learning Objectives: This course will enable the students to	
CLO1	Analyze Embedded System architecture including the characteristics and quality attributes of Embedded systems.
CLO2	Develop program modeling for Hardware-Software co-design.
CLO3	Analyze ARM Microcontroller hardware and software architecture for Embedded system Design.
CLO4	Apply Real Time Operating System (RTOS) concepts for Embedded Systems development.
CLO5	Interpret Embedded system development environment and recent trends in the embedded industry.

Module - 1	**08 Hrs**
Embedded System: Embedded v/s General Computing System, classification, application and purpose of ES. Core of an Embedded System, Memory, Sensors, Actuators, LED, Optocoupler, Communication Interface, Reset circuits, RTC, WDT, Characteristics and Quality Attributes of Embedded Systems. **Text Book1: 1.1,1.2,1.3,1.4,1.5,1.6,2.1,2.2,2.3,2.4,2.5,2.6,2.7,3.1,3.2**	
Module - 2	**08 Hrs**
Hardware Software Co-Design: Embedded firmware design approaches, computational models, embedded firmware development languages, Integration and testing of Embedded Hardware and firmware, Components in embedded system development environment (IDE), Files generated during compilation, simulators, emulators and debugging. **Text Book1: 7.1,7.2,7.3,7.4,9.1,9.2,9.3**	
Module - 3	**08 Hrs**
ARM - 32-bit Microcontroller: Thumb-2 technology and applications of ARM, Architecture of ARM Cortex M3, Various Units in the architecture, General Purpose Registers, Special Registers, exceptions, interrupts, stack operation, reset sequence. **Text Book2: 4.1,4.2,4.3,4.4,4.5,4.8**	

Module - 4	**08 Hrs**
Instruction Sets: Assembly basics, Instruction list and description, useful instructions, Memory Systems, Memory maps, Cortex M3 implementation overview, pipeline and bus interface, Exceptions, Nested Vector interrupt controller design, Systick Timer, Cortex- M3 Programming using assembly and C language, CMSIS **Text Book2: 5.3,5.4,5.5,5.6,7.1,7.2,7.10**	
Module - 5	**08 Hrs**
Embedded Firmware Design and Development: Embedded Firmware Design Approaches, Embedded Firmware Development Languages, Real-Time Operating System (RTOS) based Embedded System Design: Operating System Basics, Types of OS, Tasks, Process and Threads, Multiprocessing and Multitasking, Task Scheduling, Threads, Processes and Scheduling: Putting them altogether, Task Communication, Task Synchronization, Device Drivers, How to Choose an RTOS . **Text Book1: 10.1,10.2,10.3,10.4,10.5,10.6,10.7,10.8,10.9,10.10**	

Course Outcomes: After completing the course, the students will be able to	
CO1	Comprehend concepts in the field of Embedded Systems.
CO2	Describe the fundamental concepts of ARM Cortex-M3 architecture, including instruction sets, memory systems, and pipeline structure.
CO3	Apply Real Time Operating System (RTOS) concepts for Embedded Systems development.
CO4	Develop and analyze simple programs using assembly language and C to demonstrate the functionality of Cortex-M3 instructions.
CO5	Engage in self-study to design, implement and demonstrate open ended problem.

Text Books	
1	Shibu K V, "Introduction to Embedded Systems", Tata McGraw Hill Education Private Limited, 2009
2	Joseph Yiu, "The Definitive Guide to the ARM Cortex-M3", Newnes, (Elsevier), 2008.
3	James K Peckol, "Embedded Systems – A contemporary Design Tool", John Weily, 2008.

Reference Books	
1	Embedded systems - A contemporary design tool', James K.Peckol, JohnWiley, 2008

Web links and Video Lectures (e - Resources)	
1	www.nptel.ac.in

CO - PO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6
CO1	**2**	**2**	**2**		**2**	**2**
CO2	**2**	**2**	**2**		**2**	**2**
CO3	**2**	**2**	**2**	**3**	**2**	**2**
CO4				**3**	**1**	**2**
CO5	**3**	**3**	**2**	**2**	**2**	**3**

PRACTICAL COMPONENT OF IPCC

Conduct the following experiments on an ARM CORTEX M3 evaluation board using evaluation version of Embedded C and Keil Uvision-4 tool/compiler.

1. Demonstrate the use of an external interrupt to toggle an LED On/Off.
2. Display "Hello World" message using Internal UART.
3. Determine Digital output for a given Analog input using Internal ADC of ARM controller.
4. Interface a 4×4 keyboard and display the key code on an LCD.
5. Display the Hex digits 0 to F on a 7-segment LED interface, with an appropriate delay in between.
6. Measure ambient temperature using a sensor and SPI ADC IC.
7. To create child process and display its ID.
8. Execute child process function using switch structure.

Semester: I						
DIGITAL CIRCUITS & LOGIC DESIGN **Stream: ECE (Digital Communication & Networking)**						
Course Code	**:**	**MEC103**		**Credits**	**:**	03digital
Hours/Week(L:T:P)	**:**	3:0:0		**CIE**	**:**	50 Marks
Total Hours	**:**	40		**SEE**	**:**	50 Marks
Course Type	**:**	Core		**SEE Duration**	**:**	3 Hours

Prerequisites:	
Courses	Digital System Design and VLSI
Knowledge on Fundamental Concepts	Digital circuits
Knowledge on Connected Tools (If any)	

Course Learning Objectives: This course will enable the students to	
CLO1	Interpret the concepts of sequential machines
CLO2	Design Sequential Machines/Circuits
CLO3	Analyze the faults in the design of circuits
CLO4	Apply fault detection experiments to sequential circuits

Module - 1	**08 Hrs**
Threshold Logic: Introductory Concepts, Synthesis of Threshold Networks Capabilities, **Minimization, and Transformation of Sequential Machines:** The Finite- State Model, Further Definitions, Capabilities and limitations of finite-state machines. **Textbook 1: Ch 1:7.1-7.2, Ch 10:10.1-10.2**	
Module - 2	**08 Hrs**
Fault detection by path sensitizing: Detection of multiple faults, Failure-Tolerant Design, Quadded Logic, Reliable Design and Fault Diagnosis Hazards: Fault Detection in Combinational Circuits. **Textbook 2: Ch 9:9.1-9.6, Ch 12:12.1-12.6**	
Module - 3	**08 Hrs**
Fault-location experiments: Boolean Differences, Limitations of Finite – State Machines, State Equivalence and Machine Minimization, Simplification of Incompletely Specified Machines. **Textbook 2: Ch 4:4.1-4.8, Ch 5:5.1-5.8**	
Module - 4	**08 Hrs**
Structure of Sequential Machines: Introductory Example, State Assignments Using Partitions, The Lattice of closed Partitions, Reductions of the Output Dependency, Input Independence and Autonomous Clocks, Covers and Generation of closed Partitions by state splitting, Information Flow in Sequential Machines, decompositions, Synthesis of Multiple Machines. **Textbook 1: Ch 12:12.1-12.9**	
Module - 5	**08 Hrs**
State Identifications and Fault-Detection Experiments: Homing Experiments, Distinguishing Experiments, Machine Identification, Fault Detection Experiments, Design of Diagnosable Machines, Second Algorithm for the Design of Fault Detection Experiments, Fault-Detection. **Textbook 1: Ch 13:13.1-13.4** **Textbook 2: Ch 2:2.1-2.9**	

Course Outcomes: After completing the course, the students will be able to	
CO1	Acquire knowledge to **analyze** threshold gates and their synthesis
CO2	**Define**, characterize and classify various fault tolerance and **apply** diagnosis techniques to complex systems.
CO3	**Design** synchronous sequential circuits
CO4	**Outline** the concepts to identify the various state identification and fault detection experiments
CO5	**Apply** the knowledge of fault detection experiments to sequential circuits.

Text Books	
1	Switching and Finite Automata Theory', Zvi Kohavi, TMH, ISBN: 978_0_07_099387_7, 3rd Edition, 2008.
2	Fault Tolerant and Fault Testable Hardware Design', Parag K Lala, Prentice Hall Inc. 1985.

Reference Books	
1	Digital Circuits and logic Design', Charles Roth Jr., Cengage Learning, 7thedition, 2014.
2	Introductory Theory of Computer', E. V. Krishnamurthy, Macmillan Press Ltd, 1983
3	Theory of computer science – Automata, Languages and Computation', Mishra & Chandrasekaran, 2ndEdition, PHI, 2004

Web links and Video Lectures (e - Resources)	
1	https://nptel.ac.in/

CO - PO MAPPING

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**
CO1	3		2			2
CO2		2	3			
CO3			3	2		
CO4	3		3			
CO5		3			2	1

Semester: I						
ASIC Design **Stream: ECE (Digital Communication & Networking)**						
Course Code	**:**	MEC114A		**Credits**	**:**	3
Hours/Week (L:T:P)	**:**	3:0:0		**CIE**	**:**	50 Marks
Total Hours	**:**	40		**SEE**	**:**	50 Marks
Course Type	**:**	Profession Elective-1		**SEE Duration**	**:**	3 Hours

Prerequisites:	
Courses	Fundamentals of CMOS VLSI
Knowledge on Fundamental Concepts	Basics of CMOS, Concepts of EDA Tool, Basics of Logic Design
Knowledge on Connected Tools (If any)	Cadence/ Synopsis/Xilinx

Course Learning Objectives: This course will enable the students to	
CLO1	Learn ASIC methodologies and programmable logic cells to implement a function onIC.
CLO2	Analyze back-end physical design flow, including partitioning, floor-planning, placement, and routing.
CLO3	Gain sufficient theoretical knowledge for carrying out FPGA and ASIC design

Module - 1	**08 Hrs.**
Introduction to ASICs: Full custom, Semi-custom and Programmable ASICs, ASIC Design flow, ASIC cell libraries. **CMOS Logic**: CMOS transistors, Combinational Logic Cells, Sequential Logic cells, Data path Logic Cells, **ASIC Library Design:** Transistors as Resistors, Transistor Parasitic Capacitance, Logical Effort. **Text-1: Chapter 1: 1.1, 1.2, 1.5, Chapter 2 :2.1, 2.4, 2.5,2.6, Chapter 3: 3.1 to 3.3**	
Module - 2	**08 Hrs**
ASIC Library Design: Logical effort: Predicting Delay, Logical area and logical efficiency, Logical paths, multi-stage cells, Optimum delay and number of stages, library cell design. **Programmable ASIC & Logic Cells:** Antifuse, Static RAM**,** EPROM & EEPROM Technology, Actel ACT: ACT 1, ACT 2 and ACT 3 Logic Modules, Xilinx LCA: XC3000 CLB, Altera FLEXand MAX **Programmable ASIC I/O Cells**: DC & AC input and Outputs, Clock Input, Power Input, Xilinx and Altera I/O Block. **Text-1: Chapter 3: 3.3, 3.4, Chapter 4: 4.1 to 4.3, Chapter 5: 5.1 to 5.4, Chapter 6: 6.5 to 6.8**	
Module - 3	**08 Hrs**
Low-level design entry: Schematic entry: Hierarchical design, The cell library, Names, Schematic Icons & Symbols, Nets, Schematic Entry for ASICs, Connections, vectored instances & buses, Edit in place, attributes, Netlist screener. **ASIC Construction**: Physical Design, CAD Tools, System partitioning, Estimating ASIC size. **Partitioning:** Goals and objectives, Constructive Partitioning, Iterative Partitioning Improvement, KL, FM and Look Ahead algorithms. **Text-1: Chapter 9:9.1, Chapter 15:15.1 to 15.4, 15.7**	

Module - 4	08 Hrs
Floor planning and placement: Goals and objectives, Measurement of delay in Floor planning, Floor planning tools, Channel definition, I/O and Power planning and Clock planning. **Placement:** Goals and Objectives, Min-cut Placement algorithm, Iterative Placement Improvement, Time driven placement methods, Physical Design Flow. **Text-1: Chapter 16: 16.1, 16.2**	
Module - 5	**08 Hrs**
Routing: Global Routing - Goals and objectives, Global Routing Methods, Global routing between blocks, Back-annotation. Detailed Routing - Goals and objectives, Measurement of Channel Density, Left-Edge Algorithm, Area-Routing Algorithms, Multilevel routing, Timing – Driven detailed routing, Final routing steps, Special Routing, Circuit extraction and DRC. **Text-1: Chapter 17: 17.1 to 17.4**	

Course Outcomes: After completing the course, the students will be able to	
CO1	Describe the concepts of ASIC design methodology, data path elements
CO2	Apply Logical Effort Technique for predicting Delay, Delay Minimization and design logic cell and I/O cells
CO3	Analyze the design of ASICs suitable for specific tasks, perform design entry and construct the ASIC Circuits
CO4	Develop the floor plan, placement including partition and routing with the use of CAD algorithms
CO5	Develop an ASIC project, including HDL design, simulation, synthesis, and layout, to meet given specifications and constraints using EDA Tools

Text Books	
1	Michael John Sebastian Smith, "Application - Specific Integrated Circuits", Addison-Wesley Professional, 2005

Reference Books	
1	Neil H.E. Weste, David Harris, and Ayan Banerjee, "CMOS VLSI Design: A Circuits and Systems Perspective", Addison Wesley/ Pearson education 3rdedition, 2011
2	Vikram Arkalgud Chandrasetty, "VLSI Design: A Practical Guide for FPGA and ASIC Implementations" Springer, ISBN: 978-1-4614-1119-2. 2011
3	Rakesh Chadha, Bhasker J, "An ASIC Low Power Primer", Springer, ISBN: 978-14614-4270-7.
4	Naveed A. Sherwani, "Algorithms for VLSI Physical Design Automation", Springer, ISBN: 978-0792383932.3rd Edition,1999.

Web links and Video Lectures (e - Resources)	
1	https://archive.nptel.ac.in/courses/106/105/106105161/
2	https://www.youtube.com/watch?v=oZSv68esbgI
3	https://youtube.com/playlist?list=PLcwp2fRcIXJU8hnEEUwHLaSJvnLsGQqaA&feature=shared

CO - PO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6
CO1	1		1	3		1
CO2	1		1	3		1
CO3	1		1	3		1
CO4	1		1	3		1
CO5	3	2	1	3	1	1

Semester: I						
ADVANCED COMPUTER NETWORKING **Stream: ECE (Digital Communication & Networking)**						
Course Code	**:**	MEC114B		**Credits**	**:**	3
Hours/Week(L:T:P)	**:**	3:0:2		**CIE**	**:**	50Marks
Total Hours	**:**	40 hours Theory + 6 Lab slots		**SEE**	**:**	50Marks
Course Type	**:**	ELECTIVE		**SEE Duration**	**:**	3 Hours

Prerequisites:	
Courses	Data Communications and Networking, Computer Networks
Knowledge on Fundamental Concepts	Basics Of Computer Networks
Knowledge on Connected Tools (If any)	NS2, NS3

Course Learning Objectives: This course will enable the students to	
CLO1	Focus on advanced networking concepts for next generation network architecture and design
CLO2	Acquire knowledge about SDN and virtualization for designing next generation networks
CLO3	Simulate the network with different configurations to measure the performance parameters and network protocols

Module - 1	**08Hrs**
Introduction: Use of Computer Networks, Network Hardware, Reference models **Medium Access Control Sub Layer**: Wireless LANs, Broadband Wireless, Bluetooth, RFID. **The Network Layer:** Network Layer Design Issues, Congestion Control Algorithms, Quality of Service, The Network Layer in the Internet **Text book 1: Chapter-1 (1.1,1.2,1.4.1 &1.4.2), chapter-4(4.4,4.5,4.6,4.7) Chapter-5(5.1,5.3,5.4,5.6)**	
Module - 2	**08Hrs**
The Application Layer: The Domain Name System, Electronic Mail, The World Wide Web **Text book 1: Chapter-7(7.1,7.2,7.3)**	
Module - 3	**08 Hrs**
Software Defined Network (SDN): Evolution of Switches and Control Planes, Cost, SDN Implications for Research and Innovation **Genesis of SDN:** The Evolution of Networking Technology, Forerunners of SDN, Software Defined Networking is Born, Sustaining SDN Interoperability, Open-Source Contributions, Network Virtualization **How SDN Works:** Fundamental Characteristics of SDN, SDN Operation, SDN Devices, SDN Controller, SDN Applications, Alternate SDN Methods **Text book 2: Chapter 2(2.1,2.2,2.3), Chapter 3 and Chapter 4**	
Module - 4	**08 Hrs**
The Open flow Specification: OpenFlow Overview, OpenFlow 1.0 and OpenFlow Basics, OpenFlow Additions - 1.1, 1.2, 1.3, 1.4, 1.5, Improving OpenFlow Interoperability, Optical Transport Protocol Extensions, OpenFlow Limitations **Text book 2 Chapter 5**	

Module - 5	08 Hrs
Network Functions Virtualization: Definition of NFV, Virtualize, Standards, OPNFV, Leading NFV Vendors, SDN Vs NFV, In-Line Network Functions. **SDN Open Source**: SDN Open-Source Landscape, The OpenFlow Open-Source Environment, Profiles of SDN Open-Source Users, OpenFlow Source Code, Switch Implementations, Controller Implementations, SDN Applications, Orchestration and Network Virtualization, Simulation, Testing and Tools, Open-Source Cloud Software, Example: Applying SDN Open Source. **Text book 2: Chapter 10 and Chapter 13**	

Course Outcomes: After completing the course, the students will be able to	
CO1	**Outline** the advanced concepts and next generation networks.
CO2	**Analyze** network Algorithms, Protocols and their functionalities.
CO3	**Comprehend** features of SDN and its application to next generation systems.
CO4	**Analyze** the performance of various server implementations.
CO5	**Design** a suitable networks different configurations and network protocols

TextBooks	
1	Andrew S. Tanenbaum, David J. Wetherall, Computer Network, 5th Edition. Pearson Education
2	Paul Goransson, Chuck Black and Timothy Culver, Software Defined Networks - A Comprehensive Approach, 2nd Edition, 2017, Morgan Kaufmann

Reference Books	
1	Behrouz A. Forouzan, Data Communications and Networking, Fourth Edition, Tata McGraw Hill, 2007.
2	James F Kurose, Keith W Ross, Computer Networking- A Top-down Approach Featuring the Internet, 7th Edition, 2017, Pearson Education.
3	Alberto Leon Garcia, Indra Widjojo, Communication Networks-Fundamental Concepts and Key Architectures, Fifth reprint 2002, Tata McGraw Hill

Web links and Video Lectures (e - Resources)	
1	https://nptel.ac.in/
2	https://www.eecis.udel.edu/~bohacek/videoLectures/ComputerNetworking/ComputerNetworking_v2.html
3	https://cosmolearning.org/courses/computer-networks-524/video-lectures/

CO - PO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6
CO1	3	1	1	1	1	1
CO2	3	1	1	1	1	1
CO3	2	1	2	2	1	1
CO4	2	1	2	2	1	1
CO5	3	3	2	3	2	2

PRACTICAL COMPONENT OF IPCC

List of Programs to be implemented & executed using any programming languages like packet tracer/NS2, NS3, Java (but not limited to)

Sl.NO	Experiments
1	Study of basic network command and Network configuration commands.
2	Implementation of simple networks and various networking protocols and algorithms using simulators like NCTUns / CISCO packet tracer
3	Implement transmission of ping messages/trace route over a network topology consisting of 6 nodes and find the number of packets dropped due to congestion
4	Implement an Ethernet LAN using n nodes and set multiple traffic nodes and plot congestion window for different source / destination
5	Implement simple ESS and with transmitting nodes in wire-less LAN by simulation and determine the performance with respect to transmission of packets
6	Write a program on datagram socket for client/server to display the messages on client side, typed at the server side using java

Semester: I						
ADVANCED SIGNAL PROCESSING **Stream: ECE (Digital Communication & Networking)**						
Course Code	**:**	MEC114C		**Credits**	**:**	3
Hours/Week (L:T:P)	**:**	3:0:0		**CIE**	**:**	50 Marks
Total Hours	**:**	40		**SEE**	**:**	50 Marks
Course Type	**:**	Elective		**SEE Duration**	**:**	3 Hours

Prerequisites:	
Courses	Signals and Systems, Digital Signal Processing
Knowledge on Fundamental Concepts	Signals and Systems
Knowledge on Connected Tools (If any)	Matlab, Scilab, C Programming

Course Learning Objectives: This course will enable the students to	
CLO1	Illustrate significance and analysis of discrete time signals and systems
CLO2	Analyze digital signals in time and frequency domain and know their applications.
CLO3	Gain in-depth knowledge of use of digital systems in real time applications
CLO4	Interpret practical implementation issues such as computational complexity, hardware resource limitations as well as cost of DSP systems or DSP Processors
CLO5	Apply the algorithms for wide area of recent applications Eg. Speech, Image, Biomedical Applications.

Module - 1	**08 Hrs**
Analysis of Discrete Time Signals and Systems: Basic elements of a DSP System - Review of Sampling (Sampling theorem), Quantization, Encoding, Discrete-Time Signals and Systems (Frequency Domain analysis): Z-transform & Inverse z-transform, Linear convolution and its properties. Discrete Time Fourier Transform (DTFT), Discrete Fourier Transform (DFT), Interpretation of DFT Spectrum, Review of DFT properties - Convolution and correlation, Convolution of long sequences. **Text Book 1: Chapter 1, Text Book 3: Chapter 1 and 3**	
Module - 2	**08 Hrs**
Digital Filters and Implementation: Review of FIR and IIR filter design, FIR and IIR Filter structures, Lattice structures. Design of Linear-phase FIR filters using windows (Rectangular, Hamming). **IIR Filter Design:** Infinite Impulse response Filter Format, Bilinear Transformation Design Method, Analog Filters using Lowpass prototype transformation. Normalized Butterworth Functions, Bilinear Transformation and Frequency Warping, Bilinear Transformation Design Procedure, Digital Butterworth Filter Design using BLT. Realization of IIR Filters in Direct form I and II. **Text Book 1: Chapter 3, Text Book 2: Chapter 2**	
Module - 3	**08 Hrs**
Multirate Signals and Systems: Introduction to multirate signal processing with applications, Multirate System Fundamentals - Decimation and Interpolation, Transform domain analysis of Decimators and Interpolators, Decimation and Interpolation filters, Fractional sampling rate alteration, Practical sampling rate converter design. **Text Book 4: Chapter 1**	

Module - 4	08 Hrs
Polyphase decomposition and efficient structures - Introduction to digital filter banks - The DFT filter bank, Two Channel Quadrature Mirror Filter bank (QMF), Perfect Reconstruction. **Adaptive Filters**-Adaptive Channel Equalization, Adaptive noise cancellation, Linear Predictive coding of Speech Signals, Adaptive direct form FIR filters-The LMS algorithm. **Text Book 3: Chapter 5, Chapter 7**	
Module - 5	**08 Hrs**
Introduction to 2-D Signals and Systems: Elementary 2D signals - Linear shift Invariant systems - Separability - 2D convolution - Introduction to 2D transforms: 2D DFT, 2D DCT, Walsh Hadamard Transform (WHT), Karhunen Loeve Transform (KLT) - Applications. **Text Book 2: Chapter 4**	

Course Outcomes: After completing the course, the students will be able to	
CO1	Analyze the effect of sampling and quantization of signals and appraise its relevance with reference to applications.
CO2	Examine finite word length effects and design practical filters for real time signals.
CO3	Demonstrate the effect of sampling rate converters and design distortion free digital filter banks illustrating their applications to process real time signals.
CO4	Analyze Polyphase and adaptive filters and illustrating their real time applications.
CO5	Formulate various transform domain representations of 1D and 2D signals and demonstrate their applications with reference to practical signals.

Text Books	
1	K Deergha Rao, M N S Swamy, Digital Signal Processing: Theory and Practice, Springer, 2018.
2	Mitra S. K., Digital Signal Processing: A Computer Based Approach, McGraw-Hill Publishing Company, 2013
3	John G. Proakis, Dimitris G. Manolakis, Digital Signal Processing: Principles, Algorithms and Applications, 4th Edition, Pearson India, 2007.
4	P.P. Vaidyanathan, Multirate systems and filter banks, 2nd Edition, Pearson Education India, 1992

Reference Books	
1	Steven W. Smith, The Scientist and Engineer's Guide to Digital Signal Processing, California, 1999

Web links and Video Lectures (e - Resources)	
1	https://nptel.ac.in/
2	https://www.arm.com/resources/education/online-courses/digital-signal-processing
3	https://www.coursera.org/learn/dsp1

CO - PO MAPPING

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**
CO1	**2**		**2**	**3**		**2**
CO2	**3**	**2**	**3**	**3**		**2**
CO3	**2**			**2**		**2**
CO4	**2**	**2**	**2**	**2**		**2**
CO5	**2**	**2**	**2**	**2**	**1**	2

Semester: I						
Power Converters **Stream: ECE (Digital Communication & Networking)**						
Course Code	**:**	**MEC114D**		**Credits**	**:**	3
Hours/Week (L:T:P)	**:**	3:0:0		**CIE**	**:**	50 Marks
Total Hours	**:**	40		**SEE**	**:**	50 Marks
Course Type	**:**	LDN		**SEE Duration**	**:**	3 Hours

Prerequisites:	
Courses	**Basic electronics and Power Electronics**
Knowledge on Fundamental Concepts	Semiconductor Devices
Knowledge on Connected Tools (If any)	Multisim Simulation Tools

Course Learning Objectives: This course will enable the students to	
CLO1	To analyze, model, and simulate various power electronics devices
CLO2	Gain ability to perform dynamic analysis of power converters.
CLO3	Develop systematic approach for transient and steady-state analysis of power electronic converters with passive and active loads.
CLO4	Interpret practical applications of power electronic circuits and systems

Module – 1	**08 Hrs**
Analysis of switched circuits: Thyristor controlled half wave rectifier – R, L, RL, RC load circuits, classification and analysis of commutation. Text Book 1: Chapter 5	
Module – 2	**08 Hrs**
Single-Phase and Three-Phase AC to DC converters: half controlled configurations- operating domains of three phase full converters and semi-converters – Reactive power considerations. Text Book 1: Chapter 6	
Module – 3	**08 Hrs**
Analysis and design of DC to DC converters: Control of DC-DC converters, Buck converters, Boost converters, Buck-Boost converters, Cuk converters Text Book 1: Chapter 7	
Module – 4	**08 Hrs**
Single phase and Three phase inverters: Voltage source and Current source inverters, Voltage control and harmonic minimization in inverters. Text Book 1: Chapter 8	
Module – 5	**08 Hrs**
AC to AC power conversion using voltage regulators: choppers and cyclo-converters, consideration of harmonics., application of choppers Text Book 2: Chapter 11	

Course Outcomes: After completing the course, the students will be able to	
CO1	Describe the characteristics of power semiconductor devices and identify suitable switch choices for a given application
CO2	Design and analyze single phase controlled rectifiers and its control circuit according to the specifications
CO3	Interpret single phase and three phase inverters working with reduced harmonics for practical applications
CO4	Acquire knowledge of voltage control in inverters and AC voltage controllers.
CO5	Analyze the basic chopper circuits and infer its use in real time applications.

Text Books	
1	Ned Mohan, Undeland and Robbin, 'Power Electronics: converters, Application and design', John Wiley and sons.Inc, Newyork, 1995.
2	Rashid M.H., 'Power Electronics Circuits, Devices and Applications ', Prentice Hall India, New Delhi, 1995.
3	P.C Sen.,' Modern Power Electronics ', Wheeler publishing Co, First Edition, New Delhi, 1998.

Reference Books	
1	Switching Power Supply Design, 3rd Ed. Abraham I. Pressman.
2	Switching Power Supply Design and Optimization Sanjaya Maniktala.
3	

Web links and Video Lectures (e – Resources)	
1	https://nptel.ac.in/

CO – PO MAPPING

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**
CO1	**2**	**3**	**3**	**1**	**-**	**2**
CO2	**2**	**3**	**3**	**1**	**1**	**-**
CO3	**3**	**2**	**3**	**2**	**1**	**1**
CO4	**2**	**2**	**3**	**1**	**1**	**1**
CO5	**3**	**3**	**3**	**2**	**2**	**1**

Semester: I						
SYSTEMVERILOG **Stream: ECE (Digital Communication & Networking)**						
Course Code	**:**	**MEC115A**		**Credits**	**:**	3
Hours/Week(L:T:P)	**:**	3:0:0		**CIE**	**:**	50Marks
Total Hours	**:**	40L		**SEE**	**:**	50Marks
Course Type	**:**	Non-Integrated		**SEE Duration**	**:**	3 Hours

Prerequisites:	
Courses	
Knowledge on Fundamental Concepts	Introduction to Verilog & VHDL
Knowledge on Connected Tools (If any)	XILINX and Cadence

Course Learning Objectives: This course will enable the students to	
CLO1	Comprehend Digital System Verification Using Object Oriented Methods
CLO2	Learn the System Verilog Language for Digital System Verification.
CLO3	Create/Build Test Benches for the Design/Methodology.
CLO4	Use Constrained Random Tests for Verification
CLO5	Interpret Concepts of Functional Coverage

Module-1	**08Hrs**
Introduction to System Verilog: key system verilog enhancements for hardware design, enhanced literal value assignments, external compilation unit declarations, simulation time units and precision. **Data Types:** Built-In Data Types, Fixed and Dynamic Arrays, Queues, Associative Arrays, Linked Lists, Array Methods, Choosing A Storage Type, Creating New Types With typedef, Creating User Defined Structures, Type Conversion, Enumerated Types, Constants and Strings, Expression Width. **TEXT BOOK:1 CH-1,2**	
Module-2	**08Hrs**
Procedural Statements and Routines: Procedural Statements, Tasks, Functions and Void Functions, Task and Function Overview, Routine Arguments, Returning from a Routine, Local Data Storage, Time Values. **Connecting the Test Bench and Design**: Separating the Test Bench and Design, The Interface Construct, Stimulus Timing, Interface Driving and Sampling, System Verilog Assertions. **TEXT BOOK:1CH-4,5**	
Module-3	**08Hrs**
System Verilog Procedural Blocks: system verilog specialized procedural blocks, enhancements to tasks and functions **Randomization**: Introduction, Randomization in System Verilog, Constraint Details, Solution Probabilities, Valid Constraints, In Line Constraints, Random Number Functions, Common Randomization Problems, Random Control, Random Number Generators. **TEXT BOOK:1 CH 7,8**	

Module-4	08Hrs
Threads and Inter process Communication: Working with Threads, Disabling Threads, Inter Process Communication, Events, Semaphores, Mailboxes, Building A Test Bench with Threads and Inter Process Communication. **TEXT BOOK:2 CH-8**	
Module- 5	**08Hrs**
Functional Coverage: Coverage Types, Functional Coverage Strategies, Simple Functional Coverage Example, Anatomy of Cover Group, triggering a Cover Group, Data Sampling, Cross Coverage, Generic Cover Groups, Coverage Options, Analyzing Coverage Data, Measuring Coverage Statistics During Simulation. **Case Study:** General Purpose Input Output (GPIO), Serial Peripheral Interface (SPI), ARM Advanced Microcontroller Bus Architecture (AMBA) and Universal Asynchronous Receiver Transmitter (UART) Verification IP (VIP) Development. **TEXT BOOK:2 CH-10**	

Course Outcomes: After completing the course, the students will be able to	
CO1	Apply the System Verilog concepts to verify the design.
CO2	Infer the constrained random tests benches inter process communication using System Verilog.
CO3	Interpret Functional Coverage.
CO4	Analyze a verification case and apply System Verilog to verify the design.
CO5	Engage in self-study to write program and demonstrate verilog code using modern tool usage.

Text Books	
1	Chris Spear, "System Verilog for Verification– A guide to learning the Test bench language features", Springer Publications Second Edition,2010.
2	Stuart Sutherland, Simon Davidmann, Peter Flake, "System Verilog for Design-A guide to using system Verilog for Hard ware design and modelling", Springer Publications Second Edition, 2006.

Weblinks and Video Lectures(e-Resources)	
1	https://nptel.ac.in/

CO-POMAPPING

	PO1	PO2	PO3	PO4	PO5	PO6
CO1	2		1	1		
CO2	2		1	1		
CO3	1		1			
CO4	2	3	1	1	1	1
CO5	2	3	2	3	2	2

Semester: I						
ADVANCED WIRELESS COMMUNICATION **Stream: ECE (Digital Communication & Networking)**						
Course Code	**:**	**MEC115B**		**Credits**	**:**	3
Hours/Week(L:T:P)	**:**	3:0:0		**CIE**	**:**	50Marks
Total Hours	**:**	40		**SEE**	**:**	50Marks
Course Type	**:**	Core		**SEE Duration**	**:**	3 Hours

Prerequisites:	
Courses	Basic Wireless Communication
Knowledge on Fundamental Concepts	Multiple Access Techniques, Antenna and Propagation, Channel Models
Knowledge on Connected Tools (If any)	

Course Learning Objectives: This course will enable the students to	
CLO1	Enable students understand the various aspects of wireless communication
CLO2	Understand the concept behind the capacity of channels.
CLO3	Gain the information on Linear time-invariant Gaussian channels, Capacity of fading channels
CLO4	Study uplink and downlink model of AWGN channel, fading channels
CLO5	Describe different types of diversity, Understanding concept behind modeling of MIMO.

Module - 1	**08Hrs**
Physical modeling for wireless channels, Input/output model of the wireless channel: Free space, fixed transmit and receive antennas, Free space, moving antenna, reflecting wall, fixed antenna, reflecting wall, moving antenna, Reflection from a ground plane, Power decay with distance and shadowing, Moving antenna, multiple reflectors, The wireless channel as a linear time-varying system, Baseband equivalent model, discrete-time baseband model. **Text Book 1: Ch 2: 2.1 - 2.2**	
Module - 2	**08Hrs**
Time and frequency coherence, AWGN channel capacity: Time and frequency coherence: Doppler spread and coherence time, delay spread and coherence bandwidth, Repetition coding, Packing spheres, Resources of the AWGN channel-Continuous time AWGN channel, Power and bandwidth, Bandwidth reuse in cellular systems. **Text Book 1: Ch 2: 2.3; Ch 5: 5.1-5.2**	
Module - 3	**08 Hrs**
Linear time-invariant Gaussian channels, Capacity of fading channels: Single input multiple output (SIMO) channel, Multiple input single output (MISO) channel, Frequency-selective channel, Slow fading channel, receive diversity, transmit diversity, Transmit and receive diversity, Time and frequency diversity, Outage for parallel channels, Fast fading channel, Transmitter side information, Frequency-selective fading channels **Text Book 1: Ch 5: 5.3 - 5.4**	

Module - 4	08 Hrs
Uplink and Downlink AWGN channel, Uplink and Downlink fading channel: Capacity via successive interference cancellation, Comparison with conventional CDMA, Comparison with orthogonal multiple access, General K-user uplink capacity, Symmetric case: two capacity achieving schemes, General case: superposition coding achieves capacity, Slow fading channel, Fast fading channel, Full channel side information, Channel side information at receiver only, Full channel side information. **Text Book 1: Ch 6: 6.3 - 6.5**	
Module - 5	**08 Hrs**
Multiuser diversity, Physical Modeling of MIMO channels: Multiuser diversity gain, Multiuser versus classical diversity, Fair scheduling and multiuser diversity, Channel prediction and feedback, Opportunistic beam forming using dumb antennas, Multiuser diversity in multi cell systems, Line-of- sight SIMO channel, Line-of-sight MISO channel, Antenna arrays with only a line-of-sight path, Geographically separated antennas, Line-of-sight plus one reflected path, MIMO multipath channel, Angular domain representation of signals, Angular domain representation of MIMO channels, Statistical modeling in the angular domain, Degrees of freedom and diversity, Dependency on antenna spacing, I.I.D. Rayleigh Fading Model. **Text Book 1: Ch 6: 6.6 - 6.7; Ch 7: 7.2-7.3**	

Course Outcomes: After completing the course, the students will be able to	
CO1	Infer key concepts of wireless communication.
CO2	Outline uplink and downlink model of AWGN channel, fading channels and multiuser diversity
CO3	Solve the capacity of AWGN channel, LTI Gaussian channels and various fading channels.
CO4	Analyze and develop physical models of wireless channels.
CO5	Analyze a case study on application of Advanced wireless communication.

Text Books	
1	David T, Pramod Viswanath, Fundamentals of Wireless Communications, Cambridge

Reference Books	
1	"MIMO Wireless Communications" by Ezio Biglieri, Andrea Goldsmith, Luca Tarocco, and others
2	Andrea Goldsmith, Wireless Communications, Cambridge University Press, 2005.
3	"Wireless Communication Systems" by Christian Schlegel, S. K. Mohammed, and Peter S. Gupta

Web links and Video Lectures (e - Resources)	
1	https://nptel.ac.in/, https://ocw.mit.edu, https://scholar.google.com

CO - PO MAPPING

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**
CO1	2	1	2	2		2
CO2	3		2	3		2
CO3	3		2	3		2
CO4	2		2	2		2
CO5	3	3	2	1	3	2

PRACTICAL COMPONENT OF IPCC

List of Programs to be implemented & executed using any programming languages like packet tracer/NS2, NS3, Java (but not limited to)

Sl.NO	Experiments
1	Study of basic network command and Network configuration commands.
2	Implementation of simple networks and various networking protocols and algorithms using simulators like NCTUns / CISCO packet tracer
3	Implement transmission of ping messages/trace route over a network topology consisting of 6 nodes and find the number of packets dropped due to congestion
4	Implement an Ethernet LAN using n nodes and set multiple traffic nodes and plot congestion window for different source / destination
5	Implement simple ESS and with transmitting nodes in wire-less LAN by simulation and determine the performance with respect to transmission of packets
6	Write a program on datagram socket for client/server to display the messages on client side, typed at the server side using java

Semester: I						
MULTIMEDIA AND APPLICATIONS **Stream: ECE (Digital Communication & Networking)**						
Course Code	**:**	**MEC115C**		**Credits**	**:**	3
Hours/Week (L:T:P)	**:**	3:0:0		**CIE**	**:**	50 Marks
Total Hours	**:**	40		**SEE**	**:**	50 Marks
Course Type	**:**	LDN		**SEE Duration**	**:**	3 Hours

Prerequisites:	
Courses	Digital Signal Processing, Information theory & Coding and Computer Networks
Knowledge on Fundamental Concepts	Fourier or wavelets transforms for image and audio processing
Knowledge on Connected Tools (If any)	Basic Programming Skills like MATLAB, Scilab and Python

Course Learning Objectives: This course will enable the students to	
CLO1	Outline the basics of multimedia including text, image, audio, video and networking terminology.
CLO2	Explore how multimedia is used in different applications like image compression and text compression.
CLO3	Develop knowledge of various methods for compressing multimedia, including audio and video.
CLO4	Comprehend the various video compression standards and Multimedia Networks with applications.

Module - 1	**08 Hrs**
Introduction Multimedia information representation, Multimedia networks, Multimedia applications, Networking terminology, Network QoS and application QoS, Digitization principles, Text, images, audio and video. **Text Book 1: Ch 1: 1.1-1.5, Ch 2: 2.1-2.6**	
Module - 2	**08 Hrs**
Text and image compression Compression principles, Text compression- Static & Dynamic Huffman coding, Arithmetic coding, Lempel-Ziv coding, Lempel-Ziv-Welsh coding LZW, Document Image compression using T2 and T3 coding, Image compression- GIF, TIFF and JPEG. **Text Book 1: Ch 3: 3.1-3.4**	
Module - 3	**08 Hrs**
Audio Compression Audio compression - DPCM, ADPCM, Adaptive and Linear Predictive coding, Code-Excited LPC, Perceptual coding, MPEG and Dolby audio coders **Text Book 1: Ch 4: 4.1-4.2**	
Module - 4	**08 Hrs**
Video Compression Video compression principles, H.261, H.263, MPEG, MPEG 1, MPEG 2, MPEG-4, MPEG-7 standardization process of multimedia content description, MPEG 21 multimedia framework. **Text Book 1: Ch 4: 4.3** **Text Book 2: Ch 5: 5.7-5.8**	

Module - 5	08 Hrs
Multimedia Networks Basics of Multimedia Networks, Communications and Applications: Quality of Multimedia Data Transmission, Multimedia over IP, Multimedia over ATM Networks, Transport of MPEG-4, Media on Demand (MoD). **Text Book 3: Ch 12,13,14: 12.2, 13.2, 13.3, 14.2, 14.3**	

Course Outcomes: After completing the course, the students will be able to	
CO1	Outline multimedia information representation, networks and compression techniques.
CO2	Apply QoS to multimedia network applications with efficient routing techniques.
CO3	Analyze various coding methods and compression techniques.
CO4	Infer the standards of digital video formats used in multimedia applications.
CO5	Assess network performance and develop multimedia applications.

Text Books	
1	Fred Halsall, "Multimedia Communications: Applications, Networks, Protocols and Standards" Pearson Education Publishers, 2001, ISBN: 97802013981871.
2	K. R. Rao, Zoran S. Bojkovic, Dragorad A. Milovanovic, “Multimedia Communication Systems”, Pearson education, 2002.
3	Anirban Mukhopadhyay, Arup Chattopadhyay, “Introduction to Computer Graphics and Multimedia, Vikas Publishing, Second Edition, 2010

Reference Books	
1	Raif Steinmetz, Klara Nahrstedt, “Multimedia: Computing, Communications and Applications”, Pearson education, 2002.
2	Hans. W. Barz, Gregory A. Bassett, "Multimedia Networks: Protocols, Design and Applications", John Wiley & Sons publications, 2016. ISBN: 9781119090137.
3	John Billamil, Louis Molina, “Multimedia: An Introduction”, PHI, 2002.

Web links and Video Lectures (e - Resources)	
1	https://nptel.ac.in/

CO - PO MAPPING

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**
CO1		**2**	**2**	**1**		**2**
CO2	**2**	**2**	**2**	**1**	**1**	
CO3	**3**	**2**	**2**	**2**	**1**	**1**
CO4		**2**	**2**	**1**	**1**	**1**
CO5	**3**	**3**	**3**	**2**	**2**	**1**

Semester: I						
PROCESS CONTROL **Stream: ECE (Digital Communication & Networking)**						
Course Code	**:**	MEC115D		**Credits**	**:**	03
Hours/Week (L:T:P)	**:**	3:0:0		**CIE**	**:**	50 Marks
Total Hours	**:**	40		**SEE**	**:**	50 Marks
Course Type	**:**	LDN		**SEE Duration**	**:**	3 Hours

Prerequisites:	
Courses	Control Engineering
Knowledge on Fundamental Concepts	Control Systems basics, Types of Controllers.
Knowledge on Connected Tools (If any)	Basic Programming Skills like MATLAB, Scilab and Python

Course Learning Objectives: This course will enable the students to	
CLO1	Understand the need of process control, basic principles of various manufacturing processes and apply engineering knowledge to do problem analysis in process control.
CLO2	Define and develop mathematical model of common dynamics of processes found in industries.
CLO3	Apply the tuning rules to achieve optimum performance using the proper controller.
CLO4	Understand, interpret and implement tuning of the controllers using various methods and study about digital controllers.
CLO5	Use of advanced control strategy to enhance the performance.

Module – 1	**08 Hrs**
Introduction: Introduction to Process Control. Control objectives, servo regulatory control, and classification of process variables. **Modeling of some Chemical Process Systems**: Modeling basics, Degree of Freedom, Mass Balance, Energy Balance equations, linearization of nonlinear systems, Modeling of Level Tank System, Continuous Stirred Tank Heater, Continuous Stirred Tank Reactor, Transfer function. **Text Book 1: Chap 4,5**	
Module – 2	**08 Hrs**
Elements of Process Control: Dead time, Interacting and non-interacting systems, self-regulation, inverse response, capacity of process, integrating systems, multi-capacity process. **Process Identification:** Dynamic behavior of first and second order processes, Obtaining First Order Plus Time Delay (FOPTD) model with Process Reaction curve. Obtaining second order model of processes. **Text Book 1: Chap 10,11,12**	
Module – 3	**08 Hrs**
Common Controller Modes: Controller Modes, ON OFF, Multi position, time proportional controller, Theory Proportional, Integral and Derivative modes, PI, PD, PID Controller, Electronics Controller implementation, Dynamic Behavior of closed loop systems with P, I, D, PI, PID modes. **Text Book 2: Chap 1**	

Module – 4	08 Hrs
Discretization and Implementation Issues: Discrete time control mode realization. Velocity and Position algorithm of PID control. Integral windup, anti-windup systems, controller bias, bumps less transfer. **Tuning of Controllers:** Application and tuning, ZN Tuning (Open loop and Closed loop), Performance criteria, Integral criteria. **Text Book 3: Chap 2,3**	
Module – 5	**08 Hrs**
Some Advance Control Techniques: Cascade Control, Feed forward Control, ratio Control, Air Fuel Ratio Control for Drum Boilers. Level Control in Drum Boiler, Shrinking and Swelling, Inverse response of Drum Boiler. **Text Book 2: Chap 2,6**	

Course Outcomes: After completing the course, the students will be able to	
CO1	Describe basic principles & importance of process control in industrial process plants.
CO2	Apply engineering knowledge to do problem analysis in process control.
CO3	Develop and analyze the mathematical model of common dynamics of processes found in many industries.
CO4	Apply the tuning rules to achieve optimum performance by making use of the proper controller.
CO5	Implement and tune digital controllers s using various advance control Techniques.

Text Books	
1	G. Stephanopolous, "Chemical Process Control An Introduction to Theory and Practice", Prentice Hall India, August 2000.
2	*Cecil L. Smith* "Advanced Process Control: Beyond Single-Loop Control", A JOHN WILEY & SONS, INC., PUBLICATION 2010.
3	Myke King "Process Control A Practical Approach" A JOHN WILEY & SONS, INC., PUBLICATION.

Reference Books	
1	Surekha Bhanot, "Process Control Principles and Applications", Oxford, 2008
2	C.D. Johnson, "Process Control Instrumentation Technology", Prentice Hall India.
3	F.G. Shinskey, "Process Control Systems Application Design and Adjustment" 3rd editionn, McGraw Hill
4	Modern Control Engineering" by Ogata, Katsuhiko International, 6. D. E. Seborg, T.F. Edgar, D. A. Mellichamp, "Process Dynamics and Control", Wiley, 2004.

Web links and Video Lectures (e – Resources)	
1	https://nptel.ac.in/

CO – PO MAPPING

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**
CO1	**-**	**-**	**2**	**-**	**-**	**-**
CO2	**3**	**3**	**3**	**3**	**1**	**2**
CO3	**3**	**3**	**3**	**3**	**1**	**2**
CO4	**3**	**2**	**2**	**2**	**1**	**2**
CO5	**3**	**2**	**2**	**2**	**1**	**1**

Semester: I						
ADVANCED MACHINE LEARNING AND DEEP LEARNING LAB **Stream: ECE (Digital Communication & Networking)**						
Course Code	**:**	**MECL 116A**		**Credits**	**:**	02
Hours/Week (L:T:P)	**:**	0:4:0		**CIE**	**:**	50 Marks
Total Hours	**:**	12P		**SEE**	**:**	50 Marks
Course Type	**:**	ETC		**SEE Duration**	**:**	3 Hours

Prerequisites:	
Courses	Python proficiency and basic machine learning knowledge.
Knowledge on Fundamental Concepts	Stronghold of linear algebra, calculus, programming skills, probability and statistics.
Knowledge on Connected Tools (If any)	**--**

Course Learning Objectives: This course will enable the students to	
CLO1	Apply theoretical knowledge to practical scenarios.
CLO2	Gain proficiency in implementing machine learning algorithms.
CLO3	Analyze real-world problems and develop appropriate solutions.

Sl. No.	**Experiments**
1.	Implement multivariate linear regression.
2.	Implementing Decision tree Classification.
3.	Implement K-means clustering algorithm.
4.	Write a program for Gradient Descent Learning.
5.	Implement Bidirectional Recurrent neural network.
6.	Implementation of Natural Language Processing.
7.	Implementation of Speech Recognition.
8.	Case study- Convolutional Neural Networks.
	Demonstration Experiments (For CIE)
9.	Visualizing linear regression: Use a physical model or software to demonstrate how a line fits to data points.
10.	Overfitting and underfitting: Demonstrate the effects of overfitting and underfitting using simple datasets
11.	Convolution operation: Visualize the convolution process using image patches.
12.	Language modelling: Generate text using a simple RNN model.

Course Outcomes: After completing the course, the students will be able to	
CO1	Implement and apply machine learning techniques in prediction problems.
CO2	Implement suitable learning algorithms to solve a given problem.
CO3	Implement a model based on machine learning for an application.

Web links and Video Lectures (e - Resources)
• Deep Learning - Goodfellow, Bengio and Courville • Fundamentals of Deep Learning – Nikhil Budama • Neural Networks and Deep Learning – Charu Aggarwal • Hands-on Deep Learning Algorithms with Python – Sudharsan Ravichandran

CO - PO MAPPING

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**
CO1	**3**	**2**	**1**	**1**	**1**	**1**
CO2	**3**	**3**	**2**	**1**	**2**	**1**
CO3	**3**	**3**	**2**	**1**	**2**	**1**

Semester: I						
ELECTRONICS AND COMMUNICATIONLABORATORY **Stream: ECE (Digital Communication & Networking)**						
Course Code	**:**	**MECL 116B**		**Credits**	**:**	02
Hours/Week (L:T:P)	**:**	0:4:0		**CIE**	**:**	50 Marks
Total Hours	**:**	12P		**SEE**	**:**	50 Marks
Course Type	**:**	ETC		**SEE Duration**	**:**	3 Hours

Prerequisites:	
Courses	Electronics Devices and Applications
Knowledge on Fundamental Concepts	Amplifiers, Oscillators, feedback Circuits and Modulators circuits
Knowledge on Connected Tools (If any)	--

Course Learning Objectives: This course will enable the students to	
CLO1	To apply theoretical knowledge to practical scenarios.
CLO2	To design and analyze analog and mixed-signal circuits.
CLO3	To implement and evaluate timing and oscillation circuits.

Sl. No.	**Experiments**
1.	Design a Two-Stage direct coupled Differential Amplifier with series voltage Negative Feedback of β=50.
2.	Design a Voltage regulator using operational amplifier to produce output of 12V with maximum load current of 50mA.
3.	Design a Two-stage CS Amplifier with overall gain of 100. Plot the frequency response and estimate the Bandwidth and Q factor.
4.	Design a Darlington Emitter follower using MOSFET/BJT with and without bootstrap; plot the frequency response. Also calculate gain and bandwidth.
5.	Design and realize:i) Four-bit weighted R – 2R ladder DAC. ii) Two-bit Flash ADC using Op-amp.
6.	Design and verify an IC 555 timer-based pulse generator for the specified pulse of 2ms.
7.	Using IC NE 566 Voltage Controlled Oscillator, design a circuit to generate square and triangular waveform with a time period of 0.2ms.
	Demonstration Experiments (For CIE)
8.	Design a radio receiver for a given frequency (88 to 108 MHz) and measure the sensitivity, selectivity, and fidelity of the same.
9.	Generate PAM and PDM signals for a pulse duration of 10 msec using IC 555 Timer.
10.	Implement an AM and FM systems and measure its noise figure.
11.	Consider the bit sequence of length 10,000. Modulate it with BPSK, BASK, BFSK. Transmit the signal through AWGN channel. Vary the SNR. Compare the theoretical and simulated probability of error.
12.	Design and implement the Adaptive delta modulation and demodulation.

Course Outcomes: After completing the course, the students will be able to	
CO1	Design Analog circuits using OPAMPs and IC555 for different applications analyze frequency response
CO2	Design and test circuits for Analog and digital modulation/demodulation schemes.
CO3	Design and test circuits for Analog to digital signal conversion techniques.

Suggested Learning Resources:

- Analog Integrated Circuit Design" by David A. Johns and Ken Martin.
- "Design of Analog CMOS Integrated Circuits" by Behzad Razavi.
- "Op-Amps and Linear Integrated Circuits" by Ramakant A. Gayakwad.
- "555 Timer IC: Operation and Application" by Michael T. R. R. Haskell.

CO – PO MAPPING

	PO 1	**PO2**	**PO3**	**PO 4**	**PO 5**	**PO 6**
CO1	**3**	**2**	**1**	**1**	**1**	**1**
CO2	**3**	**3**	**2**	**1**	**2**	**1**
CO3	**3**	**3**	**2**	**1**	**2**	**1**

Specialization in –(Digital Communication and Networking)

II SEMESTER

Sl. No	Course	Course Code	Course Title	Teaching Hours /Week			Examination				Credits
				Theory	Practical/ Seminar	Tutorial/ Skill Development Activities	Duration in hours	CIE Marks	SEE Marks	Total Marks	
				L	P	T/SDA					
1	IPCC	MLDN201	Antenna Theory and Design	03	02	–	03	50	50	100	4
2	PCC	MLDN202	Advanced Communication Systems	03	–	–	03	50	50	100	3
3	PCC	MLDN203	Cryptography and Network Security	03	–	–	03	50	50	100	3
4	PCC	MLDN204	Wireless Sensor Networks	03	–	–	03	50	50	100	3
5	PEC	MLDN215	Professional elective III	03	–	–	03	50	50	100	3
6	PEC	MLDN216	Professional elective IV	03	–	–	03	50	50	100	3
7	PCCL	MLDNL207	Cryptography and Network Security Lab	--	04	--	03	50	50	100	2
8	AEC/SEC	MLDN257x	Ability/Skill Enhancement Course (Offline/Online)	00 01	02 00	--- ----	02 01	50	50	100	1
TOTAL								**400**	**400**	**800**	**22**

Note: **PCC**: Professional core. **IPCC**-Integrated Professional Core Courses, **PCC(PB):** Professional Core Courses (Project Based), **PCCL**-Professional Core Course lab**, PEC-** Professional Elective Courses, **MDC-** Multi-Disciplinary Courses, **L-Lecture, P-Practical, T/SDA-Tutorial / Skill Development Activities** (Hours are for Interaction between faculty and students)

L-Lecture, P-Practical, T/SDA-Tutorial / Skill Development Activities (Hours are for Interaction between faculty and students)

PBLC: Project Based Learning Course, **MPS**: Mini Project with Seminar/ Societal Project with Seminar

Professional elective III		**Professional elective IV**	
Course Code	**Course title**	**Course Code**	**Course title**
MLDN215A	Multimedia Over Communication Links	MLDN216A	High Speed Communication Networks
MLDN215B	Statistical Signal Processing	MLDN216B	Applied Cyber Security
MLDN215C	Probability and Random Process	MLDN216C	Optical Communication and Networking
MLDN215D	Simulation, Modeling and Analysis	MLDN216D	Error Control Coding

Ability / Skill Enhancement Courses

Course Code	Course title	L	T/SDA	P	
MLDN257A	Modeling and Simulation of Antenna Using Simulation Tool	00	---	02	
MLDN257B	MATLAB and Simulink	00	---	02	
MLDN257C	Programming in Java	00	---	02	
MLDN257D	Python Programming	00	---	02	

Note:

Integrated Professional Core Course (IPCC): Refers to a Professional Theory Core Course Integrated with practicals of the same course. The theory part of the IPCC shall be evaluated both by CIE and SEE. The practical part shall be evaluated by only CIE (no SEE). However, questions from the practical part of IPCC shall be included in the SEE question paper.

Project Based Learning Course (PBLC): Project Based Learning Course is a professional core Course only Students have to complete a project out of learning from the course and SEE will be viva voce on project work

1 Mini Project/ Societal with Seminar: This may be hands-on practice**,** survey report, data collection and analysis, coding, mobile app development, field visit and report preparation, modelling of system, simulation, analysing and authenticating, case studies, etc. It may be Techno Societal Project, technical Project work useful for the society.

CIE marks shall be awarded by a committee comprising of HoD as Chairman, Guide/co-guide, if any, and a senior faculty of the department. Students can present the seminar based on the completed mini-project/Societal Project. Participation in the seminar by all postgraduate students of the programshall be mandatory.

The CIE marks awarded for Mini/Societal Project work and Seminar, shall be based on the evaluation of Mini/ Societal Project work and Report, Presentation skill and performance in Question-and-Answer session in the ratio 50:25:25. Mini-Project with Seminar shall be considered as a head of passing and shall be considered for vertical progression as well as for the award of degree. Those, who do not take-up/complete the Mini Project and Seminar shall be declared as fail in that course and have to complete the same during the subsequent semester. **There is no SEE for this course.**

Semester:II					
Antenna Theory and Design					
Course Code	**:**	MLDN201	**Credits**	**:**	4
Hours/Week(L:T:P)	**:**	3:2:2	**CIE**	**:**	50Marks
TotalHours	**:**	40 hours Theory + 10-12 Lab slots	**SEE**	**:**	50Marks
Course Type	**:**	Core+Integrated	**SEE Duration**	**:**	3 Hours

Prerequisites:	
Courses	Electromagnetics, Signals & Systems, Linear Algeabra
Knowledge on Fundamental Concepts	Smith Chart, Impedance, reactance, resonance
Knowledge on Connected Tools (If any)	Ansys HFSS or CST Suite

Course Learning Objectives: This course will enable the students to	
CLO1	To classify different types of antennas
CLO2	To define and illustrate various types of array antennas
CLO3	To design antennas like Yagi-Uda, Helical antennas and other broad band antennas
CLO4	To describe different antenna synthesis methods.
CLO5	To apply methods like Method of Moments, Pocklington's integral equation, Source modeling.

Module – 1	**08Hrs**
Antenna Fundamentals and Definitions: Radiation Mechanisms, Overview, EM Fundamentals, Solution of Maxwell's Equations for Radiation Problems, Ideal Dipole, Radiation patterns, Directivity and Gain, Antenna impedance, Radiation efficiency, Antenna polarization. RBT Level: L1, L2, L3	
Module – 2	08Hrs
Arrays: Array factor for linear arrays, Uniformly excited equally spaced linear arrays, Pattern multiplication, Directivity of linear arrays, Non uniformly excited equally spaced linear arrays, Mutual coupling. Antenna Synthesis: Formulation of the synthesis problem, Synthesis principles, Line sources shaped beam synthesis, Linear array shaped beam synthesis, Fourier series, Woodward - Lawson sampling method, Comparison of shaped beam synthesis methods, low side lobe narrow main beam synthesis methods, Dolph Chebyshev linear array, Taylor line source method. RBT Level: L1, L2, L3	
Module – 3	08 Hrs
Resonant Antennas: Wires and Patches, Dipole antenna, Yagi-Uda antennas, Micro-strip antenna. Broadband antennas: Traveling wave antennas Helical antennas, Biconical antennas, Sleeve antennas, and Principles of frequency independent antennas, Spiral antennas, and Log - periodic antennas. RBT Level: L1, L2, L3, L4	
Module – 4	08 Hrs

Aperture antennas: Techniques for evaluating gain, Reflector antennas, Parabolic reflector antenna principles, Axi-symmetric parabolic reflector antenna, offset parabolic reflectors, Dual reflector antennas, Gain calculations for reflector antennas, Feed antennas for reflectors, Field representations, Matching the feed to the reflector, General feed model, Feed antennas used in practice. RBT Level: L1, L2, L3

Module – 5	08 Hrs
Antenna in systems & Measurements: Receiving properties of antennas, Antenna temperature & radiometry. CEM for antennas: The method of moments: Introduction of the methods moments, Pocklington's integral equation. Advanced Topics: Mobile phone antenna designs. RBT Level: L1, L2, L3	

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

Sl. No	Description
CO1	Describe antenna fundamentals and solve basic radiation problems using Maxwell's equations.
CO2	Illustrate array principles and apply synthesis techniques for beam shaping.
CO3	Analyze and design resonant and broadband antennas for frequency-specific applications.
CO4	Analyze the advanced aperture antenna systems using measurement techniques and computational methods for practical applications
CO5	Engage in self-study to design and demonstrate the applications of Antenna for the society.

PRACTICAL COMPONENT OF IPCC: Conduct the experiments using MATLAB / Scilab / any antenna simulation tool

Sl.No	Experiments
1	MATLAB/C implementation to obtain the radiation pattern of an antenna
2	Study of radiation pattern of different antennas.
3	Determine the directivity and gains of Horn/Yagi/dipole/Parabolic antennas.
4	Impedance measurements of Horn/Yagi/dipole/Parabolic antennas.
5	Study of radiation pattern of E and H plane horns
6	Significance of Pocklington's integral equation.
7	Measurement of radiation pattern of reflector antennas
8	Design and simulation of Microstrip antenna
9	Performance analysis of Log periodic antenna
10	Performance analysis of Helix antenna
Demo Experiments for CIE	
11	Design and simulate a basic 2×2 MIMO antenna system using MATLAB/HFSS/CST tool.

Text Books	
1	Antenna Theory and Design', Stutzman and Thiele, John Wiley, 2nd Edition, 2010
2	C Rowell and E Y Lam, " Mobile phone antenna design/"

Reference Books	
1	'Antenna Theory Analysis and Design', C. A. Balanis, John Wiley, 2nd Edition, 2007

2	'Antennas and Wave Propagation', J. D. Krauss, McGraw Hill TMH, 4th Edition, 2010
3	'Antennas and propagation', A.R.Harish, M.Sachidanada, Pearson Education, 2015

Skill Development Activities Suggested
• Project Based Learning.

Web links and Video Lectures (e – Resources)	
1	https://www.youtube.com/watch?v=fIbdW0NGIU0
2	https://nptel.ac.in/courses/117107035

CO – PO MAPPING

CO-PO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**
CO1	3		2			
CO2	2		3	3		
CO3	3	2	3	3	1	
CO4	3	2	3	3		
CO5	3	3	3	2	3	3

Semester: II						
ADVANCED COMMUNICATION SYSTEMS						
Course Code	**:**	MLDN202		**Credits**	**:**	3
Hours/Week(L:T:P)	**:**	2:0:2		**CIE**	**:**	50 Marks
Total Hours	**:**	25 Hours Theory		**SEE**	**:**	50 Marks
Course Type	**:**	Core		**SEE Duration**	**:**	3 Hours

Prerequisites:	
Courses	Analog and Digital Communication, DSP
Knowledge on Fundamental Concepts	Signal Processing
Knowledge on Connected Tools (If any)	Scilab, Python

Course Learning Objectives: This course will enable the students to	
CLO1	To understand the concept of low pass and Band pass signals during modulation at the Transmitter.
CLO2	To analyze the Receiver performance for various types of single carrier symbol modulations through ideal and AWGN channels.
CLO3	To apply single carrier equalizers for various modulation schemes and detection methods for defined channel models
CLO4	To understand the concepts of synchronization for carrier and symbol timing recovery at receiver.
CLO5	To understand the concepts of spread spectrum systems for communications in a Jamming, multiuser and low power intercept environment.

Module – 1	**08 Hrs**
Introduction: Elements of a Digital Communication System, mathematical models for communication channels, Communication channels and their characteristics. Representation of bandpass signals and system, Signal space representations. Memoryless Modulation Methods, Pulse Amplitude Modulation ,PAM Phase Modulation, Quadrature Amplitude Modulation , Multidimensional Signaling. **Text 1: Chapter 1,2,3**	
Module – 2	**08 Hrs**
Receiver and Channel Estimation: Optimum receiver for signals corrupted by AWGN, Performance of the optimum receiver for memoryless modulation, Optimum receiver for CPM signals and signals with random phase in AWGN channel. Signal parameter estimation, Carrier phase estimation, Symbol timing estimation, Joint estimation of carrier phase and symbol timing, Performance characteristics of ML estimators. **Text 1: Chapter 4**	
Module – 3	**08 Hrs**
Digital Communication Through Band-Limited Channels: Characterization of band-limited channels, Signal design for band-limited channels, Probability of error in detection of PAM, Modulation codes for spectrum shaping. Optimum Receiver for channels with ISI and AWGN, Linear equalization, Decision feedback equalization, Reduced complexity ML detectors, Iterative equalization and decoding-Turbo equalization. **Text 1: Chapter 9**	
Module – 4	**08 Hrs**
Multicarrier Systems: Multi Carrier Communications, Orthogonal Frequency Division Multiplexing(OFDM), Modulation and Demodulation of OFDM system, Algorithm implementation IFFT/FFT of OFDM, Peak to average Power Ratio in multi carrier Modulation **Text 1: Chapter 11**	
Module – 5	**08 Hrs**

SPREAD SPECTRUM SIGNALS FOR DIGITAL COMMUNICATION: Model of spread spectrum digital communication system, Direct sequence spread spectrum signals, some applications of DS spread spectrum signals, generation of PN sequences, Frequency hopped spread spectrum signals, Time hopping SS, Synchronization of SS systems **Text 1, Chapter 12**

Course Outcomes: After completing the course, the students will be able to	
CO1	Interpret the concept of low pass and Band pass signals representations at the Transmitter, process of Detection and Estimation at the receiver in the presence of AWGN only.
CO2	Evaluate Receiver performance for various types of single carrier symbol modulations through ideal and AWGN Non-band limited and band limited channels.
CO3	Analyze single carrier equalizers working for various symbol modulation schemes and detection methods for defined channel models, and compute parameters to meet desired rate and performance requirements.
CO4	Infer the concepts of multi-channel signaling scheme and synchronization for carrier and symbol timing recovery at receiver.
CO5	Estimate measurable Parameters of Non band limited and Non power limited spread spectrum systems for communications in a Jamming environment, multiuser situation and low power intercept environment.

Text Books	
1	'Digital Communications', John G. Proakis, Masoud Salehi, Pearson Education, ISBN:978-9332535893,5th edition, 2014.
2	Digital Communications: Fundamentals and Applications: Fundamentals & Applications', Bernard Sklar, Pearson Education, ISBN:9788131720929, 2nd edition, 2009.
3	'Digital Communications Systems', Simon Haykin, Wiley,ISBN:9788126542314, 1st edition, 2014

Reference Books	
1	Madhow, Upamanyu. *Fundamentals of digital communication*. Cambridge university press, 2008.
2	Grami, Ali. *Introduction to digital communications*. Academic Press, 2015.

Skill Development Activities Suggested
Massive Open Online Courses: 1. Modern Digital Communication Techniques-By Prof. Suvra Sekhar Das | IIT Kharagpur 2. Principles of Signal Estimation for MIMO/ OFDM Wireless Communication-By Prof. Aditya K. Jagannatham | IIT Kanpur

Web links and Video Lectures (e – Resources)	
1	https://www.youtube.com/watch?v=MPosAPk9qN8
2	https://www.youtube.com/watch?v=AqH4dfTUscY
3	https://www.youtube.com/watch?v=0b_jDaC7mCE&list=PLs5_Rtf2P2r5qubN5CEvPGBBh84OYESfX

CO – PO MAPPING

CO-PO	PO1	PO2	PO3	PO4	PO5	PO6	PSO 1	PSO 2
CO1	**3**	**1**	**1**	**1**	**1**	**2**	**2**	**1**
CO2	**2**	**2**	**1**	**2**	**1**	**2**	**2**	**1**
CO3	**2**	**2**	**1**	**2**	**1**	**2**	**2**	**1**
CO4	**2**	**2**	**1**	**1**	**1**	**2**	**2**	**1**
CO5	**2**	**2**	**1**	**1**	**1**	**2**	**2**	**1**

CRYPTOGRAPHY AND NETWORK SECURITY			
Course Code	**MLDN203**	**CIE Marks**	**50**
Teaching Hours/Week (L:P:SDA)	**3:0:0**	**SEE Marks**	**50**
Total Hours of Pedagogy	**40 Hours Theory**	**Total Marks**	**100**
Credits	**3**	**Exam Hours**	**03**

Course Objectives: This course will enable students:

- **Understand the basics of symmetric key.**
- **Use basic cryptographic algorithms to encrypt the data.**
- **Generate some pseudorandom numbers required for cryptographic applications.**
- **Provide authentication and protection for encrypted data.**
- **Understand the techniques and features of Email, IP and Web security.**

Module-1

Foundations: Terminology, Steganography, substitution ciphers and transpositions ciphers, Simple XOR,One-Time Pads. (Text 2: Chapter 1: Section 1.1 to 1.6).

SYMMETRIC CIPHERS: Traditional Block Cipher structure, Data Encryption Standard (DES), The AES Structure, AES Key Expansion (Text 1: Chapter 2: Section 1 & 2, Chapter 4: 2 & 4).

RBT Level: L1, L2

Module-2

More Number Theory: Prime Numbers, Fermat's and Euler's theorem, Testing for Primality, The Chinese Remainder theorem, Discrete Logarithms. (Text 1: Chapter 7: Section 1, 2, 3, 4, 5).

Principles of Public-Key Cryptosystems, The RSA algorithm, Diffie - Hellman Key Exchange. (Text 1: Chapter 8 , Chapter 9: Section 9.1, 9.3, 9.4).

RBT Level: L1, L2, L3

Module-3

Pseudo-Random-Sequence Generators and Stream Ciphers: Linear Congruential Generators, Linear Feedback Shift Registers, Design and analysis of stream ciphers, Stream ciphers using LFSRs, A5, Hughes XPD/KPD, Nanoteq, Rambutan, Additive generators, Gifford, Algorithm M, PKZIP (Text 2: Chapter 16).

RBT Level: L1, L2, L3

Module-4

One-Way Hash Functions: Background, Snefru, N-Hash, MD4, MD5, Secure Hash Algorithm [SHA], One way hash functions using symmetric block algorithms, Using public key algorithms, Choosing a one- way hash functions, Message Authentication Codes. Digital Signature Algorithm.(Text 2: Chapter 18: Section 18.1 to 18.5, 18.7, 18.11 to 18.14 and Chapter 20: Section 20.1, 20.4). **RBT Level: L1, L2, L3**

Module-5

E-mail Security: Pretty Good Privacy-S/MIME (Text 1: Chapter 17: Section 17.1, 17.2).

IP Security: IP Security Overview, IP Security Policy, Encapsulation Security Payload (ESP) (Text 1: Chapter 18: Section 18.1 to 18.4).

Web Security: Web Security Considerations, SSL (Text 1: Chapter 15: Section 15.1, 15.2).

RBT Level: L1, L2

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 50% of the maximum marks. Minimum passing marks in SEE is 40% of the maximum marks of SEE. A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures not less than 50% (50 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.

Continuous Internal Evaluation:

1. **Two Unit Tests each of 25 Marks**
2. **Two assignments each of 25 Marks or one Skill Development Activity of 50 marks**

to attain the COs and POs

The sum of two tests, two assignments/skill Development Activities, will be scaled down to 50 marks
CIE methods /question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

Semester-End Examination:

1. **The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 50.**
2. **The question paper will have ten full questions carrying equal marks.**
3. **Each full question is for 20 marks. There will be two full questions (with a maximum of four sub-questions) from each module.**
4. **Each full question will have a sub-question covering all the topics under a module.**
5. **The students will have to answer five full questions, selecting one full question from each module**

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Suggested Learning Resources:

Textbooks:

1. "Cryptography and Network Security Principles and Practice", William Stallings, Pearson Education Inc.,ISBN: 978-93325-1877-3, 6th Edition, 2015

2. "Applied Cryptography Protocols, Algorithms, and Source code in C", Bruce Schneier, Wiley PublicationsISBN: 9971-51348-X, 2nd Edition

Reference Books:

1. "Cryptography and Network Security", Behrouz A. Forouzan, TMH, 2007

2. "Cryptography and Network Security", Atul Kahate, TMH, 200

Web links and Video Lectures (e-Resources):

- **https://nptel.ac.in/courses/106105162**
- **Cryptography & Network Security, IIT Kharagpur, Prof. Sourav Mukophadhyay**

Skill Development Activities Suggested

1. **Online certification courses.**
2. **Mini projects can be su*gge*sted on the related area.**

course outcomes
at the end of the course students will able to:

Sl. No.	Description	Blooms Level
CO1	Understand the basics concept of symmetric key encryption.	Understand
CO2	Apply basic cryptographic algorithms to encrypt the data.	Apply
CO3	Develop some pseudorandom numbers required for cryptographic applications.	Apply
CO4	formulate different authentication and protection algorithms for encrypted data.	Apply
CO5	Understand the techniques and features of Email, IP and Web security.	Understand

program outcomes

Sl. No.	Description	POs
1	An ability to independently carry out research /investigation and development work to solve practical problems	PO1
2	An ability to write and present a substantial technical report/document	PO2
3	Students should be able to demonstrate a degree of mastery over the area as per the specialization of the program. The mastery should be at a level higher than therequirements in the appropriate bachelor program	PO3
4	An ability to create, select, apply appropriate techniques, resources and modern tools to solve complex engineering activities with an understanding of their limitations.	PO4
5	An ability to apply Professional ethics, responsibilities and norms of the engineering.	PO5
6	An ability to recognize the need to engage in independent and life-long learning in Digital Communication and Networking domain.	PO6

Mapping of COS and POs

	PO1	PO2	PO3	PO4	PO5	PO6
CO1	2	1		3		
CO2	2	1	1	3		
CO3	2	1		2		
CO4	3	2	2	2		2
CO5	2	2	1	2		2

Semester: II						
Wireless Sensor Networks **Stream: ECE (Digital Communication & Networking)**						
Course Code	**:**	**MLDN204**		**Credits**	**:**	3
Hours/Week(L:P:SDA)	**:**	**(2:0:2)**		**CIE**	**:**	50 Marks
Total Hours of Pedagogy	**:**	**25 Hours Theory + 10-12 Slots of Skill Development Activities**		**SEE**	**:**	50 Marks
Course Type	**:**	**3**		**SEE Duration**	**:**	3 Hours

Prerequisites:	
Courses	Computer Networks, Digital Communication, Operating System
Knowledge on Fundamental Concepts	Analysis, Routing and Applications
Knowledge on Connected Tools (If any)	Emulator TOSSIM

Course Learning Objectives: This course will enable the students to	
CLO1	Learn the basic concepts of Wireless sensor networks architecture and protocols.
CLO2	Understand the challenges in designing a Wireless sensor networks.
CLO3	Understand the function of Data link and Network layer Protocols.
CLO4	Understand the function of Transport layer Protocols.
CLO5	Analyze wireless sensor network system for different applications under consideration

Module – 1	**05Hrs**
INTRODUCTION: Sensor Mote Platforms, WSN Architecture and Protocol Stack (Chap.1Text 1). WSN Applications: Military Applications, Environmental Applications, Health Applications, Home Applications, Industrial Applications (Chap.2 Text1).	
Module – 2	**05Hrs**
FACTORS INFLUENCING WSN DESIGN: Hardware Constraints Fault Tolerance Scalability Production Costs WSN Topology, Transmission Media, Power Consumption (Chap. 3 Text 1). **Physical Layer:** Physical Layer Technologies, Overview of RF Wireless Communication, Channel Coding (Error Control Coding), Modulation, Wireless Channel Effects, PHY Layer Standards (Chap. 4 of Text 1).	
Module – 3	**05 Hrs**
MEDIUM ACCESS CONTROL: Challenges for MAC, CSMA Mechanism, Contention-Based Medium Access, Reservation-Based Medium Access, Hybrid Medium Access (Chap. 5 of Text 1). **Network Layer:** Challenges for Routing, Data-centric and Flat Architecture Protocols, Hierarchical Protocols, Geographical Routing Protocols (Chap. 7 of Text 1)	
Module – 4	**05 Hrs**

Transport Layer: Challenges for Transport Layer, Reliable Multi Segment Transport (RMST) Protocol, Pump Slowly, Fetch Quickly (PSFQ) Protocol, Congestion Detection and Avoidance (CODA) Protocol, Event-to Sink Reliable Transport (ESRT) Protocol, GARUDA (Chap.8 Text 1).

Application Layer: Source Coding (Data Compression), Query Processing, Network Management (Chap 9 Text 1).

Module – 5	**05 Hrs**

Operating Systems for Wireless Sensor Networks: Introduction - Operating System Design Issues - Examples of Operating Systems – TinyOS – Mate – MagnetOS – MANTIS - OSPM - EYES OS – SenOS – EMERALDS – PicOS – Introduction to Tiny OS – NesC – Interfaces and Modules- Configurations and Wiring - Generic Components -Programming in Tiny OS using NesC, Emulator TOSSIM (Chap 10 Text 2)

Course Outcomes: After completing the course, the students will be able to	
CO1	Outline the Concepts of Wireless sensor Networks and its applications
CO2	Apply statistical models of multipath fading
CO3	Interpret the multiple radio access techniques, radio standards and protocols
CO4	Analyze and Design wireless sensor network system for different applications
CO5	Summarize Various OS for WSN

Text Book	
1	Wireless Sensor Networks, Ian F. Akyildiz and Mehmet Can Vuran, John Wiley & Sons Ltd. ISBN 978-0-470-3601-3 (H/B),2010
2	Wireless Sensor Networks,Kazem Schraby, Daniel Minoli, Taieb Znati,, ISBN 978-0-471-74300-2,2007

Reference Books	
1	Ian F. Akyildiz, Mehmet Can Vuran , ―Wireless Sensor Networks‖, Wiley 2010
2	Wireless Sensor Networks: Signal Processing and Communications Perspectives', Ananthram Swami, et.al, John Wiley & Sons Ltd., ISBN 978-0470-03557-3, 2007.

Skill Development Activities Suggested
1. Online certification courses. 2. Mini projects can be su*gge*sted on the related area.

Web links and Video Lectures (e – Resources)	
1	https://archive.nptel.ac.in/courses/106/105/106105160/#- Wireless Ad Hoc and Sensor Networks BY Prof. SUDIP MISHRA,IITKGP
2	https://youtu.be/GUSrkWJ_Z2g?si=Q_gFcYUI6AL86oS6

Mapping of COs and POs

	PO1	PO2	PO3	PO4	PO5	PO6
CO1	3	1	1	3	1	
CO2	2	1	1	3		
CO3	2	1		2		
CO4	3	2	1	2		2
CO5	2	2	1	2	1	3

Semester: II						
MULTIMEDIA OVER COMMUNICATION LINKS **Stream: LDN**						
Course Code	**:**	**MLDN215A**		**Credits**	**:**	3
Hours/Week(L:P:SDA)	**:**	2:0:2		**CIE**	**:**	50 Marks
Total Hours (25 Hours Theory + 10-12 Slots of Skill Development Activities)	**:**	40		**SEE**	**:**	50 Marks
Course Type	**:**	LDN		**SEE Duration**	**:**	3 Hours

Prerequisites:	
Courses	Digital Signal Processing, Computer Networks, Operating Systems Concepts
Knowledge on Fundamental Concepts	Multimedia and Applications
Knowledge on Connected Tools (If any)	Basic Programming Skills like MATLAB, Scilab, Python

Course Learning Objectives: This course will enable the students to	
CLO1	Gain fundamental knowledge in understanding the standards for multimedia communications.
CLO2	Understand the concepts of distributed multimedia systems.
CLO3	Analyze Audio compression techniques required to compress Audio.
CLO4	Analyze compression techniques required to compress video.
CLO5	Gain fundamental knowledge about the Multimedia Communications in different Networks.

Module – 1	**05 Hrs**
Standards for Multimedia Communications: Introduction, Reference models, Standards relating to interpersonal communications, Standards relating to interactive applications over the Internet, Standards for entertainment applications. (Chapter 5, Text 1) **RBT Levels: L1, L2**	
Module – 2	**05 Hrs**
Distributed Multimedia Systems: Introduction, Main Features of a DMS, Resource Management of DMS, Networking, Multimedia Operating Systems. (Chap. 4 - Sections 4.1 to 4.5 of Text 2) **RBT Levels: L1, L2, L3, L4**	
Module – 3	**05 Hrs**
Multimedia Processing in Communication: Introduction, Digital Media, Perceptual Coding of Digital Audio Signals, Transform Audio Coders, Audio Sub band Coders. (Chap. 3 - Sections 3.1, 3.2, 3.5. 3.6, 3.7 of Text 2) **RBT Levels: L1, L2**	
Module – 4	**05 Hrs**
Video Compression Standards: Introduction, MPEG Approach to Multimedia Standardization, MPEG-1, MPEG-2, Overview of MPEG-4. (Chap. 5 - Sections 5.1 to 5.4 and 5.5.1 of Text 2) **RBT Levels: L1, L2, L3**	
Module – 5	**05 Hrs**
Multimedia Communication Across Networks: Packet Audio/Video in the Network Environment, Video Transport across Generic Networks, Multimedia Transport across ATM Networks. (Chap. 6 - Sections 6.1, 6.2, 6.3 of Text 2) **RBT Levels: L1, L2, L3**	

Course Outcomes: After completing the course, the students will be able to	
CO1	Interpret various standards and reference models in multimedia communication.
CO2	Apply the principles of distributed multimedia systems and resource management.
CO3	Analyze audio and video coding techniques used in multimedia processing.
CO4	Outline the multimedia communication mechanisms used in various network environments.
CO5	Analyze multimedia communication systems over various network links using ProModel simulation software

Text Books	
1	Fred Halsall, "Multimedia Communications", Pearson education, 2001, ISBN - 9788131709948.
2	K. R. Rao, Zoran S. Bojkovic, Dragorad A. Milovanovic, "Multimedia Communication Systems", Pearson education, 2004. ISBN - 9788120321458.

Reference Books	
1	Raif steinmetz, Klara Nahrstedt, "Multimedia: Computing, Communications and Applications", Pearson education, 2002, ISBN -9788177584417.

Web links and Video Lectures (e – Resources)	
1	https://onlinecourses.nptel.ac.in/noc20_ph07/preview
2	https://www.classcentral.com/course/swayam-optical-communications-6699

Skill Development Activities Suggested

1. Features of Promodel Package and Input Modeling
2. Simulation of Manufacturing System I
3. Simulation of Manufacturing System II
4. Simulation of Service Operations I
5. Simulation of Service Operations II

Suggested Simulation Packages;

- **Promodel**

Note: A minimum of 5 exercises to be executed covering the entire syllabus in SDA

CO – PO MAPPING

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**
CO1	**2**		**2**			**1**
CO2	**2**		**2**			**1**
CO3	**2**		**2**			**1**
CO4	**2**		**2**			**1**
CO5	**2**	**2**	**2**	**3**	**1**	

Semester: II						
STATISTICAL SIGNAL PROCESSING **Stream: ECE (Digital Communication & Networking)**						
Course Code	**:**	**MEC215B**		**Credits**	**:**	3
Hours/Week(L:T:P)	**:**	3:0:0		**CIE**	**:**	50Marks
TotalHours	**:**	40L		**SEE**	**:**	50Marks
Course Type	**:**	Elective		**SEEDuration**	**:**	3 Hours

Prerequisites:	
Courses	Signals and Systems
Knowledge on Fundamental Concepts	Python
Knowledge on Connected Tools (If any)	

Course Learning Objectives: This course will enable the students to	
CLO1	Understand random processes and its properties
CLO2	Understand the basic theory of signal detection and estimation
CLO3	Identify the engineering problems that can be put into the frame of statistical signal processing
CLO4	Solve the identified problems using the standard techniques learned through this course.
CLO5	Make contributions to the theory and the practice of statistical signal processing.

Module – 1	**08Hrs**
Random Processes: Random variables, random processes, white noise, filtering random processes, spectral factorization, ARMA, AR and MA processes . **Text Book 1**	
Module – 2	**08Hrs**
Signal Modeling: Least squares method, Pade approximation, Prony's method, finite data records, stochastic models, Levinson-Durbin recursion; Schur recursion; Levinson recursion. **Text Book 1**	
Module – 3	**08 Hrs**
Spectrum Estimation: Non parametric methods, minimum-variance spectrum estimation, maximum entropy method, parametric methods, frequency estimation, principal components spectrum estimation. **Text Book 1**	
Module – 4	**08 Hrs**
Optimal and Adaptive Filtering: FIR and IIR Wiener filters, Discrete Kalman filter, FIR Adaptive filters: Steepest descent, LMS, LMS-based algorithms, adaptive recursive filters,RLS algorithms. **Text Book 1**	
Module – 5	**08 Hrs**
Array Processing: Array fundamentals, beam-forming, optimum array processing, performance considerations, adaptive beam-forming, linearly constrained minimum-variance beam-formers, side-lobe cancellers.	

Text Book 2	
Course Outcomes: After completing the course, the students will be able to	
CO1	Design statistical DSP algorithms to meet desired needs.
CO2	Apply vector space methods to statistical signal processing problems
CO3	Identify the engineering problems that can be put into the frame of statistical signal processing
CO4	Understand Wiener filter theory and design discrete and continuous Wiener filters.
CO5	Understand Kalman Filter theory and design discrete Kalman filters

TextBooks	
1	1. Monson H. Hayes, "Statistical Digital Signal Processing and Modeling",John Wiley & Sons (Asia) Pvt. Ltd.,2002.
2	Dimitris G. Manolakis,Vinay K. Ingle, and Stephen M. Kogon, "Statistical and Adaptive Signal Processing : Spectral Estimation, Signal Modeling, Adaptive Filtering and Array Processing" ,McGraw-Hill International Edition, 2000.

ReferenceBooks	
1	S. M. Kay, Fundamentals of Statistical Signal Processing, Volume I: Estimation Theory, Prentice Hall, 1993.

Skill Development Activities Suggested
• Mathematical modeling of signals: linear vs. nonlinear, deterministic signals, random signals, unknown parameters. • Mathematical modeling of noise: white Gaussian noise, coloured Gaussian noise, general Gaussian noise, IID non-Gaussian noise. • Specific algorithms for estimation, detection, and spectral estimation: parameter estimation, signal extraction, adaptive filtering, sinusoidal estimation, matched filters, estimator-correlator, spectral estimation via Fourier and high-resolution methods.

Web links and Video Lectures (e – Resources)	
1	https://www.youtube.com/playlist?list=PLwdnzlV3ogoVj-FLNpzXInhZxcnibqb56
2	https://onlinecourses.nptel.ac.in/noc20_ee53/preview
3	https://archive.nptel.ac.in/courses/108/103/108103158/

CO – PO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6
CO1	3	-	3	2	-	1
CO2	2	-	3	2	-	2
CO3	3	2	3	3	1	2
CO4	2	-	3	2	-	1
CO5	2	-	3	3	-	2

Semester: II						
PROBABILITY AND RANDOM PROCESS						
Course Code	**:**	MLDN215C		**Credits**	**:**	3
Hours/Week(L:T:SDA)	**:**	(2:0:2)		**CIE**	**:**	50Marks
Total Hours	**:**	25 Hours Theory + 10-12 Slots of Skill Development Activities		**SEE**	**:**	50Marks
Course Type	**:**	Non-Integrated		**SEE Duration**	**:**	3 Hours

Prerequisites:	
Courses	
Knowledge on Fundamental Concepts	
Knowledge on Connected Tools (If any)	MATLAB, Python with libraries like NumPy and SciPy,

Course Learning Objectives: This course will enable the students to	
CLO1	To understand Discrete and Continuous Random variables, Random Processes and their applications in Electronic Transmissions.
CLO2	To apply concepts of Probability to solve problems in communication Engineering.
CLO3	To find functional relationship between random inputs and outputs with the use of Random Process Techniques
CLO4	Analyze about the correlation Functions.

Module – 1	**08 Hrs**
Probability and Random Variable Probability: Set theory, Experiments and Sample Spaces, Discrete and Continuous Sample Spaces, Events, Probability Definitions and Axioms, Mathematical Model of Experiments, Joint Probability, Conditional Probability, Total Probability, Bayes' Theorem, and Independent Events, Bernoulli's trials. The Random Variable: Definition of a Random Variable, Conditions for a Function to be a Random Variable, Discrete and Continuous, Mixed Random Variable. **RBT Level: L1, L2**	
Module – 2	**08 Hrs**
Distribution and density functions and Operations on One Random Variable Distribution and density functions: Distribution and Density functions, Properties, Binomial, Poisson, Uniform, Exponential Gaussian, Rayleigh and Conditional Distribution, Methods of defining Conditioning Event, Conditional Density function and its properties, problems. Operation on One Random Variable: Expected value of a random variable, function of a random variable, moments about the origin, central moments, variance and skew, characteristic function, moment generating function, transformations of a random variable, monotonic transformations for a continuous random variable, nonmonotonic transformations of continuous random variable, transformations of Discrete random variable. **RBT Level: L1, L2**	
Module – 3	**08 Hrs**
Multiple Random Variables and Operations on Multiple Random Variables Multiple Random Variables: Vector Random Variables, Joint Distribution Function and Properties, Joint density Function and Properties, Marginal Distribution and density Functions, conditional Distribution and density Functions, Statistical Independence, Distribution and density functions of Sum of Two Random Variables and Sum of Several Random Variables, Central Limit Theorem - Unequal Distribution, Equal Distributions Operations on Multiple Random Variables: Expected Value of a Function of Random Variables, Joint Moments about the Origin, **RBT Level: L1, L2, L3**	

Module – 4	08 Hrs
Stochastic Processes-Temporal Characteristics: The Stochastic process Concept, Classification of Processes, Deterministic and Nondeterministic Processes, Distribution and Density Functions, Statistical Independence and concept of Stationarity: First-Order Stationary Processes, Second Order and WideSense Stationarity, Nth-Order and Strict-Sense Stationarity, Time Averages and 1 Ergodicity, MeanErgodic Processes, Correlation-Ergodic Processes Autocorrelation Function and Its Properties, CrossCorrelation Function and Its Properties, Covariance Functions and its properties, Gaussian Random Processes**RBT Level: L1, L2, L3**	
Module – 5	**08 Hrs**
Stochastic Processes-Spectral Characteristics: The Power Spectrum and its Properties, Relationship between Power Spectrum and Autocorrelation Function, the Cross-Power Density Spectrum and Properties, Relationship between Cross-Power Spectrum and Cross-Correlation Function. Spectral characteristics of system response: power density spectrum of response, cross power spectral density of input and output of a linear system. **RBT Level: L1, L2, L3, L4**	

Course Outcomes: After completing the course, the students will be able to	
CO1	Understand Discrete and Continuous Random variables, Random Processes and their applications in Electronic Transmissions
CO2	To apply concepts of Probability to solve problems in Communication Engineering.
CO3	To find functional relationship between random inputs and outputs with the use of Random Process Techniques
CO4	Analyze about the correlation Functions
CO5	Engage in self study on mini projects and online course related to probability and random process

Text Books	
1	Probability, Random Variables & Random Signal Principles -Peyton Z. Peebles, TMH, 4th Edition, 2001.
2	Probability and Random Processes-Scott Miller, Donald Childers,2nd Edn, Elsevier,2012

Web links and Video Lectures (e – Resources)	
1	• https://archive.nptel.ac.in/courses/117/105/117105085/ • https://www.youtube.com/watch?v=p6lze5nPkzk • https://www.youtube.com/watch?v=C3srT7bVJrs
Skill Development Activities Suggested	
	• Online certification courses on probability and random process. • Mini projects can be suggested on the related area.

CO – PO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6
CO1	2	1	2	1		1
CO2	2	1	2			1
CO3	1		2	1		1
CO4	2	1	2			1
CO5	3	3	3	3	3	2

Semester: II						
ERROR CONTROL CODING **Stream: ECE (Digital Communication & Networking)**						
Course Code	**:**	**MLDN215D**		**Credits**	**:**	03
Hours/Week(L:T:P)	**:**	3:0:0		**CIE**	**:**	50 Marks
Total Hours	**:**	25 Hours Theory + 15 Hours of Skill Development Activities		**SEE**	**:**	50 Marks
Course Type	**:**	Elective		**SEE Duration**	**:**	3 Hours

Prerequisites:	
Courses	Information Theory and Coding
Knowledge on Fundamental Concepts	Different Types of Digital Coding Techniques
Knowledge on Connected Tools (If any)	

Course Learning Objectives: This course will enable the students to	
CLO1	Understand the concept of the Entropy, information rate and capacity for the Discrete memoryless channel
CLO2	Apply modern algebra and probability theory for the coding.
CLO3	Compare Block codes such as Linear Block Codes, Cyclic codes, etc. and Convolutional codes.
CLO4	Detect and correct errors for different data communication and storage systems.
CLO5	Analyse and implement different Block code encoders and decoders, and also convolutional encoders and decoders including soft and hard Viterbi algorithm

Module – 1	**05 Hrs**
Information theory: Introduction, Entropy, Source coding theorem, discrete memoryless channel, Mutual Information, Channel Capacity Channel coding theorem. **Textbook 1: Ch 5** **Introduction to algebra:** Groups, Fields, binary field arithmetic, Construction of Galois Fields GF (2m) and its properties, (Only statements of theorems without proof) Computation using Galois field GF (2m) arithmetic, Vector spaces and Matrices. **Textbook 2: Ch 2**	
Module – 2	**05 Hrs**
Linear block codes: Generator and parity check matrices, Encoding circuits, Syndrome and error detection, Minimum distance considerations, Error detecting and error correcting capabilities, Standard array and syndrome decoding, Single Parity Check Codes (SPC), Repetition codes, Self-dual codes, Hamming codes, Reed-Muller codes. Product codes and Interleaved codes (Chap. 3 of Text 2). **Textbook 2: Ch 3**	
Module – 3	**05 Hrs**
Cyclic codes: Introduction, Generator and parity check polynomials, Encoding of cyclic codes, Syndrome computing and error detection, Decoding of cyclic codes, Error trapping Decoding, Cyclic hamming codes, Shortened cyclic codes. **Textbook 2: Ch 4**	
Module – 4	**05 Hrs**
BCH codes: Binary primitive BCH codes, Decoding procedures, Implementation of Galois field arithmetic. Primitive BCH codes over GF (q), **Textbook 2: Ch 6.1, 6.2, 6.7.** **Reed -Solomon codes**. **Textbook 2: Ch 7.2, 7.3** **Majority Logic decodable codes:** One -step majority logic decoding, Multiple step majority logic. **Textbook 2: Ch 8.1, 8.4.**	
Module – 5	**05 Hrs**
Convolution codes: Encoding of convolutional codes: Systematic and Non-systematic Convolutional Codes, Feedforward encoder inverse, A catastrophic encoder, **Structural properties of convolutional codes:** state diagram, state table, state transition table, tree diagram, trellis diagram. Viterbi algorithm, **Sequential decoding:** Log Likelihood Metric for Sequential Decoding. **Textbook 2: Ch 10.1, 10.2, 11.1, 12.1.**	

Course Outcomes: After completing the course, the students will be able to	
CO1	Understand the concept of the Entropy, information rate and capacity for the Discrete memoryless channel.
CO2	Apply modern algebra and probability theory for the coding.
CO3	Compare Block codes such as Linear Block Codes, Cyclic codes and Convolutional codes. Also detect and correct errors for different data communication and storage systems.
CO4	Analyse and implement different Block code encoders and decoders, and also convolutional encoders and decoders including soft and hard Viterbi algorithm.
CO5	Implement a Mini-project to enhance the coding skill / Online Certification course on related area.

Text Books	
1	Digital Communication systems', Simon Haykin, Wiley India Private. Ltd, ISBN 978-81-265-4231-4, First edition, 2014
2	'Error control coding', Shu Lin and Daniel J. Costello. Jr, Pearson, Prentice Hall, 2nd edition, 2004.

Reference Books	
1	'Theory and practice of error control codes', Blahut. R. E, Addison Wesley, 1984
2	'Introduction to Error control coding', Salvatore Gravano, Oxford University Press, 2007
3	'Digital Communications - Fundamentals and Applications', Bernard Sklar, Pearson Education (Asia) Pvt. Ltd., 2nd Edition, 2001

Web links and Video Lectures (e – Resources)	
1	**https://archive.nptel.ac.in/courses/117/104/117104121/**
2	**https://www.youtube.com/watch?v=0lCYkXUOA5Y**
3	**https://www.youtube.com/watch?v=2_uC9stwBR4**
4	**https://www.youtube.com/watch?v=M5ZiflJXluQ**

Skill Development Activities Suggested	
1	Mini Projects can be suggested to improve the coding skills.
2	Online certification courses can be suggested in the related area.

CO – PO MAPPING

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**
CO1				2		1
CO2	1			1	2	
CO3		2	2			2
CO4	2					3
CO5	3	2		2	2	

Semester:II						
HIGHSPEED COMMUNICATION NETWORKS **Stream: LDN**						
Course Code	**:**	**MLDN216A**		**Credits**	**:**	3
Hours/Week(L:P:SDA)	**:**	2:0:2		**CIE**	**:**	50Marks
TotalHours (25 Hours Theory + 10-12 Slots of Skill Development Activities)	**:**	40		**SEE**	**:**	50Marks
Course Type	**:**	LDN		**SEEDuration**	**:**	3 Hours

Prerequisites:	
Courses	Computer Networks, architecture, protocols and applications of major high-speed networking technologies.
Knowledge on Fundamental Concepts	Computer Networks

CourseLearning Objectives: This course will enable the students to	
CLO1	**Compare and analyse the fundamental principles of various high speed communication networks and their protocol architectures**
CLO2	**Analyse the methods adopted for performance modeling of traffic flow and estimation.**
CLO3	**Examine the congestion control issues and traffic management in TCP/IP and ATM networks**
CLO4	**Compare, analyse and implement the various routing protocols in simulation software tools**
CLO5	**Examine the various services**

Module – 1	**05Hrs**
Frame Relay Networks – Asynchronous transfer mode – ATM Protocol Architecture, ATM logical Connection, ATM Cell – ATM Service Categories – AAL, **High Speed LANs:** Emergence of High-Speed LANs, Gigabit Ethernet, WDM systems, Optical LANs, SONET.	
Module – 2	**05Hrs**
ADMISSION AND ACCESS CONTROL: CAC for ATM VBR Services - Worst-Case Traffic Model and CAC, Effective Bandwidth, Lucent's CAC, NEC's CAC, Tagged-Probability-Based CAC, CAC for Integrated Services Internet - Guaranteed Quality of Service, Controlled-Load Service, ATM Traffic Contract and Control Algorithms - Traffic Contract, PCR Conformance, SCR, and BT, Cell Delay Variation Tolerance, Generic Cell Rate Algorithm.	
Module – 3	**05Hrs**
SHAPING AND SCHEDULING: An ATM Shaping Multiplexer - Regularity Condition-Dual Leaky Bucket, Algorithm, Implementation Architecture, Finite Bits Overflow Problem, An Integrated Packet Shaper - Basics, Integrating Traffic Shaping and WFI Scheduling, Logical Structure and implementation of the WFI Packet Shaper Packet Scheduling – FIFO, RR, Stop-and-Go, HRR, EDD, Rate-Controlled Static Priority, GPS-WFQ, Virtual Clock, Self-Clocked Fair Queuing, Worst-case Fair Weighted Fair Queuing, Scheduling Algorithm - Shaped Virtual Clock Algorithm, Core-Stateless Shaped Virtual Clock Algorithm.	
Module – 4	**05Hrs**

QUEUING & BUFFER MANAGEMENT: Conceptual Framework and Design Issues, Sequencer - Store Cells in Logical Queues, Sort Priorities Using a Sequencer, Priority Content-Addressable Memory - Searching by the PCAM Chip, Connecting Multiple PCAM Chips, RAM-Based Searching Engine - Hierarchical Searching, Timestamp Overflow, Design of the RSE, RSE Operations, Write-in Operation, Reset Operation, Search Operation, General Shaper - Scheduler - Slotted Updates of System Virtual Time, Implementation Architecture, Timestamp Aging Problem Buffer Management: A Look at ATM Networks - Self-Calibrating Pushout, TCP/IP over ATM_UBR, Dynamic Threshold with Single Loss Priority, A Look at the Internet - Tail Drop, Drop on Full, Random Early Detection, **Differential Dropping:** RIO, FRED, SRED, LQD.

Module – 5	**05Hrs**
FLOW AND CONGESTION CONTROL: Window-Based Flow Control, Rate-Based Flow Control, Predictive Control Mechanism, ATM Networks - Backlog Balancing Flow Control - ABR Flow Control, TCP/IP Networks - TCP Congestion Control - Other TCP Variants - TCP with Explicit Congestion Notification, Rate-Based Flow Control Scheme.	

TextBooks	
1	H. Jonathan Chao and XiaoleiGuo, "Quality of Service Control in High-Speed Networks", John Wiley & Sons, Inc., First Edition, 2002.
2	William Stallings, "High Speed Networks and Internet", Pearson Education, Second Edition, 2002.
3	Jean Walrand and PravinVariaya, "High Performance Communication Networks", Morgan kaufmann Publishers, Second Edition, 2000.
4	Leon Garcia and Widjaja, "Communication Network", Tata McGraw Hill, New Delhi, Second Edition, 2003.

Skill Development Activities Suggested	
1	Mini projects carried out in groups based on latest trends in Industry and continue work to prepare a research Article.
2	Industrial Visit or Seminar on any new topic.

Web links and Video Lectures (e – Resources)	
1	https://www.classcentral.com/course/swayam-communication-networks-58423
2	http://nptel.iitm.ac.in
3	Communication Networks By G**outam Das, IIT Kharagpur .**
4	Lecture Series on Data Communication by Prof.A. Pal, Department of Computer Science Engineering

CO – PO MAPPING

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**
CO1	**3**		**2**			**2**
CO2	**3**		**3**			**2**
CO3	**3**		**2**			**1**
CO4	**2**		**3**			**1**
CO5	**2**	**2**	**2**	**3**	**1**	

Semester: II						
APPLIED CYBER SECURITY						
Course Code	**:**	MLDN216B		**Credits**	**:**	3
Hours/Week(L:T:P)	**:**	3:0:0		**CIE**	**:**	50Marks
Total Hours	**:**	40		**SEE**	**:**	50Marks
Course Type	**:**	Elective		**SEE Duration**	**:**	3 Hours

Prerequisites:	
Courses:	**Cyber Security**
Knowledge on Fundamental Concepts	confidentiality, integrity, and availability, authentication, authorization, and access control
Knowledge on Connected Tools (If any)	Firewalls, Wireshark

Course Learning Objectives: This course will enable the students to	
CLO1	Understand the basics of cyber security
CLO2	Understand the basics architecture of cyber security
CLO3	Understand the basics of ethical Hacking.
CLO4	Understand the concepts of web Hacking.
CLO5	Understand the concepts of Computer Forensics and encryption Forensics.

Module – 1	**08 Hrs**
Introduction Cyber network security concepts: Security Architecture, antipattern: signature based malware detection versus polymorphic threads, document driven certification and accreditation, policy driven security certifications. **Refactored solution:** reputational, behavioral and entropy based malware detection. **The problems:** cyber antipatterns concept, forces in cyber antipatterns, cyber anti pattern templates, cyber security antipattern catalog (Text-1: Chapter1 & 2). **RBT Level: L1, L2**	
Module – 2	**08 Hrs**
Cyber network security concepts: Enterprise security using Zachman framework Zachman framework for enterprise architecture, primitive models versus composite models, architectural problem solving patterns, enterprise workshop, matrix mining, mini patterns for problem solving meetings. (Text-1: Chapter 3). **RBT Level: L1, L2, L3**	
Module – 3	**08 Hrs**
Introduction To Hacking: Introduction to Hacking – Important Terminologies – Penetration Test – Vulnerability Assessments versus Penetration Test – Pre-Engagement – Rules of Engagement -Penetration Testing Methodologies – OSSTMM – NIST – OWASP – Categories of Penetration Test – Types of Penetration Tests – Vulnerability Assessment Summary –Reports (Text-2: Chapter 1). **RBT Level: L1, L2**	
Module – 4	**08 Hrs**
Web Hacking: Attacking the Authentication – Brute Force and Dictionary Attacks – Types of Authentication – Log-In Protection Mechanisms – Captcha Validation Flaw – Captcha RESET Flaw – Manipulating User- Agents to Bypass Captcha and Other Protection (Text-2: Chapter 12). **RBT Level: L1, L2, L3**	

Module – 5	08 Hrs
Introduction to Computer Forensics-what is Forensics? The Growing Problem of Computer. Crime What Exactly Is Computer Forensics? Encryption & Forensics Cryptographic Integrity Services, Cryptographic Privacy Services, Time Stamping (Text-3: Chapter 1 & 4) **RBT Level: L1, L2, L3**	

Course Outcomes: After completing the course, the students will be able to	
CO1	Understand the basics of cyber security
CO2	Apply the basics architecture of cyber security
CO3	Understand the basics of ethical Hacking
CO4	Apply the concepts of web Hacking
CO5	Apply the concepts of Computer Forensics and encryption Forensics

Text Books	
1	Thomas J. Mowbray, ―Cyber Security – Managing Systems, Conducting Testing, and Investigating Intrusions‖, Wiley.
2	Rafay Baloch, "Ethical Hacking and Penetration Testing Guide", CRC Press, 2014.
3	Warren G. Kruse II and Jay G. Heiser, "Computer Forensics: Incident Response Essentials", Addison Wesley, 2002.

Reference Books	
1	Sunit Belapure and Nina Godbole, "Cyber Security: Understanding Cyber Crimes, Computer Forensics And Legal Perspectives", Wiley India Pvt Ltd, ISBN: 978-81- 265-21791, 2011, First Edition (Reprinted 2018)

Skill Development Activities Suggested
• Mini projects carried out in groups based on latest trends in Industry and continue work to prepare a research Article. • Industrial Visit or Seminar on any new topic.

Web links and Video Lectures (e – Resources)	
1	https://onlinecourses.nptel.ac.in/noc22_cs13.
2	https://onlinecourses.swayam2.ac.in/cec20_cs15

CO – PO MAPPING

CO-PO	PO1	PO2	PO3	PO4	PO5	PO6
CO1		2				
CO2			3			
CO3		2				
CO4			3			
CO5			3			

Semester: II						
OPTICAL COMMUNICATION AND NETWORKING						
Course Code	**:**	**MLDN216C**		**Credits**	**:**	03
Hours/Week(L:T:P)	**:**	2:0:2		**CIE**	**:**	50 Marks
Total Hours	**:**	25+12		**SEE**	**:**	50 Marks
Course Type	**:**	ETC		**SEE Duration**	**:**	3 Hours

Prerequisites:	
Courses	**Optical Communication**
Knowledge on Fundamental Concepts	**Optical Fibre Networks**
Knowledge on Connected Tools (If any)	**--**

Course Learning Objectives: This course will enable the students to	
CLO1	Understand the various optical devices and how they operate.
CLO2	Recognize and choose various components for optical networking in accordance with the established design requirements
CLO3	Acquire knowledge of the elements of data transmission, loss obstacles, and other network operating artifacts.
CLO4	Acquire knowledge of the problems associated with setting up and maintaining the optical network's access component while keeping up with current data transmission trends.
CLO5	Build a WDM network and explore the management of components and networks.

Module-1
Introduction to optical networks: Optical Networks, optical packet switching, **Propagation of signals in optical fiber:** Different losses, Nonlinear effects, Solitons. **Optical Components (Part-1):** Couplers, Isolators, and Circulators (1.3, 1.6, 2.1 up to 2.6, 3.1, 3.2 of Text). **RBT Level: L1, L2**
Module-2
Optical Components (Part-2): Multiplexers and Filters, Optical Amplifiers, detectors. **Modulation - Demodulation:** Formats, Ideal receivers, Practical direct detection receivers, Optical preamplifiers, Bit error rates, Coherent detection (3.3, 3.4, 3.6, 4.1, 4.4.1, 4.4.2, 4.4.5, 4.4.6, 4.4.7 of Text). **RBT Level: L1, L2**
Module-3
Transmission System Engineering: System model, Power penalty, Transmitter, Receiver, Crosstalk. **Client Layers of optical layer:** SONET/SDH: Multiplexing, layers, Frame structure. **Asynchronous Transfer Mode:** ATM functions, Adaptation layers, Quality of Service (QoS) and flow control, Signaling and Routing (5.1 up to 5.4, 5.6, 6(introduction), 6.1(introduction), 6.1.1, 6.1.3, 6.1.4, J.1 up to J.5 of Text). **RBT Level: L1, L2**
Module-4
WDM network elements: Optical line terminals, Optical line amplifiers, Optical Add/ Drop Multiplexers, Optical cross-connects. **WDM Network Design:** Cost trade-offs, LTD and RWA problems, Routing and wavelength assignment, Wavelength conversion (Chapter 7 (full), 10 (introduction), 10.1, 10.2 of Text). **RBT Level: L1, L2**

Module-5
Control and Management (Part-1): Network management functions, management framework, Information model, management protocols, **Layers within the optical layer.** Control and Management (Part-2): Performance and fault management, Impact of transparency, BER measurement, Optical trace, Alarm management, Configuration management, Optical Safety (8(introduction), 8.1, 8.3, 8.5 (introduction), 8.5.1 up to 8.5.4, 8.6, 8.7 of Text). **RBT Level: L1, L2, L3, L4**

Suggested Learning Resources:

Textbooks:

1. ‘‘Optical Networks’, Rajiv Ramaswami, Kumar N. Sivarajan and Galan H Sasaki, Morgan KaufmanPublishers, 3rd edition, 2010.

Reference Books:

1. ‘Optical fiber communication’, John M. Senior, Pearson edition, 2000.
2. ‘Optical fiber Communication’, Gerd Keiser, John Wiley, New York, 5th Edition, 2017.
3. ‘Fiber Optic Networks’, P. E. Green, Prentice Hall, 1994.

Course Outcomes: After completing the course, the students will be able to	
CO1	Comprehend the various optical devices and their working strategies
CO2	Recognize and select various optical networking components according to the prescribed design specifications
CO3	Learn the aspects of data transmission, loss hindrances, and other artifacts affecting the network operation
CO4	Learn the issues involved in setting up and maintaining access part of the optical network with the latest trends in the data communication
CO5	Design a WDM network and study the component and network management aspects

Web links and Video Lectures (e – Resources)

- https://onlinecourses.nptel.ac.in/noc20_ph07/preview
- https://www.classcentral.com/course/swayam-optical-communications-6699

CO – PO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6
CO1	2	2	1	-	2	-
CO2	1	2	-	1	-	1
CO3	2	1	2	-	2	1
CO4	2	1	-	2	-	-
CO5	1	-	-	-	-	1

Semester: II						
SIMULATION, MODELLING AND ANALYSIS **Stream: ECE (Digital Communication & Networking)**						
Course Code	**:**	MLDN216D		**Credits**	**:**	3
Hours/Week(L:T:P)	**:**	3:0:0		**CIE**	**:**	50Marks
Total Hours	**:**	40L		**SEE**	**:**	50Marks
Course Type	**:**	Elective		**SEE Duration**	**:**	3 Hours

Prerequisites:	
Courses	Lab View
Knowledge on Fundamental Concepts	Probability
Knowledge on Connected Tools (If any)	Octave

Course Learning Objectives: This course will enable the students to	
CLO1	Define the basics of simulation modelling and replicating the practical situations in organizations
CLO2	Generate random numbers and random variates using different techniques.
CLO3	Develop simulation model using heuristic methods.
CLO4	Analysis of Simulation models using input analyzer, and output analyzer.
CLO5	Explain Verification and Validation of simulation model.

Module – 1	**08Hrs**
Basic Simulation Modeling: Nature of simulation, Systems, Models and Simulation, Discrete-Event Simulation, Simulation of Single Server Queuing System, Simulation of inventory system, Parallel and distributed simulation and the high level architecture, Steps in sound simulation study, and Other types of simulation, Advantages and disadvantages. **Text Book 1:** (1.1, 1.2, 1.3, 1.4, 1.4.1, 1.4.2, 1.4.3, 1.5, 1.5.1, 1.5.2, 1.6, 1.7, 1.8, 1.9)	
Module – 2	**08Hrs**
Review of Basic Probability and Statistics: Random Variables and their properties, Simulation Output Data and Stochastic Processes, Estimation of Means, Variances and Correlations, Confidence Intervals and Hypothesis tests for the Mean. **Building valid, credible and appropriately detailed simulation models:** Introduction and definitions, Guidelines for determining the level of models detail, Management's Role in the Simulation Process, Techniques for increasing model validity and credibility, Statistical procedure for comparing the real world observations and simulation output data. **Text Book 1:** (4.2, 4.3, 4.4, 4.5, 5.1, 5.2, 5.4, 5.5, 5.6, 5.6.1, 5.6.2)	
Module – 3	**08 Hrs**
Selecting Input Probability Distributions: Useful probability distributions, activity I, II and III. Shifted and truncated distributions; Specifying multivariate distribution, correlations, and stochastic processes; Selecting the distribution in the absence of data, Models of arrival process **Text Book1:** (6.2, 6.4, 6.5, 6.6, 6.8, 6.10, 6.11, 6.12)	
Module – 4	**08 Hrs**
Random Number Generators: Linear congruential Generators, Other kinds, Testing number generators. **Generating the Random Variates:** General approaches, generating continuous random variates, generating discrete random variates, generating random vectors, and correlated random variates; Generating arrival processes. **Text Book 1:** (7.2, 7.3, 7.4, 8.2, 8.3, 8.4, 8.5, 8.6)	

Module – 5	08 Hrs
Output data analysis for a single system: Transient and steady state behavior of a stochastic process; Types of simulations with regard to analysis; Statistical analysis for terminating simulation; Statistical analysis for steady state parameters; Statistical analysis for steady state cycle parameters; Multiple measures of performance, Time plots of important variables. **Text Book 1:** (9.2,9.3,9.4,9.5,9.6,9.7,9.8)	

Course Outcomes: After completing the course, the students will be able to	
CO1	Understanding the role of important elements of discrete event simulation and modeling paradigm
CO2	Construct the real world situations related to systems development decisions, originating from source requirements and goals.
CO3	Develop skills to apply simulation software to construct and execute goal driven system models.
CO4	Build the model and apply the results to resolve critical issues in a real world environment.
CO5	Engage students in Simulation, modelling for practical and research applications.

Text Book	
1	Averill Law, "Simulation modeling and analysis", McGraw Hill 4th edition, 2007.

Reference Books	
1	Tayfur Altiok and Benjamin Melamed, “Simulation modeling and analysis with ARENA”, Elsevier, Academic press, 2007.
2	Jerry Banks, "Discrete event system Simulation", Pearson, 2009
3	Seila Ceric and Tadikamalla, "Applied simulation modeling", Cengage, 2009.

Skill Development Activities Suggested
1. Online certification courses. 2. Mini projects can be suggested on the related area

Web links and Video Lectures (e – Resources)	
1	"Introduction to simulation" https://www.youtube.com/watch?v=6S27gQoFOYM
2	"Introduction to Modelling" https://www.youtube.com/watch?v=V5XyzCQa6uo

CO – PO MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6
CO1	3	2	3	2	1	2
CO2	3	2	3	3	1	2
CO3	3	2	2	3	1	2
CO4	2	2	3	2	1	3
CO5	3	1	2	2	2	3

Semester: II						
Modeling and Simulation of Antenna Using Simulation Tool **Stream: ECE (Digital Communication & Networking)**						
Course Code	**:**	MLDN258A		**Credits**	**:**	1
Hours/Week(L:T:P)	**:**	0:2:0:0 / 1:0:0:0		**CIE**	**:**	50 Marks
Total Hours	**:**	40		**SEE**	**:**	50 Marks
Course Type	**:**	AEC		**SEE Duration**	**:**	02/01

Prerequisites:	
Courses	**Antenna basics**
Knowledge on Fundamental Concepts	**Electromagnetics, Antenna basics**
Knowledge on Connected Tools (If any)	

Course Learning Objectives: This course will enable the students to	
CLO1	Understand the basic concepts of antenna theory.
CLO2	Identify antenna types for specific applications
CLO3	To design antennas like dipole, Yagi-Uda, Microstrip patch antenna, MIMO antenna, Helical antennas and other broad band antennas
CLO4	To describe different antenna synthesis methods.

Sl No	**Experiments**
1	Design and simulate 1 GHz dipole antenna using suitable high frequency simulation tool, for return loss and gain characteristics.
2	Create and simulate a 5 element Yagi-Uda antenna using a copper wire with given data (a) Resonance frequency of 3 GHz (b) wire diameter of 1 mm. Study return Loss (RL) and gain characteristics
3	Design, model and simulate microstrip patch antenna at 2.45 GHZ for blue-tooth applications. Study its radiation pattern in terms of E and H plane.
4	Design, model and simulate 2 element MIMO antennas for 5G applications in Frequency Range-1. Perform isolation analysis and return loss characterization.
5	Design, model and simulate 4 element array antennas for a suitable frequency and study (a) Return loss characteristics (b) gain (c) radiation pattern.
6	Design, model and simulate normal mode helical antenna (NMHA) at 1.8 GHz. Study its return loss characteristics and effect of wire radius (between $\lambda/180$ to $\lambda/120$) on Bandwidth.
7	Design and simulate horn antenna at 2 GHz with a suitable simulator. Study its return loss Characteristics. Observe E-field, H-field and surface current distribution
8	Design and simulate a parabolic reflector antenna for a suitable frequency with efficiency at 50%. Find reflection coefficient and gain in DB by plotting radiation pattern.
9	Design, Model and Simulate a log periodic (or planar) antenna at 5 GHz. Study its radiation characteristics and gain.
10	Design and Analyze VHF/UHF Biconical Antenna. Study its reflection coefficient, bandwidth and Radiation pattern at 300MHz, 600 MHz and 1000 MHz.

Course Outcomes: After completing the course, the students will be able to	
CO1	Understand the fundamental concept of antenna and describe the various terminology related to antenna.
CO2	Explain the method of moments to transform integral equations to systems of equations
CO3	Compare different types of antennas
CO4	Calculate different methods to solve complex problem related to antenna
CO5	Analyze the characteristics of different Antenna devices for different Measurement and testing techniques.

Text Books	
1	Constantine A. Balanis - Antenna Theory and Applications – John Wiley & Sons, 4th Ed., 2021
2	J.D Kraus, R. J. Marhefka & A.S.Khan - Antennas and Wave Propagation –TMH, 4 th Ed., 2010.
3	E.C. Jordan and K.G. Balmain - Electromagnetic Waves and Radiating Systems – PHI,2nd Ed., 2009.
4	K.D. Prasad, Satya Prakashan - Antennas and Wave Propagation – Tech India Publications, New Delhi, 2001

Web links and Video Lectures (e – Resources)	
1	https://www.youtube.com/watch?v=kUDlCVOPlvY
2	https://innovationspace.ansys.com/product/electromagnetic-simulation-of-an-antenna-using-ansys-discovery/

CO – PO MAPPING

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**
CO1	**3**	**2**	**2**	**2**	**1**	**1**
CO2	**2**	**3**		**2**		**1**
CO3	**1**	**2**	**1**		**1**	**1**
CO4	**2**	**1**	**1**	**1**	**1**	**1**
CO5	**1**	**1**	**1**	**1**		

Semester: II						
MATLAB and Simulink **Stream: LDN**						
Course Code	**:**	MLDN258B		**Credits**	**:**	1
Hours/Week(L:P:SDA)	**:**	0:2:0:0 / 1:0:0		**CIE**	**:**	50 Marks
Total Hours	**:**	24		**SEE**	**:**	50 Marks
Course Type	**:**	AEC		**SEE Duration**	**:**	2/1

Prerequisites:	
Courses	Digital Signal Processing, Computer Networks, Operating Systems Concepts
Knowledge on Fundamental Concepts	Multimedia and Applications
Knowledge on Connected Tools (If any)	Basic Programming Skills like MATLAB, Scilab, Python

Course Learning Objectives: This course will enable the students to	
CLO1	To provide skills for modelling and simulation of communication systems & networks on MatLab platform.
CLO2	To provide skills for writing MatLab programs and use communication and signal processing toolboxes.
CLO3	To enable the students to implement and validate the algorithms studied in Communication.

Sl No	**Experiments**
1	Familiarity with MatLab communication and signal processing toolbox.
2	Programs to generate uniformly distributed random variables between [0, 1] using Linear Congruential Generator.
3	Programs to generate discrete random variables based on inverse transform technique
4	Programs to generate discrete random variables based on acceptance rejection technique
5	Programs to validate random variable generators based on KS test.
6	Programs to validate random variable generators based on Chi square test
7	Programs to validate independence of random variable generators based on Runs test
8	Programs to validate independence of random variable generators based on Autocorrelation test.
9	Programs to use Monte Carlo techniques to estimate parameters of quantities used in communication system
10	Designing the digital communication system to evaluate BER vs. SNR performance

Course Outcomes: After completing the course, the students will be able to	
CO1	Interpret and abstract the simulation model design of communication systems.
CO2	Design and develop modular programming skills on MatLab platform
CO3	Trace, debug and validate simulation models.
CO4	Implement the algorithms required for discrete event simulation.
CO5	Implement the validation tests for discrete event simulation model

Text Books	
1	Agam Kumar Tyagi, "MATLAB and Simulink for Engineers", OXFORD Higher Education.
2	Dr. Shailendra Jain, "Modeling& Simulation using MATLAB – Simulink", Wiley – India.

Reference Books	
1	Won Y.Tang, Wemun Cao, Tae-Sang Ching and John Morris, "Applied Numerical Methods Using MATLAB", A John Wiley & Sons.
2	Steven T. Karris, "Introduction to Simulink with Engineering Applications", Orchard Publications.

Web links and Video Lectures (e – Resources)	
1	https://www.mathworks.com/videos/introduction-to-simulink-for-modeling-simulation-and-testing-1717082437882.html
2	https://www.mathworks.com/videos/simulink-and-simscape-electrical-for-research-and-teaching-1617375272684.html

CO – PO MAPPING

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**
CO1	**2**	**2**	**2**			**1**
CO2	**2**	**2**	**2**	**2**	**1**	**1**
CO3	**2**	**2**	**2**	**2**		**1**
CO4	**2**		**2**		**1**	**1**
CO5	**2**	**2**	**2**	**3**	**1**	

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 50% of the maximum marks. A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each course. The student has to secure not less than 40% of maximum marks in the semester-end examination(SEE). In total of CIE and SEE student has to secure 50% maximum marks of the course.

Continuous Internal Evaluation (CIE):

CIE marks for the practical course is **50 Marks**.

The split-up of CIE marks for record/ journal and test are in the ratio **60:40**.

- Each experiment to be evaluated for conduction with an observation sheet and record write-up. Rubrics for the evaluation of the journal/write-up for hardware/software experiments designed by the faculty who is handling the laboratory session and is made known to students at the beginning of the practical session.
- Record should contain all the specified experiments in the syllabus and each experiment write-up will be evaluated for 10 marks.
- **Total marks scored by the students are scaled down to 30 marks** (60% of maximum marks).
- Weightage to be given for neatness and submission of record/write-up on time.
- Department shall conduct 01 tests for 100 marks, test shall be conducted after the 14th week of the semester.
- In test, test write-up, conduction of experiment, acceptable result, and procedural knowledge will carry a weightage of 60% and the rest 40% for viva-voce.
- The suitable rubrics can be designed to evaluate each student's performance and learning ability.
- **The test marksis scaled down to 20 marks** (40% of the maximum marks).

The Sum of **scaled-down** marks scored in the report write-up/journal and marks of test is the total CIE marks scored by the student.

Semester End Evaluation (SEE):

SEE marks for the practical course is 50 Marks.

SEE shall be conducted jointly by the two examiners of the same institute, examiners are appointed by the University.

All laboratory experiments are to be included for practical examination.

(Rubrics) Breakup of marks and the instructions printed on the cover page of the answer script to be strictly adhered to by the examiners. **OR** based on the course requirement evaluation rubrics shall be decided jointly by examiners.

Students can pick one question (experiment) from the questions lot prepared by the internal /external examiners jointly.

Evaluation of test write-up/ conduction procedure and result/viva will be conducted jointly by examiners.

General rubrics suggested for SEE are mentioned here, writeup-20%, Conduction procedure and result in -60%, Viva-voce 20% of maximum marks. SEE for practical shall be evaluated for 100 marks and scored marks shall be scaled down to 50 marks (however, based on course type, rubrics shall be decided by the examiners)

Change of experiment is allowed only once and 10% Marks allotted to the procedure part to be made zero.

The duration of SEE is 03 hours

Suggested Learning Resources:

- https://www.udemy.com/course/simulink/
- https://in.mathworks.com/learn/training.html
- https://www.nielit.gov.in/calicut/content/online-course-matlab-simulink
- https://www.coursera.org/courses?query=matlab%20simulink

Semester: II						
Programming in JAVA **Stream: ECE (Digital Communication & Networking)**						
Course Code	**:**	MLDN258C		**Credits**	**:**	1
Hours/Week(L:T:P)	**:**	0:2:0:0 / 1:0:0:0		**CIE**	**:**	50 Marks
Total Hours	**:**	12		**SEE**	**:**	50 Marks
Course Type	**:**	AEC		**SEE Duration**	**:**	02/01

Prerequisites:	
Courses	**Java Programming Concepts**
Knowledge on Fundamental Concepts	**Algorithms, Data Structures**
Knowledge on Connected Tools (If any)	

Course Learning Objectives: This course will enable the students to	
CLO1	To introduce Java compiler and eclipse platform.
CLO2	To make the students to learn an object oriented way of solving problems using java and write programs using multithreading concepts and handle exceptions.
CLO3	To make the students to write programs that connects to a database and be able to perform various operations.
CLO4	To make the students to create the Graphical User Interface using Applets, AWT Components & Swing Components.

Sl No	**Experiments**
1	Write a Java program that works as a simple calculator. Use a grid layout to arrange buttons for the digits and for the +, -,*, % operations. Add a text field to display the result. Handle any possible exceptions like divide by zero
2	Use eclipse or Netbean platform and acquaint with the various menus, create a test project, add a test class and run it see how you can use auto suggestions, auto fill. Try code formatter and code refactoring like renaming variables, methods and classes. Try debug step by step with a small program of about 10 to 15 lines which contains at least one if else condition and a for loop.
3	a) Develop an applet that displays a simple message. b) Develop an Applet that receives an integer in one text field & compute its factorial value & returns it in another text filed when the button "Compute" is clicked
4	Write a program that creates a user interface to perform integer divisions. The user enters two numbers in the text fields, Num1 and Num2. The division of Num1 and Num2 is displayed in the Result field when the Divide button is clicked. If Num1 or Num2 were not an integer, the program would throw a Number Format Exception. If Num2 were Zero, the program would throw an Arithmetic Exception Display the exception in a message dialog box
5	Write a java program that implements a multi-thread application that has three threads. First thread generates random integer every 1 second and if the value is even, second thread computes the square of the number and prints. If the value is odd, the third thread will print the value of cube of the number.
6	Write a java program that connects to a database using JDBC and does add, deletes, modify and retrieve operations
7	Write a java program that simulates a traffic light. The program lets the user select one of three lights: red, yellow, or green with radio buttons. On selecting a button, an appropriate message with "stop" or yellow, or green with radio buttons. On selecting a button, an appropriate message with "stop" or "ready"
8	Write a java program to create an abstract class named Shape that contains two integers and an empty method named printArea(). Provide three classes named Rectangle, Triangle and Circle such that each one of the classes extends the class Shape. Each one of the classes contain only the method printArea( ) that prints the area of the given shape

9	Write a java program that loads names and phone numbers from a text file where the data is organized as one line per record and each field in a record are separated by a tab (\t).it takes a name or phone number as input and prints the corresponding other value from the hash table(hint: use hash tables)
10	Write a java program that takes tab separated data 51-54 (one record per line) from a text file and inserts them into a database
11	Write a Java program that reads on file name from the user, then displays information about whether the file exists, whether the file is readable, whether the file is writable, the type of file and the length of the file in bytes?

Course Outcomes: After completing the course, the students will be able to	
CO1	Understand the fundamental concept of JAVA Programming Concepts.
CO2	Explain the Applet concept and utilize it communicate with inputs and outputs
CO3	Interpret class concept and utilize it to perform numerical Calculations.
CO4	Infer multi-thread Concept and application
CO5	Analyze the real world problems such as traffic light, Phone Number sorting,reading and manipulating files etc

Text Books	
1	Introduction to Programming Using Java, David J. Eck, December 2006
2	Java Fundamentals – A Comprehensive Introduction, Herbert Schildt and Dale Skrien, TMH.
3	Java for Programmers, P.J.Deitel and H.M.Deitel, PEA (or) Java: How to Program , P.J.Deitel and H.M.Deitel,PHI
4	Object Oriented Programming through Java, P. Radha Krishna, UniversitiesPress

Web links and Video Lectures (e – Resources)	
1	https://www.youtube.com/watch?v=A74TOX803D0
2	https://www.youtube.com/watch?v=PymbRTMb4hY

CO – PO MAPPING

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**
CO1	**3**		**2**			
CO2	**2**	**3**				**1**
CO3	**1**	**2**	**1**			**1**
CO4	**2**	**1**	**1**	**1**	**1**	**1**
CO5	**1**	**1**	**1**	**1**		1

Semester: II						
Python Programming						
Course Code	**:**	MLDNL258D		**Credits**	**:**	1
Hours/Week(L:T:P)	**:**	0:0:2:0		**CIE**	**:**	50 Marks
Total Hours	**:**	12-14 Lab slots		**SEE**	**:**	50 Marks
Course Type	**:**	AEC		**SEE Duration**	**:**	2 Hours

Prerequisites:	
Courses	Python Programming Basics
Knowledge on Fundamental Concepts	Operating System, Data structures
Knowledge on Connected Tools (If any)	……..

Course Learning Objectives: This course will enable the students to	
CLO1	Design and implement Python programs that solve complex problems.
CLO2	Capable of effectively managing and analyzing datasets using Python libraries like Pandas and NumPy
CLO3	Demonstrate the ability to connect Python programs to MySQL databases
CLO4	Apply object-oriented programming concepts like inheritance and Apply abstraction
CLO5	Design and implement Python programs that solve real world complex problems

Sl No	**Experiments**
1	Write a Python program that calculates the sum of the first n terms of the following mathematical series: $1 – x^2 / 2! + x^4 / 4! – x^6 / 6! + …… x^n / n!$
2	Write a Python program that reads a file and calculates the number of characters, words, and lines in it.
3	Write a Python program to compute various matrix and vector operations such as dot product, inner product, outer product, and matrix exponentiation.
4	a) Write a Python program that uses Pandas' built-in visualization tools to create the following plots: i. Bar plots ii. Histograms iii. Line plots iv. Scatter plots b) Write a program to demonstrate the use of the groupby() method in Pandas. c) Write a program that shows how to merge, join, and concatenate dataframes in Pandas. d) Write a Python program to create dataframes from CSV and Excel files.
5	Write a python program to check the validity of a password given by the user. The password should satisfy the following criteria: i) Contain at least 1 letter between a and z ii) Contain at least 1 number between 0 and 9 iii) Contain at least 1 letter between A and Z iv) Contain at least 1 character from $, #, @ v) Minimum length of password: 6 vi) Maximum length of password: 12
6	Write a Python program that performs basic database operations (create, insert, delete, update) using MySQL and its corresponding Python adapter.
7	Write a Python program that accepts a space-separated sequence of words as input and outputs the words in a hyphen-separated sequence after sorting them alphabetically.
8	Write a Python program that demonstrates data indexing, selection, and filtering using Pandas.
9	Write a Python GUI application that a) simulates traffic lights with appropriate colors and text for "Stop", "Wait", and "Go" signals. b) Write a python program for simple GUI calculator using Tk

10	Design a AI chat bot using Python
11	Create a Website with Python
12	Design a Resume Generator App Using Python
Course Outcomes: After completing the course, the students will be able to	
CO1	Understand Python syntax , semantics ,Python flow control and Functions.
CO2	Evaluate data structures such as arrays and dataframes using libraries like NumPy and Pandas, with an emphasis on data manipulation, grouping, and visualization techniques.
CO3	Analyze techniques to to connect Python applications to MySQL databases, perform essential operations such as creating tables, inserting, updating, and deleting records, and manage data efficiently.
CO4	Infer the application of object-oriented programming concepts, including inheritance and abstraction.
CO5	Interpret the concept and execute Python programs that solve real-world problems, focusing on mathematical operations, file manipulation, matrix computations, and building graphical user interfaces (GUIs)...

Text Books	
1	R. Nageswara Rao , "Core Python Programming" Dreamtech Press India Pvt Ltd 2018.
2	Core Python Programming, Wesley J. Chun, Second Edition, Pearson.
3	Python Programming: A Modern Approach, VamsiKurama, Pearson

Reference Books	
1	**Think Python, Allen Downey, Green Tea Press**
2	**Introduction to Python, Kenneth A. Lambert, Cengage**

Skill Development Activities Suggested
Massive Open Online Courses:
1. https://ocw.mit.edu/courses/6-0001-introduction-to-computer-science-and-programming-in-python-fall-2016/
2. https://developers.google.com/edu/python

Web links and Video Lectures (e – Resources)	
1	https://nptel.ac.in/courses/106106139/
2	https://nptel.ac.in/courses/106105152/
3	https://nptel.ac.in/courses/106106202/

CO – PO MAPPING

CO-PO	PO1	PO2	PO3	PO4	PO5	PO6	PSO 1	PSO 2
CO1	3	3	3	2	2	1	2	1
CO2	3	2	1	1	1	1	2	1
CO3	3	2	1	1	1	1	2	1
CO4	2	2	2	2	2	1	2	1
CO5	2	2	1	1	1	1	2	1

Semester: II						
Cryptography and Network Security Lab **Stream: ECE (Digital Communication & Networking)**						
Course Code	**:**	MLDNL207		**CIE**	**:**	50
Hours/Week(L:T:P)	**:**	1:0:2:0		**SEE**	**:**	50
Credits	**:**	2		**SEE Duration**	**:**	03

Prerequisites:	
Courses	Number theory, Algebra
Knowledge on Fundamental Concepts	Fundamentals of C/C++/Java/Matlab
Knowledge on Connected Tools (If any)	

Course Learning Objectives: This course will enable the students to	
CLO1	Identify and classify various Attacks and explain the same.
CLO2	Compare and contrast symmetric and asymmetric encryption systems and their vulnerability to various attacks.
CLO3	Comprehend and apply authentication, email security, web security services and mechanisms.
CLO4	Explain the role of third-party agents in the provision of authentication services.
CLO5	Distinguish and explain different protocol like SSL, and their applications

Sl.No	**Experiments**
1	Write a C program that contains a string (charpointer) with a value \ Hello World'. The Program should XOR each character in this string with 0 and displays the result.
2	Write a C program that contains a string (char pointer) with a value \Hello World'.The Program should AND or and XOR each character in this string with127 and display the result
3	Writea C/ Java/ Matlab program to perform encryption and decryption using the following algorithms: Ceaser Cipher Hill Cipher
4	Implementation and Performance evaluation of DES algorithmin using C/ C++/ Java/ Matlab
5	Implementation and Performance evaluation of AES algorithmin using C/C++/ Java/ Matlab
6	Implementation and Performance evaluation of RSA algorithmin using C/C++/ Java/ Matlab
7	Implement the Diffie-Hellman Key Exchange algorithm for a given problem in C/C++/Java/ Matlab.
8	Write a C/C++/Java/ Matlab program to calculate the message digest of a text using the SHA-1 algorithm.
9	Write a C/C++/Java/Matlab program to calculate the message digest of a text using the MD5 algorithm.
	Demonstration Experiments(For CIE)if any
10	Implement the SIGNATURESCHEME –Digital Signature Standard.
11	Using open SSL for web server-browser communication
12	Configuring S/MIME for e-mail communication

Course outcome(Course Skill Set) At the end of the course the student will be able to:		
Sl.No.	**Description**	**BloomsLevel**
CO1	Develop code for classical Encryption Techniques to solve the problems.	Create
CO2	Build cryptosystems by applying symmetric and public key encryption algorithms.	Create
CO3	Construct code for authentication algorithms.	Create
CO4	Develop a signature scheme using Digital signature standard.	Create
CO5	Setup secure mail and web communication channels	Create

Text Book	
1	**"Cryptography and Network Security Principles and Practice", William Stallings, Pearson Education Inc., ISBN: 978**
2	**"Applied Cryptography Protocols, Algorithms, and Source code in C", Bruce Schneier, Wiley Publications ISBN: 9971**

Reference Books	
1	**"Cryptography and Network Security", Behrouz A. Forouzan, TMH, 2007**
2	**"Cryptography and Network Security", Atul Kahate, TMH, 2000**

Skill Development Activities Suggested
1. Online certification courses. **2. Mini projects can be sug*ge*sted on the related area.**

Web links and Video Lectures (e – Resources)	
1	https://online.stanford.edu/courses/xacs130-using-cryptography-correctly
2	https://www.coursera.org/learn/crypto
5	https://www.udemy.com/topic/cryptography.

Mapping of COs and POs

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**
CO1	**3**	**1**	**1**	**3**	**1**	
CO2	**2**	**1**	**1**	**3**		
CO3	**2**	**1**		**2**		
CO4	**3**	**2**	**1**	**2**		**2**
CO5	**2**	**2**	**1**	**2**	**1**	**3**



Institute Vision

Preparing Competent Engineering and Management Professionals to Serve the Society

Institute Mission

- Providing Students with a Sound Knowledge in Fundamentals of their branch of Study.
- Promoting Excellence in Teaching, Training, Research and Consultancy.
- Exposing Students to Emerging Frontiers in various domains enabling Continuous Learning.
- Developing Entrepreneurial acumen to venture into Innovative areas.
- Imparting Value based Professional Education with a sense of Social Responsibility.

Department Vision

Transforming Individuals into Competent Electronics and Communication Engineers for Technological and Societal Advancements

Department Mission

- Strengthening Fundamental Knowledge for Academic and Professional Excellence.
- Empowering innovation through Research in Emerging Technologies.
- Fostering Industry-Institute Collaboration for Technical & Entrepreneurial Progress.
- Equipping Students with Technical Skills and Ethical Values to cater Societal Needs.
- Nurturing Supportive Environment for Lifelong Learning.

SJC INSTITUTE OF TECHNOLOGY

An Autonomous Institution under VTU from 2024-25

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