SRI MANAKULA VINAYAGAR ENGINEERING COLLEGE

(An Autonomous Institution)
(As per UGC -2018 Regulations and Affiliated to Pondicherry University)

PUDUCHERRY

DEPARTMENT OF INFORMATION TECHNOLOGY

M.TECH - NETWORKING

ACADEMIC REGULATIONS 2020
(R-2020)

CURRICULUM AND SYLLABI

COLLEGE VISION AND MISSION

Vision

To be globally recognized for excellence in quality education, innovation and research for the transformation of lives to serve the society.

Mission

M1: Quality Education:

To provide comprehensive academic system that amalgamates the cutting edge technologies with best practices.

M2: Research and Innovation:

To foster value- based research and innovation in collaboration with industries and institutions globally for creating intellectuals with new avenues.

M3: Employability and Entrepreneurship:

To inculcate the employability and entrepreneurial skills through value and skill based training.

M4: Ethical Values:

To instill deep sense of human values by blending societal righteousness with academic professionalism for the growth of society.

DEPARTMENT VISION AND MISSION

Vision

To be a pioneer in the field of Information Technology by achieving academic excellence, involving in research & development and promoting technical & professional expertise

Mission

M1: Expertise: To impart quality education and create excellent engineers with strong analytical, Programming and Problem solving Skills to meet the ever changing demands of IT industry

M2: Eminence: To kindle creative thinking, innovation and foster value-based research in the field of information technology

M3: Complaisant: To enrich the employability skills, inculcate entrepreneurial ideology and promote professional expertise

M4: Exemplar: To instil moral values, ethical responsibilities and empowering graduates to be socially responsible and technically competent

Dr. R.Raju, M.Tech., Ph.D.,
PROFESSOR AND HEAD.
Department of Information Technology
Sri Manakula Vinayagar Engineering College
Madagadipet. Puducherry-605 107.

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PROGRAMME OUTCOMES (POs)

PO1: Exploration of Research:

An ability to independently carry out research/investigation and development work to solve practical problems.

PO2: Technical Skill:

An ability to write and present a substantial technical report/document.

PO3: Expertise in Academics:

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.

PO4: Problem solving:

An ability to discriminate, analyze, evaluate and synthesize the technologies to provide solution for multidimensional engineering problems.

PO5: Usage of Modern Tools:

Create, select, learn and apply appropriate techniques, resources, and modern engineering and IT tools, including prediction and modelling, to complex engineering activities with an understanding of the limitations.

PO6: Ethical Practices and Social Responsibility:

Acquire professional and intellectual integrity, professional code of conduct, ethics of research and scholarship, consideration of the impact of research outcomes on professional practices and an understanding of responsibility to contribute to the community for sustainable development of society.

PROGRAM EDUCATIONAL OBJECTIVES (PEOs)

PEO-1: To provide essential background in network design, management, and networking based software and tools

PEO-2: To empower the graduates to identify, formulate and solve engineering problems in Network design and management by using communication and networking platforms and tools.

PEO-3: To explore the research gaps, and apply creativity and logical reasoning to solve innovative and complex problems in the specialized/emerging areas of networking domain.

PEO-4: To solve the techno-socio-economic problems by providing automated solution in this domain by utilizing and exhibiting social, communication and ethical values.

PEO-5: To encourage and mould the graduates to be industry ready or entrepreneurs and sustain in their professional career.

PROGRAM SPECIFIC OBJECTIVES (PSOs)

PSO-1: To provide engineering and technological solutions to simple and complex networking problems

PSO-2: To design and demonstrate the knowledge of evolving architectures and protocols to model and design connected and wireless networks of systems

PSO-3: To apply the knowledge of acquisition, representation and management of data /information resources with focus on security and network management.

STRUCTURE FOR POST GRADUATE ENGINEERING PROGRAM

SI.No.	Course Category	Breakdown of Credits
1	Humanities and Social Sciences (HS)	-
2	Basic Sciences(BS)	3
3	Engineering Sciences (ES)	-
4	Professional Core (PC)	31
5	Professional Electives (PE)	18
6	Open Electives (OE)	0
7	Project Work and Internship	20
8	Employability Enhancement Courses (EEC)	-
9	Mandatory courses (MC)	-
Total		**72**

SCHEME OF CREDIT DISTRIBUTION – SUMMARY

SI.No	Course Category	Credits per Semester				Total Credits
		I	II	III	IV	
1	Humanities and Social Sciences (HS)	-	-	-	-	-
2	Basic Sciences(BS)	3	-	-	-	3
3	Engineering Sciences (ES)	-	-	-	-	-
4	Professional Core (PC)	15	16	-	-	31
5	Professional Electives (PE)	3	6	9	-	18
6	Open Electives (OE)	-	-	-	-	0
7	Project Work and Internship	-	-	8	12	20
8	Employability Enhancement Courses (EEC)*	-	-	-	-	-
9	Mandatory Courses (MC)*	-	-	-	-	-
Total		**21**	**22**	**17**	**12**	**72**

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SEMESTER – I

Sl. No.	Course Code	Course Title	Category	Periods			Credits	Max. Marks		
				L	T	P		CAM	ESM	Total
Theory										
1	P20BST104	Fundamental Mathematics for Networking	BS	2	2	0	3	40	60	100
2	P20NWT101	Computer Network Components & Protocol	PC	3	0	0	3	40	60	100
3	P20NWT102	Information Coding Techniques	PC	3	0	0	3	40	60	100
4	P20NWT103	Network Management	PC	3	0	0	3	40	60	100
5	P20CCT101	Research Methodology and IPR	PC	2	0	0	2	40	60	100
6	P20NWE1XX	Professional Elective I	PE	3	0	0	3	40	60	100
Practical										
7	P20NWP101	Computer Network Protocol Simulation Lab	PC	0	0	4	2	50	50	100
8	P20CCP101	Technical Report Writing and Seminar	PC	0	0	4	2	100	0	100
Audit Course										
9	P20ACT10X	Audit Course - I	AC	0	0	2	0	100	0	100
Employability Enhancement Course										
10	P20NWC1XX	Employability Enhancement course I#	EEC	0	0	4	0	100	0	100
		Total					21	590	410	1000

SEMESTER – II

Sl. No.	Course Code	Course Title	Category	Periods			Credits	Max. Marks		
				L	T	P		CAM	ESM	Total
Theory										
1	P20NWT204	Cyber Security	PC	3	0	0	3	40	60	100
2	P20NWT205	Network Performance Tuning	PC	3	0	0	3	40	60	100
3	P20NWT206	Wireless and Ad-hoc Networking	PC	3	0	0	3	40	60	100
4	P20NWT207	Data Science for Networks	PC	3	0	0	3	40	60	100
5	P20NWE2XX	Professional Elective II	PE	3	0	0	3	40	60	100
6	P20NWE2XX	Professional Elective III	PE	3	0	0	3	40	60	100
Practical										
7	P20NWP202	Data Science for Networks Lab	PC	0	0	4	2	50	50	100
8	P20CCP202	Seminar on ICT a hands on approach	PC	0	0	4	2	100	0	100

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Audit Course											
9	P20ACT20X	Audit Course - II	AC	0	0	2	0	100	0	100
Employability Enhancement Course											
10	P20NWC2XX	Employability Enhancement Course II#	EEC	0	0	4	0	100	0	100
		Total					22	590	410	1000

SEMESTER – III										
Sl. No.	Course Code	Course Title	Category	Periods			Credits	Max. Marks		
				L	T	P		CAM	ESM	Total
Theory- Elective										
1	P20NWE3XX	Professional Elective IV	PE	3	0	0	3	40	60	100
2	P20NWE3XX	Professional Elective V	PE	3	0	0	3	40	60	100
2	P20NWE3XX	Professional Elective VI	PE	3	0	0	3	40	60	100
Project Work										
3	P20NWW301	Project Phase I	PW	0	0	12	6	50	50	100
4	P20NWW302	Internship	PW	0	0	0	2	100	0	100
Employability Enhancement Course										
6	P20NWS301	NPTEL/ GIAN /MOOC	EEC	0	0	0	0	100	0	100
		Total					17	370	230	600

SEMESTER – IV										
Sl. No.	Course Code	Course Title	Category	Periods			Credits	Max. Marks		
				L	T	P		CAM	ESM	Total
Project Work										
1	P20NWW403	Project Phase II	PC	0	0	24	12	50	50	100
		Total					12	50	50	100

BS-Basic Science   **PC**-Professional Core   **PE**-Professional Elective   **PW**-Project Work
AC- Audit Course   **CC**-Common Course   **EEC**- Employability Enhancement course

SEMESTER WISE CREDIT DISTRIBUTION

Sem-I	Sem-II	Sem-III	Sem-IV	Total
21	22	17	12	72

- MC and EEC course are not considered for CGPA calculation

Total number of credits required to complete
M.Tech in Networking   : **72 Credits**

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Annexure-I
PROFESSIONAL ELECTIVE COURSES

Sl.No	Course Code	Course Title
Professional Elective -I Offered in Semester -I		
1	P20NWE101	Multimedia Communication Networks
2	P20NWE102	Next Generation Networks
3	P20NWE103	Software Defined Networks
4	P20NWE104	Network System Modelling and Simulation
5	P20NWE105	Distributed and Cloud Computing
Professional Elective -II Offered in Semester -II		
1	P20NWE206	Graph Theory
2	P20NWE207	Robotic Process Automation
3	P20NWE208	Machine Learning
4	P20NWE209	Web Analytics and Development
5	P20NWE210	Human Computer interaction
Professional Elective -III Offered in Semester -II		
1	P20NWE211	High Speed Switching Architectures
2	P20NWE212	Internet Routing Design
3	P20NWE213	Wireless Sensor Protocols and Programming
4	P20NWE214	Next Generation Internetworking Protocol
5	P20NWE215	Protocol engineering
Professional Elective -IV Offered in Semester -III		
1	P20NWE316	Social Network Analysis
2	P20NWE317	Autonomous Vehicles & UAV
3	P20NWE318	Human Computer Interaction
4	P20NWE319	Smart Sensors and Internet of Things
5	P20NWE320	Multicore Architecture
Professional Elective -V Offered in Semester -III		
1	P20NWE321	Cyber Physical system
2	P20NWE322	Secure Coding
3	P20NWE323	Cloud security
4	P20NWE324	Cyber Laws and Security Policies
5	P20NWE325	Digital Forensics
Professional Elective -VI Offered in Semester -III		
1	P20NWE326	Ethical Hacking
2	P20NWE327	Intrusion Detection and Prevention
3	P20NWE328	Software Architecture and Design
4	P20NWE329	Switching and Statistical Multiplexing in Telecommunication
5	P20NWE330	Network Embedded application

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Annexure-II

EMPLOYABILITY ENHANCEMENT COURSES

Sl. No.	Course Code	Course Title
1	P20NWCX01	Advanced Python
2	P20NWCX02	Android Programmming
3	P20NWCX03	Artificial Intelligence
4	P20NWCX04	CCNA (Routing And Switching)
5	P20NWCX05	CCNA (Wireless)
6	P20NWCX06	Azure Devops
7	P20NWCX07	Cisco-Certified Design Associate (CCDA)
8	P20NWCX08	CCNA Collaboration
9	P20NWCX09	CCNA CyberOps
10	P20NWCX10	CCNA Security
11	P20NWCX11	CCNA Service Provider
12	P20NWCX12	Google Analytics
13	P20NWCX13	Google Cloud
14	P20NWCX14	Industry Internet of Things 4.0
15	P20NWCX15	IoT using Python
16	P20NWCX16	Network Programming
17	P20NWCX17	Advanced Java Programming
18	P20NWCX18	Search Engine Optimization
19	P20NWCX19	WAN Technologies
20	P20NWCX20	Data Centre: Networking & Virtualization

Annexure-III

AUDIT COURSES

Sl. No.	Course Code	Course Title
1	P20ACTX01	English for Research Paper Writing
2	P20ACTX02	Disaster Management
3	P20ACTX03	Sanskrit for Technical Knowledge
4	P20ACTX04	Value Education
5	P20ACTX05	Constitution of India
6	P20ACTX06	Pedagogy Studies
7	P20ACTX07	Stress Management by Yoga
8	P20ACTX08	Personality Development Through Life Enlightenment Skills
9	P20ACTX09	Unnat Bharat Abhiyan

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P20BST104	FUNDAMENTAL MATHEMATICS FOR NETWORKING	L	T	P	C	Hrs
		2	2	0	3	45

Course Objectives

- To develop the ability to use the concepts of Special Functions for solving problems on Networks.
- To analyse the Graph Theory algorithms and understand its applications in Networks.
- To impart knowledge on planar graphs along with edges and cycles
- To impart knowledge on probability theory that will come in handy to solve the problem that arise in engineering. This will also serve as a precursor for future research.
- To acquire skills in analysing Queuing Models.

Course Outcomes

After completion of the course, the students will be able to

CO1 - Solve problems in graph theory. **(K4)**

CO2 - Assimilate the concepts of Matching and covers algorithm along with connectivity. **(K2)**

CO3 - Explore the idea of edges and cycles of planar graphs. **(K2)**

CO4 - Explain basic concepts in probability theory. **(K2)**

CO5 - Calculate the traffic intensity, blocked traffic and the utilization of queuing systems. **(K4)**

UNIT I GRAPH THEORY INTRODUCTION   (9 Hrs)

Introduction to Graphs - Paths - Cycles - And Trails - Vertex Degrees and Counting - Directed Graphs - Trees and Distance: Basic Properties - Spanning Trees and Enumeration - Optimization and Trees.

UNIT II MATCHING CONNECTIVITY AND FLOW   (9 Hrs)

Matching and Covers Algorithms and Applications - Matching in General Graphs. - Connectivity and Paths: Cuts and Connectivity - k-connected graphs – Network Flow Problems.

UNIT III PLANAR GRAPHS - EDGES AND CYCLES   (9 Hrs)

Planar Graphs - Embedding and Euler s Formula - Characterization of Planar graphs - Parameters of Planarity - Line Graphs and Edge-Coloring - Hamiltonian Cycles - Planarity - Coloring and Cycles - Applications in Networks.

UNIT IV INTRODUCTION TO PROBABILITY THEORY   (9 Hrs)

Probability concepts - Random variables - moments - Moment Generating function - Binomial - Poisson - Geometric - Negative binominal - Exponential - Gamma - Weibull distributions - Functions of random variable - Chebyshev inequality - Application in Networks.

UNIT V QUEUING THEORY   (9 Hrs)

Markovian queuing models - Little's formula - Multi-server queues - M/G/1 Queues - Pollaczek - Khintchine formula - Applications in Networks.

Text Books

1. R J Wilson," Introduction to Graph Theory", Pearson Education,4th Edition, 2003.
2. Reinhard Diestel ,"Graph Theory", Springer- Verlog , 2nd Edition, 2000.
3. Gunavathi K ,"Probability and Queuing Theory", S Chand & Company, December 2010.

Reference Books

1. T Veerarajan,"Probability - Statistics and Random Processes", McGraw Hill Education ,3rd edition, July 2017
2. V Sundarapandian,"Probability - Statistics and Queuing Theory", Prentice Hall India Learning Private Limited; 1st Edition ,2009

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3. Jay Yellen, Jonathan L.Gross,"Graph Theory and Its Applications", CRC Press LLC 1998.
4. John Adrian Bondy,U S R Murty "Graph theory with applications", Elsevier, Dec 1976
5. Bela Bollobas,"Modern Graph Theory" , Springer, December 2013

Web References

1. http://discrete.openmathbooks.org/dmoi3/sec_planar.html
2. https://www.csd.uoc.gr/~hy583/papers/ch13.pdf
3. https://www.youtube.com/watch?v=xGkpXk-AnWU (NPTEL Lecture)
4. https://www.khanacademy.org/math/ap-calculus-bc/bc-series-new/bc-10-14/v/euler-s-formula-and-euler-s-identity
5. https://www.researchgate.net/publication/260708469_Generalized_Pollaczek-Khinchin_Formula_for_Markov_Channels

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)						Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3
CO1	3	3	3	3	2	-	3	2	3
CO2	2	3	2	1	-	-	1	-	2
CO3	2	3	2	1	-	-	1	-	2
CO4	2	3	2	1	-	-	1	-	2
CO5	3	3	3	3	2	-	3	2	3

Correlation Level: 1-Low, 2-Medium, 3-High

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P20NWT101	COMPUTER NETWORK COMPONENTS AND PROTOCOL	L	T	P	C	Hrs
		3	0	0	3	45

Course Objectives

- To understand the basics of network topologies
- To learn the installation procedures of Computer networks
- To understand the designing of networks and challenges and management of LAN and MAN network
- To understand the network layer protocols and applications
- To understand the transport protocols and applications

Course Outcomes

After completion of the course, the students will be able to

CO1 - Paraphrase the Network Components and Topologies. **(K2)**

CO2 - Apply various the installation procedures of Computer networks. **(K3)**

CO3 - Design networks and analyse the various management procedures of LAN and MAN network. **(K5)**

CO4 - Write simple network debugging software applications using socket system calls. **(K2)**

CO5 - Manage transport layer service and issues in a network. **(K3)**

UNIT I NETWORK COMPONENTS AND TOPOLOGIES (9 Hrs)

Basic Networking Components: Cables - Network adapter cards – Hubs - Switching Hubs - Network Interface - Link Interconnect and Switch. Network Topologies - Network Hardware Components - MAC Addresses - Access Methods - Ethernet and IEEE 802.3 - Token Ring and IEEE 802.5 - FDDI

UNIT II NETWORK INSTALLATION (9 Hrs)

Network installation and upgrades – Connectors – Components - Structured Wiring Systems - Wiring Techniques - Crimping Cables - Cabling Diagram - Wiring for a UTP Patch Cable - Wiring for a Cross - over Cable - Network Adapter Cards - Network Card Drivers - Configuring network services.

UNIT III NETWORK DESIGN (9 Hrs)

Major challenges in network design - centralized network design - distributed network design - Technical consideration of networking design and planning - Similarities and comparisons between LAN and WAN design - Performance analysis using network simulation tool. Management overview of LAN design and planning - Information source for baseline LAN models - LAN planning and design tools - Management overview of WAN network design - Technical overview of WAN network design - Major features and functions of automated design tools

UNIT IV NETWORK LAYER AND ROUTING (9 Hrs)

Protocol layers and their service models Multiple access protocols (random access protocols - current Ethernet Technologies - Network service models - routing principles - hierarchical routing - the Internet Protocol (IP) - routing in the internet (RIP, OSPF, BGP), IPv6

Case study: Cisco Routers. Multicasting and Multicast Routing

UNIT V TRANSPORT LAYER (9 Hrs)

TCP, UDP and SCTP - Introduction to transport layer services – UDP – TCP - principles of congestion control - TCP congestion control – SCTP- Socket programming with TCP - Socket programming with UDP

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Text Books

1. Teresa C.Mann-Rubinson, Kornel Terplan, "Network Design Management and Technical Perspectives", Auerbach Publications, Second Edition, 2004
2. James .D.McCabe, "Network analysis architecture and design", Morgan Kaufmann; 2nd edition 2003
3. Behrouz A. Forouzan, "TCP/IP Protocol Suite", Tata McGraw Hill, 3rd Edition, 2012.

Reference Books

1. Bruce Hallberg, "Networking for Beginners", McGraw-Hill Education; 6th edition, 2013.
2. Gurdeep S. Hura, Mukesh Singhal, "Data and computer communications: Networking and Internetworking", CRC Press; 1st edition, 2010.
3. Engr Wilson Kurt ," Network Topology: The Physical and Logical Structure of a Network connection Between Model and nodes", Paperback – Import, December 2019.
4. Mike Meyers ," Managing and Troubleshooting Networks", Kindle Edition, Fourth Edition , 2015
5. BICSI ,"Network Design Basics for Cabling Professionals",1st Edition, McGraw-Hill Professional, April 2002

Web References

1. https://www.javatpoint.com/computer-network-components
2. https://www.sciencedirect.com/topics/computer-science/transport-layer-protocol
3. https://access.itxlearning.com/data/cmdata/NETPLUSN10004/Books/ec2_netplus004c03.pdf.
4. https://www.cisco.com/en/US/docs/switches/lan/catalyst3850/software/release/3se/consolidated_guide/b_consolidated_3850_3se_cg_chapter_0101000.html
5. https://www.geeksforgeeks.org/tcp-server-client-implementation-in-c/

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)						Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3
CO1	2	3	2	1	-	-	1	-	2
CO2	3	3	3	2	1	-	2	1	3
CO3	3	3	3	3	3	-	3	3	3
CO4	2	3	2	1	-	-	1	-	2
CO5	3	3	3	2	1	-	2	1	3

Correlation Level: 1-Low, 2-Medium, 3-High

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P20NWT102	**INFORMATION CODING TECHNIQUES**	L	T	P	C	Hrs
		3	0	0	3	45

Course Objectives

- To equip students with the basic understanding of the fundamental concept of entropy and information as they are used in communications.
- To guide the student through the implications and consequences of fundamental theories and laws of information theory and coding theory
- To manage the information using the convolutional codes.
- To measure the performance of the turbo codes
- To understand the compression techniques used in text, video and image.

Course Outcomes

After completion of the course, the students will be able to

CO1 - Calculate the information content of a random variable from its probability distribution. **(K4)**
CO2 - Construct efficient codes for data on imperfect communication channels. **(K5)**
CO3 - Manage the information using the Convolution codes. **(K3)**
CO4 - Measure the performance of the turbo codes. **(K4)**
CO5 - Apply the compression techniques for text, video and image. **(K3)**

UNIT I INTRODUCTION   (9 Hrs)

Information and entropy information measures, Shannon's concept of Information. Channel coding, channel mutual information capacity (BW), Theorem for discrete memory less channel, information capacity theorem, Error detecting and error correcting codes

UNIT II CODING FOR RELIABLE DIGITAL TRANSMISSION AND STORAGE   (9 Hrs)

Types of Errors, Error Control Strategies. Linear Block Codes: Introduction to Linear Block Codes, Syndrome and Error Detection, Minimum Distance of a Block code, Error-Detecting and Error-correcting Capabilities of a Block code, Standard array and Syndrome Decoding, Probability of an undetected error for Linear Codes over a BSC, Hamming Codes. cyclic code, Masking techniques, Applications of Block codes for Error control in data storage system

UNIT III CONVOLUTIONAL CODES   (9 Hrs)

Encoding of Convolutional Codes, Structural and Distance Properties, maximum likelihood decoding, Sequential decoding, Majority- logic decoding of Convolution codes. Application of Viterbi Decoding and Sequential Decoding, Applications of Convolutional codes in ARQ system.

UNIT IV TURBO CODES   (9 Hrs)

Turbo Codes: LDPC Codes- Codes based on sparse graphs, decoding for binary erasure channel, Log-likelihood algebra, Brief propagation, Product codes, Iterative decoding of product codes, Concatenated convolutional codes- Parallel concatenation, The UMTS Turbo code, Serial concatenation, Parallel concatenation, Turbo decoding

UNIT V COMPRESSION   (9 Hrs)

Compression: loss less and lossy, Huffman codes, LZW algorithm, Binary Image compression schemes, run length encoding, CCITT group 3 1- D Compression, CCITT group 3 2D compression, CCITT group 4 2DCompression.

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Text Books
1. Ranjan Bose, "Information theory, coding and cryptography", Tata McGraw Hill,2002.
2. Shu Lin, Daniel J.Costello,Jr, "Error Control Coding- Fundamentals and Applications", Prentice Hall, Inc,2004
3. Khalid Sayood,"Introduction To Data Compression ",Fifth Edition,Elsevier,2017

Reference Books
1. Salvatore Gravano, "Introduction to Error Control Codes", Oxford,2007
2. Todd K.Moon, "Error Correction Coding – Mathematical Methods and Algorithms", Wiley India ,2006
3. Thomas M. Cover and Joy A. Thomas, "Elements of Information Theory", John Wiley & Sons, 2006
4. David Soloman," Data Compression: The Complete Reference",Fourth Edition,Springer,2007.
5. Ranjan Bose,"Information Theory, Coding and Cryptography",Second Edition,Tata McGraw Hill Education,2008

Web References
1. https://nptel.ac.in/courses/117/101/117101053/
2. https://web.stanford.edu/class/ee398a/BookWiegandSchwarz.pdf
3. https://www.coursera.org/courses?query=information%20theory
4. https://www.geeksforgeeks.org/data-compression-arithmetic-coding/
5. https://www.geeksforgeeks.org/lzw-lempel-ziv-welch-compression-technique/

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)						Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3
CO1	3	3	3	3	2	-	3	2	3
CO2	3	3	3	3	3	-	3	3	3
CO3	3	3	3	2	1	-	2	1	3
CO4	3	3	3	3	2	-	3	2	3
CO5	3	3	3	2	1	-	2	1	3

Correlation Level: 1-Low, 2-Medium, 3-High

P20NWT103	NETWORK MANAGEMENT	L	T	P	C	Hrs
		3	0	0	3	45

Course Objectives

- To understand the concept of network management perspectives and OSI networking management
- To provide working knowledge of SNMP models and management
- To explore the technologies involved in Broadband network management
- To exposure the various Network management applications
- To understand the need and modelling of Telecommunication Model Networks

Course Outcomes

After completion of the course, the students will be able to

CO1 - Explain the concept of network management standards. (K2)
CO2 - Demonstrate broad knowledge underlying SNMP protocol. (K3)
CO3 - Design and analyze the broadband network and its services. (K5)
CO4 - Analyze the concept of examples of network management applications. (K4)
CO5 - Architect and implement telecommunication management networks.(K3)

UNIT I OVERVIEW OF NETWORK MANAGEMENT   (9 Hrs)

Case histories on network, system and service management, challenges of IT managers- Network Management: Goals, organization and functions- Network management architecture and organization network management perspectives
OSI Network Management - Network management standards- Network management models- Abstract syntax notation – encoding structure, macros functional model CMIP/CMISE

UNIT II INTERNET MANAGEMENT (SNMP)   (9 Hrs)

SNMP-organizational model- System overview- Information model, communication model, functional model- SNMP proxy server, Management information, Protocol- Remote monitoring. RMON

UNIT III BROADBAND NETWORK MANAGEMENT   (9 Hrs)

Broadband networks and services- ATM Technology – VP, VC, ATM Packet, Integrated service, ATM LAN emulation- Virtual LAN- ATM Network Management – ATM network reference model, integrated local management interface. ATM management information base - role of SNMP and ILMI in ATM management - M1, M2, M3, M4 interface. ATM digital exchange interface management.

UNIT IV NETWORK MANAGEMENT APPLICATIONS   (9 Hrs)

Configuration management- Fault management- Performance management- Event correlation techniques- Security management- Accounting management, report management, policy based management services- Level management

UNIT V TELECOMMUNICATION MANAGEMENT NETWORKS (TMN)   (9 Hrs)

Need for TMN- Conceptual model- TMN standards- TMN management services architecture and TMN implementation

Text Books

1. Mani Subramanian, "Network Management: Principles and Practice", Pearson Education, Second edition, 2010.
2. Lakshmi G Raman, "Fundamentals of Telecommunications Network Management",Wiley, 1st edition 1999.
3. Haynes, John D ,"Internet Management Issues: A Global Perspective", Idea Group Inc (IGI), 2001

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Reference Books

1. Henry Haojin Wang, "Telecommunication Network Management", Mc- GrawHill, 1999.
2. Salah Aidarous and Thomas Plevyak, "Telecommunication Network Management: Technologies and Implementations", Wiley,1997.
3. Mani Subramaniam," Network Management: Principles and Practice", Second Edition, Prentice Hall, May 2012
4. Dr. Sidnie M. Feit ,"SNMP: A Guide to Network Management", McGraw Hill ,September 1994
5. Kornel TerPlan,Jill Hungtington-Lee,"Applications for Distributed Systems and Network Management", Second Edition, Van Nostrand Reinhold, 1995

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1. https://www.researchgate.net/publication/221106548_Evolution_of_Broadband_Network_M anagement_System_Using_an_AOP
2. https://www.manageengine.com/network-monitoring/what-is-snmp.html
3. https://fac.ksu.edu.sa/sites/default/files/02-standards-models-and-language.pdf
4. https://www.sciencedirect.com/topics/computer-science/network-management
5. https://www.sciencedirect.com/topics/computer-science/telecommunication-management-network

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)						Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3
CO1	2	3	2	1	-	-	1	-	2
CO2	3	3	3	2	1	-	2	1	3
CO3	3	3	3	3	3	-	3	3	3
CO4	3	3	3	3	2	-	3	2	3
CO5	3	3	3	2	1	-	2	1	3

Correlation Level: 1-Low, 2-Medium, 3-High

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	L	T	P	C	Hrs
P20CCT101 **RESEARCH METHODOLOGY AND IPR**	3	0	0	3	45

Course Objectives

- To understand some basic concepts of research and its methodologies
- To identify appropriate research topics
- To disseminate knowledge on patents, patent regime in India and abroad and registration aspects
- To disseminate knowledge on trademarks and registration aspects
- To aware about current trends in IPR and Govt. steps in fostering IPR

Course Outcomes

After completion of the course, the students will be able to

CO1 - Understand research problem formulation and analyse research related information. **(K2)**

CO2 - Understand that today's world is controlled by Computer, Information, but tomorrow world will be ruled by ideas, concept, and creativity. **(K2)**

CO3 - Adequate knowledge on patent and copyright for their innovative research works. **(K2)**

CO4 - Understand that IPR protection provides an incentive to inventors for further Intellectual Property Right to be promoted among students in general & engineering in particular. **(K2)**

CO5 - Understand and developing their idea or innovations. **(K2)**

UNIT I RESEARCH PROBLEM AND SCOPE FOR SOLUTION   (9 Hrs)

Meaning of research problem, Sources of research problem, Criteria Characteristics of a good research problem, Errors in selecting a research problem, Scope and objectives of research problem. Approaches of investigation of solutions for research problem, data collection, analysis, interpretation, Necessary instrumentations.

UNIT II FORMAT   (9 Hrs)

Effective literature studies approaches, analysis Plagiarism, Research ethics, Effective technical writing, how to write report, Paper Developing a Research Proposal, Format of research proposal, a presentation and assessment by a review committee

UNIT III PROCESS AND DEVELOPMENT   (9 Hrs)

Nature of Intellectual Property: Patents, Designs, Trade and Copyright. Process of Patenting and Development: technological research, innovation, patenting, development. International Scenario: International cooperation on Intellectual Property. Procedure for grants of patents, Patenting under PCT

UNIT IV PATENT RIGHTS   (9 Hrs)

Patent Rights: Scope of Patent Rights. Licensing and transfer of technology. Patent information and databases. Geographical Indications.   Unit 6: New Developments in IPR: Administration of Patent System. New developments in IPR; IPR of Biological Systems, Computer Software etc. Traditional knowledge Case Studies, IPR and IITs.

UNIT V NEW DEVELOPMENTS IN IPR   (9 Hrs)

New Developments in IPR: Administration of Patent System. New developments in IPR; IPR of Biological Systems, Computer Software etc. Traditional knowledge Case Studies, IPR and IITs.

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Text Books

1. Mousami V. Munot, Vinayak Bairagi "Research Methodology A Practical and Scientific Approach" CRC Press, 2019.
2. Nithyananda, K V. (2019). Intellectual Property Rights: Protection and Management. India, IN: Cengage Learning India Private Limited.

Reference Books

1. P.Neeraj and D Khusdeep, 'Intellectual Property Rights'. India, IN: PHI learning Private Limited, 2014.
2. World Intellectual Property Organization "Understanding Copyrights and Related Rights"WIPO 2016.
3. V KAhuja, 'Law relating to Intellectual Property Rights'. India, IN: Lexis Nexis, 2017.
4. Ranjit Kumar "Research Methodology A Step-by-Step Guide for Beginners" SAGE Publications 2018.
5. Dipankar Deb, Rajeeb Dey Valentina E. Balas, Engineering Research Methodology, Springer Singapore,2019.

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1. https://nptel.ac.in/courses/121/106/121106007/
2. https://nptel.ac.in/courses/107/108/107108011/
3. https://nptel.ac.in/courses/109/105/109105115/.
4. https://www.wipo.int/about-p/en/
5. https://www.ipindia.nic.in/

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)						Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3
CO1	2	1	1	2	1	1	2	1	2
CO2	2	1	2	3	1	1	2	2	3
CO3	3	1	2	2	1	1	2	2	3
CO4	2	1	2	3	1	1	3	3	3
CO5	3	2	3	3	1	1	2	2	3

Correlation Level: 1-Low, 2-Medium, 3-High

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P20NWP101	COMPUTER NETWORK PROTOCOL SIMULATION LAB	L	T	P	C	Hrs
		0	0	4	2	45

Course Objectives

- This course teaches an understanding of networks and systems design through hands-on construction and experimentation with real-world implementations

Course Outcomes

After completion of the course, the students will be able to

CO1 - Model network protocols with wireshark. **(K3)**

CO2 - Implement application layer and protocols. **(K3)**

CO3 - Implement routing layer and protocols. **(K3)**

CO4 - Design and analyses the performance of LAN and WAN **(K5)**

CO5 - Implement Socket programming in a network model. **(K3)**

LIST OF EXPERIMENTS

1. Familiarization of Wireshark.
2. Detailed Study of protocols in TCP/IP model using Wireshark.
3. Familiarization of following Linux/Unix network commands
    a. Ping
    b. traceroute
    c. arp
    d. route
    e. netstat
    f. About /etc folder
    g. IP Setting /Subnet Masking
4. Setting up Hostname/Setting local name resolution.
5. Deploy Web, Postgre SQL, Email, DNS, DHCP, SSH FTP, SAMBA and Proxy Servers. Deploy it using
    Virtual machines..
6. Build your own ISP. It should include a DNS, DHCP, Leased Line, PPP, Webserver, Internet.
7. Backbone with appropriate routing protocols. Experiment may be implemented using real systems/Simulators
8. Develop your own LAN with WAN for offshore connectivity. It should employ a firewall/proxy to redirect all external traffic. Use CIDR for forming departments. Experiment may be implemented using real systems/Simulators
9. Socket Programming Experiments on
    a. TCP Echo Server, TCP Echo Client
    b. UDP Echo server, UDP Echo Client
    c. File Server
    d. Broadcast, Multicast
    e. Simple Network Time Protocol
    f. TCP Iterative Server
    g. TCP Concurrent Server
10. Build client applications for major APIs (Amazon S3, Twitter etc) in Python
11. Develop an application that interacts with e-mail servers in python
12. Develop applications that work with remote servers using SSH, FTP etc in Python

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Reference Books

1. Bruce Hallberg, "Networking for Beginners", McGraw-Hill Education; 6th edition, 2013.
2. Gurdeep S. Hura, Mukesh Singhal, "Data and computer communications: Networking and Internetworking", CRC Press; 1st edition, 2010.
3. Engr Wilson Kurt ," Network Topology: The Physical and Logical Structure of a Network connection Between Model and nodes", Paperback – Import, December 2019.
4. Mike Meyers ," Managing and Troubleshooting Networks", Kindle Edition, Fourth Edition , 2015
5. BICSI ,"Network Design Basics for Cabling Professionals",1st Edition, McGraw-Hill Professional, April 2002)

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1. WALE SOYINKA, Linux Administration:A Beginner's Guide, Fifth Edition, McGraw-Hill
2. Tom Adelstein, Bill Lubanovic , Linux System Administration, O'Reilly
3. https://access.itxlearning.com/data/cmdata/NETPLUSN10004/Books/ec2_netplus004c03.pdf.
4. https://www.cisco.com/en/US/docs/switches/lan/catalyst3850/software/release/3se/consolidated_guide/b_consolidated_3850_3se_cg_chapter_0101000.html
5. https://www.geeksforgeeks.org/tcp-server-client-implementation-in-c/

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)						Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3
CO1	3	3	3	2	1	-	2	1	3
CO2	3	3	3	2	1	-	2	1	3
CO3	3	3	3	2	1	-	2	1	3
CO4	3	3	3	3	3	-	3	3	3
CO5	3	3	3	2	1	-	2	1	3

Correlation Level: 1-Low, 2-Medium, 3-High

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	L	T	P	C	Hrs

P20CCP101   TECHNICAL REPORT WRITING AND SEMINAR   L T P C Hrs
                                                          0 0 4 2 45

Course Objectives

- Selecting a topic based on interest
- Objective formulation
- To develop their scientific and technical reading and writing skills that they need to understand and construct research articles
- To obtain information from a variety of sources (i.e., Journals, dictionaries, reference books) and then place it in logically developed ideas
- Process in reading

Course Outcomes

After completion of the course, the students will be able to

CO1 - Selecting a subject, narrowing the subject into a topic **(K2)**
CO2 - Stating an objective and collecting the relevant bibliography (at least 15 journal papers) **(K2)**
CO3 - Studying the papers and understanding the author's contributions and critically analysing each paper. **(K2)**
CO4 - Preparing a working outline and linking the papers and preparing a draft of the paper **(K3)**
CO5 - Preparing conclusions based on the reading of all the papers and Writing the Final Paper and giving final Presentation **(K3)**

Activity	Instructions	Submission week	Evaluation
Selection of area of interest and Topic	Select an area of interest, topic and state an objective	2nd week	Based on clarity of thought, current relevance and clarity in writing
Stating an Objective			
Collecting Information about area & topic	1. List 1 Special Interest Groups or professional society 2. List 2 journals 3. List 2 conferences, symposia or workshops 4. List 1 thesis title 5. List 3 web presences (mailing lists, forums, news sites) 6. List 3 authors who publish regularly in your area 7. Attach a call for papers (CFP) from your area.	3rd week	The selected information must be area specific and of international and national standard
Collection of Journal papers in the topic in the context of the objective – collect 20 & then filter	• provide a complete list of references you will be using- Based on your objective -Search various digital libraries and Google Scholar • When picking papers to read - try to: - Pick papers that are related to each other in some ways and/or that are in the same field so that you can write a meaningful survey out of them. - Favour papers from well-	4th week	The list of standard papers and reason for selection

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	known journals and conferences,in the field (as indicated in other Favour more recent papers, - Pick a recent survey of the field so you can quickly gain an overview,Find relationships with respect to each other and to your topic area(classification scheme/categorization) - Mark in the hard copy of papers whether complete work or section/sections of the paper are being considered		
Reading and notes for first 5 papers	Reading Paper Process For each paper form a Table answering the following questions: • What is the main topic of the article? • What was/were the main issue(s) the author said they want to discuss? • Why did the author claim it was important? • What simplifying assumptions does the author claim to be making? • What did the author do? • How did the author claim they were going to evaluate their work and compare it to others? • What did the author say were the limitations of their research? • What did the author say were the important directions for future research? • Conclude with limitations/issues not addressed by the paper (from the perspective of survey)	6th week	The table given should indicate your understanding of the paper and the evaluation is based on your conclusions about each paper
Reading and notes for next 5 papers	Repeat Reading Paper Process	7th week	The table given should indicate your understanding of the paper and the evaluation is based on your conclusions about each paper
Draft outline 1 and Linking papers	Prepare a draft Outline, your survey goals, along with a classification / categorization diagram	8th week	This component will be evaluated based on the linking and classification among the papers

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Abstract	Prepare a draft abstract and give a presentation	9th week	Clarity, purpose and Conclusion Presentation & Viva Voce
Introduction Background	Write an introduction and background sections	10th week	clarity
Sections of the paper	Write the sections of your paper based on the classification / categorization diagram in keeping with the goals of your survey	11thweek	This component will be evaluated based on the linking and classification among the papers)
Conclusions	Write your conclusions and future work	12th week	Conclusions
Final Draft	Complete the final draft of your paper	13th week	formatting, English, Clarity and linking Plagiarism Check Report
Seminar	A brief 15 slides on your paper	14th & 15th week	Based on presentation and Viva-voce

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)						Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3
CO1	2	3	3	1	2	3	2	1	2
CO2	2	3	2	1	2	2	2	1	2
CO3	2	3	2	1	2	2	2	1	2
CO4	3	3	3	1	2	2	3	1	2
CO5	2	3	2	1	2	2	2	1	2

Correlation Level: 1-Low, 2-Medium, 3-High

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		L	T	P	C	Hrs
P20NWC1XX	**EMPLOYABILITY ENHANCEMENT COURSE - I**	0	0	4	-	50

Students shall choose an International certification course offered by the reputed organizations like Google, Microsoft, IBM, Texas Instruments, Bentley, Autodesk, Eplan and CISCO, etc. The duration of the course is 40-50 hours specified in the curriculum, which will be offered through Centre of Excellence.

Pass /Fail will be determined on the basis of participation, attendance, performance and completion of the course. If a candidate Fails, he/she has to repeat the course in the subsequent years. Pass in this course is mandatory for the award of degree.

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P20NWT204	CYBER SECURITY	L	T	P	C	Hrs
		3	0	0	3	45

Course Objectives

- To understand the basics of network topologies
- To learn the installation procedures of Computer networks
- To understand the designing o networks and challenges
- To learn the management of LAN and MAN network
- To learn the trouble shooting procedures in network

Course Outcomes

After completion of the course, the students will be able to

CO1 - Paraphrase the Network Components and Topologies. **(K2)**

CO2 - Apply various the installation procedures of Computer networks. **(K3)**

CO3 - Design networks and solve the challenges. **(K5)**

CO4 - Analyse the various management procedures of LAN and MAN network. **(K4)**

CO5 - Apply trouble shooting procedures in network. **(K3)**

UNIT I INTRODUCTION   (9 Hrs)

Introduction-Threat to information system-Threat Agents-Threat Motivation-Threat Intent-Information Assurance

UNIT II APPLICATION SECURITY   (9 Hrs)

Database Security-Email Security- Internet Security-Data Security Consideration- Security Technology-Intrusion Detection – Access Control

UNIT III SECURITY THREATS   (9 Hrs)

Introduction-Networks and Security Services attacks-Security threats to e-commerce

UNIT IV SECURE INFORMATION SYSTEMS   (9 Hrs)

Developing secure information systems-Key Elements- Development life cycle-Application Security – Information Security and Risk Management

UNIT V SECURITY ISSUES & POLICIES   (9 Hrs)

Hardware Supply chain Security-Hardware support for Software Security-Architectural support for Control Flow Security –Physical Security of IT assets and – Security Measures-Security Policies-Development-E-mail Security Policies-Corporate Policies-Template of Security policy

Text Books

1. Mayank Bhusan/Rajkumar Singh Rathore/Aatif Jamshed," Fundamental Of Cyber Security: Principles, Theory and Practices",BPB Publications, Second Edition , 2019
2. Erdal Ozkaya," Cyber Security- The Beginners Guide" ,PACKT – Pub , First Edition ,2019
3. Christopher Grow, Donald Short," Cyber Security Essentials" first edition, Wiley ,2019

Reference Books

1. Man Young Rhee, "Internet Security: Cryptographic Principles, Algorithms and Protocols", Wiley Publications, 2003.
2. Richard E.Smith, "Internet Cryptography", 3 rd Edition Pearson Education, 2008.
3. Joseph Steinberg,"Cyber Security for Dummies", Wiley , October 2019
4. Allan Friedman, P. W. Singer,"Cyber security and Cyber war" Oxford University Press,2014

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Web References

1. http://ebook.eqbal.ac.ir/Security/Forensics/Guide%20to%20Computer%20Forensics%20and%20Investigations.pdf.
2. http://cybersd.com/sec2/lect/Chapter%207.pdf
3. http://nptel.ac.in/courses/10610503
4. https://www.programmer-books.com/cyber-security-engineering-book-pdf/
5. http://www.uou.ac.in/sites/default/files/slm/Introduction-cyber-security.pdf

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)						Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3
CO1	2	3	2	1	-	-	1	-	2
CO2	3	3	3	2	1	-	2	1	3
CO3	3	3	3	3	3	-	3	3	3
CO4	3	3	3	3	2	-	3	2	3
CO5	3	3	3	2	1	-	2	1	3

Correlation Level: 1-Low, 2-Medium, 3-High

P20NWT205	NETWORK PERFORMANCE TUNING	L	T	P	C	Hrs
		3	0	0	3	45

- To understand the mathematical basis for analyzing the performance of networks.
- To understand queuing theory and queuing models.
- To analytically model traffic control protocols, and error control protocols using these concepts.
- To model performance of wired and wireless MAC such as 802.3, 802.11 and 802.16.
- To model network traffic and study the performance of different packet scheduling algorithms.

Course Outcomes

After completion of the course, the students will be able to

CO1 - Understand the mathematical basis for analyzing the performance of networks. **(K2)**
CO2 - Understand queuing theory and queuing models. **(K2)**
CO3 - Analytically model traffic control protocols, and error control protocols using these concepts. **(K3)**
CO4 - Model performance of wired and wireless MAC such as 802.3, 802.11 and 802.16. **(K3)**
CO5 - Model network traffic and study the performance of different packet scheduling algorithms. **(K3)**

UNIT I MARKOV CHAINS BASICS (9 Hrs)

Overview of Random Processes, Markov Chains – Markov matrices, State transition matrix, Markov chains at equilibrium – steady state distribution vector

UNIT II REDUCIBLE (9 Hrs)

Reducible Markov chain – Transition matrix, Reducible Composite Markov chain, Transient analysis, Steady state

UNIT III PERIODIC MARKOV CHAIN (9 Hrs)

Periodic Markov chain – Transition matrix, canonical form, strongly and weakly periodic Markov chains, Queuing Analysis –M/M/1 queues, M/M/1/B queues, D/M/1/B queues, performance, communicating Markov chains

UNIT IV TRAFFIC CONTROL, ERROR CONTROL AND MAC MODELING (9 Hrs)

Modeling traffic control protocols – Modeling leaky bucket and token bucket algorithms, Modeling Error control protocols - Stop and wait and GBN ARQ performance, Modeling media access control protocols – 802.1p, ALOHA, 802.3.

UNIT V MODELING PROTOCOLS (9 Hrs)

Modeling 802.11 protocol – Basic DCF modeling, RTS/CTS modeling, Modeling 802.11e, Performance, 802.11e HCCA Performance. Modeling 802.16 protocol – system and user performance.

Text Books

1. Anurag Kumar, D. Manjunath, Joy Kuri, "Communication Networking: An analytical Approach", Elsevier, 1st edition, 2004.
2. Bertsekas D and Gallager R, "Data Networks", 2nd Edition, Prentice-Hall, 1992.
3. Sunil Kumar, John D. Matyjas, Fei Hu" Wireless Network Performance Enhancement via Directional Antennas: Models, Protocols, and Systems"CRC Press , 2015

Reference Books

1. Fayez Gebali, "Analysis of computer networks", Springer, 2nd Edition, 2015.

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2. Harrison P G and Patel N M, "Performance Modelling of Communication Networks and Computer Architectures", Addison-Wesley, 1st edition, 1993.
3. Robertazzi T G, "Computer Networks and Systems: Queuing Theory and Performance Evaluation", 2nd, Edition, Springer-Verlag, 1994
4. Stênio Fernandes, "Performance Evaluation for Network Services, Systems and Protocols", Springer, 2017
5. Richard Blum," Network Performance Open Source Toolkit: Using Netperf, Tcptrace, NISTnet, and SSFNet, Wiley, 2003

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1. https://www.researchgate.net/publication/222662892_Markov_Chain_based_performance_analysis_of_multihop_IEEE_802154_wireless_networks
2. https://solutionsreview.com/network-monitoring/5-key-metrics-to-analyze-when-evaluating-network-performance
3. https://www.researchgate.net/publication/291739358_Study_on_network_performance_evaluation_method_based_on_measurement
4. https://web.cs.wpi.edu/~claypool/courses/533-S04/slides/intro.pdf
5. https://en.wikipedia.org/wiki/Network_performance

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)						Program Specific Outcomes (PSOs)		
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CO2	2	3	2	1	-	-	1	-	2
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CO4	3	3	3	2	1	-	2	1	3
CO5	3	3	3	2	1	-	2	1	3

Correlation Level: 1-Low, 2-Medium, 3-High

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P20NWT206	WIRELESS AND AD-HOC NETWORKING	L	T	P	C	Hrs
		3	0	0	3	45

Course Objectives
- Analyse the various design issues and challenges in the layered architecture of Ad hoc wireless networks
- Understand the design goals of MAC protocol
- Working knowledge of routing protocol used in adhoc wireless networks
- Understand the Security issues and challenges involved in adhoc wireless networks
- Explore various Energy management schemes.

Course Outcomes
After completion of the course, the students will be able to
CO1 - Compare the differences between cellular and ad hoc networks and analyse the challenges at various layers and applications. **(K2)**
CO2 - Summarize the protocols used at the MAC layer and scheduling mechanisms. **(K2)**
CO3 - Compare and analyse types of routing protocols used for unicast and multicast routing. **(K2)**
CO4 - Examine the network security solution and routing mechanism. **(K4)**
CO5 - Evaluate the energy management schemes and Quality of service solution in ad hoc networks. **(K4)**

UNIT I INTRODUCTION   (9 Hrs)
Cellular and ad hoc wireless networks- Applications of ad hoc wireless networks- Issues in ad hoc wireless networks-medium access scheme, routing, transport layer protocols, security and energy management. Adhoc wireless internet.

UNIT II MAC PROTOCOL   (9 Hrs)
Design goals of a MAC protocol- Contention based protocols- Contention based protocols with reservation mechanisms and scheduling mechanisms- MAC protocols using directional antennas.

UNIT III ROUTING PROTOCOLS   (9 Hrs)
Table driven routing protocols- On demand routing protocols- hybrid routing protocols- Hierarchical routing protocols- Power aware routing protocols- Tree based and mesh based multicast routing protocols.

UNIT IV SECURITY REQUIREMENTS   (9 Hrs)
Network security requirements-Issues and challenges- network security attacks- key management-secure routing protocols

UNIT V ENERGY MANAGEMENT SCHEMES   (9 Hrs)
Energy management schemes – battery management- transmission power management- system power management schemes. Quality of service solutions in ad hoc wireless networks.

Text Books
1. Siva ram murthy,B.S. Manoj, "Ad hoc wireless networks-Architectures and protocols" , Pearson Education, 3rd edition, 2014.
2. Stefano Basagni, Marco Conti, "Mobile ad hoc networking", Wiely inderscience, 3rd edition, 2013
3. S. Kami Makki, Xiang-Yang Li," Sensor and Ad-Hoc Networks: Theoretical and Algorithmic Aspects", Springer Science & Business Media, First edition -2010

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Reference Books

1. Xiuzhen Cheng, Xiao Huang ,Ding Zhu DU ,"Ad hoc wireless networking", Kluwer Academic Publishers, 1st edition,2004
2. George Aggelou,"Mobile ad hoc networks-From wireless LANs to 4G networks, McGraw Hill publishers, 3rd edition,2005
3. Charles E.Perkins ,"Ad hoc networking", Addison Wesley, 1st edition,2001
4. C. K. Toh "Wireless ATM and Ad-Hoc Networks: Protocols and Architectures" Springer US, 1997
5. Kia Makki, Niki Pissinou" Mobile and Wireless Internet: Protocols, Algorithms and Systems', Springer Science & Business Media, 2003

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1. https://www.dummies.com/computers/computer-networking/wireless/wireless-security-protocols-wep-wpa-and-wpa2/
2. https://www.sciencedirect.com/topics/computer-science/ad-hoc-wireless-network
3. https://searchmobilecomputing.techtarget.com/definition/ad-hoc-network
4. https://link.springer.com/chapter/10.1007/978-981-15-4451-4_3
5. https://www.youtube.com/watch?v=W9oCYSXkjr4

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)						Program Specific Outcomes (PSOs)		
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CO2	2	3	2	1	-	-	1	-	2
CO3	2	3	2	1	-	-	1	-	2
CO4	3	3	3	3	2	-	3	2	3
CO5	3	3	3	3	2	-	3	2	3

Correlation Level: 1-Low, 2-Medium, 3-High

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	L	T	P	C	Hrs
P20NWT207 **DATA SCIENCE FOR NETWORKS**	3	0	0	3	45

Course Objectives

- To understand the mathematical basis for analyzing the performance of networks.
- To understand queuing theory and queuing models.
- To analytically model traffic control protocols, and error control protocols using these concepts.
- To model performance of wired and wireless MAC such as 802.3, 802.11 and 802.16.
- To model network traffic and study the performance of different packet scheduling algorithms.

Course Outcomes

After completion of the course, the students will be able to

CO1 - Understand the mathematical basis for analyzing the performance of networks. **(K2)**
CO2 - Understand queuing theory and queuing models. **(K2)**
CO3 - Analytically model traffic control protocols, and error control protocols using these concepts. **(K3)**
CO4 - Model performance of wired and wireless MAC such as 802.3, 802.11 and 802.16. **(K3)**
CO5 - Model network traffic and study the performance of different packet scheduling algorithms. **(K3)**

UNIT I TOWARDS DATA SCIENCE AND NETWORKING (9 Hrs)

Introduction to Data science & Tool box for Data science - Machine learning - Basics, Regression, Classification and other Techniques - Supervised Learning

UNIT II APPROACHES FOR ANALYTICS AND DATA SCIENC (9 Hrs)

Model Building and Model Deployment -Analytics Methodology and Approach- Logical Models for Data Science and Data - Data analytics and Advanced data analytics

UNIT III ACCESSING DATA FROM NETWORK COMPONENTS (9 Hrs)

Planes of Operation on IT Networks -Data and the Planes of Operation - Methods of Networking Data Access-Data Types and Measurement Considerations -Data Transport Methods

UNIT IV MENTAL MODELS ,COGNITIVE BIAS AND THINKING TECHNIQUES (9 Hrs)

Changing How You Think - Domain Expertise - Mental Models and Intuition, Opening Your Mind to Cognitive Bias -Acting Like an Innovator and Mindfulness - Developing Analytics for Your Company

UNIT V ANALYTICS USE CASES & BUILDING USE CASES (9 Hrs)

Analytics Definitions - Designing Your Analytics Solutions - Using the Analytics Infrastructure Model - Operationalizing Solutions as Use Cases - Popular Analytics Use Cases - Steps of Setting Up an Environment to Do Own Analysis

Text Books

1. Anurag Kumar, D. Manjunath, Joy Kuri, "Communication Networking: An analytical Approach", Elsevier, 2nd edition,2014.
2. Bertsekas D and Gallager R, "Data Networks", 2nd Edition, Prentice-Hall, 1992.
3. Hadley Wickham, Garrett Grolemund," R for Data Science: Import, Tidy, Transform, Visualize, and Model Data" "O'Reilly Media, Inc.", 2016

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Reference Books

1. Fayez Gebali, "Analysis of computer networks", Springer, 2nd Edition, 2015.
2. Harrison P G and Patel N M, "Performance Modelling of Communication Networks and Computer Architectures", Addison-Wesley,1st edition, 1993.
3. Robertazzi T G, "Computer Networks and Systems: Queuing Theory and Performance Evaluation", 2nd, Edition, Springer-Verlag, 1994
4. Foster Provost, Tom Fawcett, Data Science for Business: What You Need to Know about Data Mining and Data-Analytic Thinking" edition 2 , O-Reily Media 2017
5. David L. Olson, Dursun Delen" Advanced Data Mining Techniques" Springer Science & Business Media, first edition , 2008

Web References

1. https://www.researchgate.net/publication/222662892_Markov_Chain_based_performance_analysis_ of_multihop_IEEE_802154_wireless_networks
2. www.simplilearn.com/pgp/data_scientist
3. https://www.cs.uic.edu/~elena/courses/fall17/cs594dsn.html
4. https://towardsdatascience.com/tagged/networking
5. https://www.oreilly.com/library/view/data-analytics-for/9780135183496/

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)						Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3
CO1	2	3	2	1	-	-	1	-	2
CO2	2	3	2	1	-	-	1	-	2
CO3	3	3	3	2	1	-	2	1	3
CO4	3	3	3	2	1	-	2	1	3
CO5	3	3	3	2	1	-	2	1	3

Correlation Level: 1-Low, 2-Medium, 3-High

		L	T	P	C	Hrs
P20NWP202	**DATA SCIENCE FOR NETWORKS LAB**	0	0	4	2	45

Course Objectives

- To examine the tools used in data science for networks
- To understand the data integrity and train the networks
- To apply the regression in the network
- To generate the different models for classification for networks
- To apply the decision tree and random tree in the networks.

Course Outcomes

After completion of the course, the students will be able to

CO1 – Examine the tools uses in Data science.**(K4)**

CO2 - Implement the data integrity and train the network.**(K3)**

CO3 - Implement the regression in the network. **(K3)**

CO4 – Generate the model for classification. **(K5)**

CO5 - Implement the decision tree and random tree. **(K3)**

LIST OF EXPERIMENTS

1. Examining anaconda and getting familiar with python
2. Loading casestudy data in Jupiter notebook and performing data cleaning
3. Verifying data integrity
4. Exploring credit limit and and demographic features
5. Implementing OHE for a categorical feature Scikit
6. Generating synthetic data and performing linear regression in sci learn kit
7. Calculating true and false positive rate and negative rates and confusion matrix in python
8. Obtaining predicted probabilities from a trained logistic regression
9. F-Test and Uninvariate feature function
10. Visualizing the variations between features and response
11. Plotting sigmoid function
12. Examining the appropriateness of features for logistics regression
13. Linear Decision boundary of logistic regression
14. Using gradient Descent to minimize a cost function
15. Generating and modelling synthetic classification data L1 and L2
16. Reducing over fitting on synthetic data classification problem
17. Decision tree in scikit learn
18. Finding optimal Hyper parameters for a decision tree
19. Fitting a random tree
20. Review the modelling results

Reference Books

1. Stephen Klosterman" Data Science Projects with Python: A case study approach to successful data science projects using Python, pandas, and scikit-learn Packt Publishing Ltd, 30-Apr-2019
2. Fayez Gebali, "Analysis of computer networks", Springer, 2nd Edition, 2015.
3. Harrison P G and Patel N M, "Performance Modelling of Communication Networks and Computer Architectures", Addison-Wesley,1st edition, 1993.
4. Robertazzi T G, "Computer Networks and Systems: Queuing Theory and Performance Evaluation", 2nd, Edition, Springer-Verlag, 1994
5. Foster Provost, Tom Fawcett, Data Science for Business: What You Need to Know about Data Mining and Data-Analytic Thinking" edition 2 , O-Reily Media 2017

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Web References

1. https://www.researchgate.net/publication/222662892_Markov_Chain_based_performance_analysis_ of_multihop_IEEE_802154_wireless_networks
2. www.simplilearn.com/pgp/data_scientist
3. https://www.cs.uic.edu/~elena/courses/fall17/cs594dsn.html
4. https://towardsdatascience.com/tagged/networking
5. https://www.oreilly.com/library/view/data-analytics-for/9780135183496/

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CO4	3	3	3	3	3	-	3	3	3
CO5	3	3	3	2	1	-	2	1	3

Correlation Level: 1-Low, 2-Medium, 3-High

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Academic curriculum and syllabi R-2020

	L	T	P	C	Hrs

P20CCP202   **SEMINATR ON ICT:A HANDS- ON APPROACH**   0   0   4   2   45

The methodology used is "learning by doing", a hands-on approach, enabling the students to follow their own pace. The teacher, after explaining the project, became a tutor, answering questions and helping students on their learning experience.

ICT skills
- Understand ICT workflow in cloud computing.
- Manage multitasking.
- Deal with main issues using technology in class.
- Record, edit and deliver audio and video.
- Automate assessments and results.

Scope
- Perspective in order to design activities in class.
- Understand the process of creating audiovisuals.

Teaching Tools
- Different ways to create audiovisual activities.
- Handle audiovisual editors.
- Collaborative working.
- Development of product models using 3D Printing
- Individualize learning experience.
- Get instant feedback from students.

Regulation
Each one of the students will be assigned an ICT Topic and the student has to conduct a detailed study on the assigned topic and prepare a report, running to 30 or 40 pages for which a demo to be performed followed by a brief question and answer session. The demo will be evaluated by the internal assessment committee (comprising of the Head of the Department and two faculty members) for a total of 100 marks.

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P20NWC2XX	EMPLOYABILITY ENHANCEMENT COURSE - II	L	T	P	C	Hrs
		0	0	4	-	50

Students shall choose an International certification course offered by the reputed organizations like Google, Microsoft, IBM, Texas Instruments, Bentley, Autodesk, Eplan and CISCO, etc. The duration of the course is 40-50 hours specified in the curriculum, which will be offered through Centre of Excellence.

Pass /Fail will be determined on the basis of participation, attendance, performance and completion of the course. If a candidate Fails, he/she has to repeat the course in the subsequent years. Pass in this course is mandatory for the award of degree.

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		L	T	P	C	Hrs
P20NWW301	**PROJECT PHASE - I**	0	0	12	6	75

Aim & Objective:

The project work aims to develop the work practice and to apply theoretical and practical tools/techniques for solving real life problems related to industry and current research. The objective of the project work is to improve the professional competency and research attitude by touching the areas which are not covered in theory or laboratory classes.

- The project work shall be a design project/experimental project and/or computer simulation project on any of the topic in manufacturing engineering or related field.
- The project work shall be allotted individually on different topics.
- The students shall be encouraged to do their project work in the parent institute itself. In exceptional cases the students shall be permitted to undertake continue their project outside the parent institute with appropriate permission from Head of the institution through the Project Coordinator.
- Department shall constitute an Evaluation Committee to review the project work.
- The Evaluation committee shall consist of at least three faculty members namely internal guide, project coordinator and another expert in the specified area of the project.

The student is required to undertake the project phase I during the third semester and the same shall be continued in the 4th semester (Phase II). Phase I consist of preliminary thesis work, Three reviews of the work and the submission of preliminary report. First review shall highlight the topic, objectives and origin of problem, second review shall highlight, Literature survey, methodology and expected results. Third review shall evaluate the progress of the work, preliminary report and scope of the work which shall be completed in the 4th semester. The award of marks for internal / external evaluation shall be as follows

Sl. No	Description			Weightage
1	**Internal Evaluation Mode (Continuous Assessment Marks)**			
a	Review 1	Review Committee[#]	10	15
		Guide	5	
b	Review 2	Review Committee[#]	10	15
		Guide	5	
c	Review 3	Review Committee[#]	15	20
		Guide	5	
		Total CAM		50
2	**External Evaluation Mode (End Semester Marks)**			
a	Evaluation of Phase I report and Viva-voce	Internal Examiner	25	50
		External Examiner	25	
		Total ESM		50
		Total Marks		100

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P20NWW302	` INTERNSHIP	L	T	P	C	Hrs
		0	0	0	2	-

Students should undergo training or internship during summer / winter vacation at Industry/ Research organization / University (after due approval from the Programme Academic Coordinator and Department Consultative Committee (DCC). In such cases, the internship/training should be undergone continuously (without break) in one organization. Normally no extension of time is allowed. However, DCC may provide relaxation based on the exceptional case. The students are allowed to undergo three to four weeks internship in established industry / Esteemed institution during vacation period. The student should give presentation and submit report to DCC. The Internship is assessed internally for 100 marks.

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P20NWW301	` NPTEL/GIAN/MOOC	L	T	P	C	Hrs
		0	0	0	0	-

Student should register online courses like MOOC / SWAYAM / NPTEL etc. approved by the Department committee comprising of HoD, Programme Academic Coordinator and Subject Experts. Students have to complete relevant online courses successfully. The list of online courses is to be approved by Academic Council on the recommendation of HoD at the beginning of the semester if necessary, subject to ratification in the next Academic council meeting. The Committee will monitor the progress of the student and recommend the grade (100% Continuous Assessment pattern) based on the marks secured in online examinations. The marks attained for this course is not considered for CGPA calculation.

P20NWW403   **PROJECT PHASE - II** | L | T | P | C | Hrs |
|---|---|---|---|---|
| 0 | 0 | 24 | 12 | 75 |

Project phase II is a continuation of project phase I which started in the third semester. There shall be three reviews in the fourth semester, first in the beginning of the semester, second in the middle of the semester and the Third at the end of the semester. First review is to evaluate the progress of the work and planned activity; second review shall be presentation and discussion. Third review shall be a pre-submission presentation before the evaluation committee to assess the quality and quantity of the work done. This would be a pre qualifying exercise for the students for getting approval for the submission of the thesis. At least one technical paper shall be prepared for possible publication in journals or conferences. The technical paper shall be submitted along with the thesis. The final evaluation of the project shall be done externally.

Sl. No	Description			Weightage
1	**Internal Evaluation Mode (Continuous Assessment Marks)**			
a	Review 1	Review Committee[#]	10	15
		Guide	5	
b	Review 2	Review Committee[#]	10	15
		Guide	5	
c	Review 3	Review Committee[#]	15	20
		Guide	5	
			Total CAM	50
2	**External Evaluation Mode (End Semester Marks)**			
a	Evaluation of Phase II report and Viva-voce	Internal Examiner	20	40
		External Examiner	20	
b	Outcome*	Publication of papers /prototypes /patents etc	10	10
			Total ESM	50
			Total Marks	100

M.Tech. Networking

| P20NWE101 | MULTIMEDIA COMMUNICATION NETWORKS | L 3 | T 0 | P 0 | C 3 | Hrs 45 |

Course Objectives
- To learn the concepts of Multimedia and Multimedia networks
- To be familiar with various information representations
- To expose with the text and image compression
- To expose with audio and video compression
- To learn how multimedia communication across networks

Course Outcomes
After completion of the course, the students will be able to
CO1 - Understand the basics of Multimedia Communications. **(K2)**
CO2 - Analyze the various Information Representation methods. **(K4)**
CO3 - Analyze and compare the performance of Text and image compression algorithms. **(K4)**
CO4 - Analyze and compare the performance of Audio and video compression algorithms. **(K4)**
CO5 - Demonstrate the basics of audio and video compression techniques across Networks. **(K3)**

UNIT I MULTIMEDIA COMMUNICATIONS   (9 Hrs)
Introduction - Multimedia information representation - multimedia networks - multimedia applications - Application and networking terminology.

UNIT II INFORMATION REPRESENTATION   (9 Hrs)
Introduction - Digitization principles – Text – Images - Audio and Video

UNIT III TEXT AND IMAGE COMPRESSION   (9 Hrs)
Introduction - Compression principles - text compression - image Compression. **Distributed multimedia systems:** Introduction - main Features of a DMS - Resource management of DMS – Networking - Multimedia operating systems

UNIT IV AUDIO AND VIDEO COMPRESSION   (9 Hrs)
Introduction - Audio compression - video compression - video compression principles.

UNIT V MULTIMEDIA TRANSPORT   (9 Hrs)
Packet audio/video in the network environment - Video transport across generic networks - Multimedia Transport across ATM Networks

Text books
1. Mihaela van der Schaar, And Philip Chou, "Multimedia over IP and Wireless Networks: Compression, networking, and Systems", Academic Press, 2007.
2. Ming-Ting Sun, Amy R. Reibman "Compressed Video over Networks", Marcel Dekker Switzerland, 2000
3. Mario Marques da Silva "Multimedia Communications and Networking". CRC Press, 2012

Reference Books
1. Mohammed Ghanbari "Standard Codecs: Image Communication to Advanced Video coding", Special Issue on Advances in Video Coding & Delivery of Proceedings of the IEEE 2005
2. Yao Wang, JoernOstermann, and Ya-Qin Zhang,"Video Processing and Communications", Prentice Hall, 2010.
3. K. R. Rao ,Zoran S. Bojkovic,Dragorad A. Milovanovic "Introduction to Multimedia Communications: Applications, Middleware, Networking",John Wiley & Sons, Inc. 2006
4. Fred Halsall "Multimedia Communications: Applications, Networks, Protocols and Standards" pearson edition 2002
5. Charles Proteus Steinmetz," Multimedia: Computing Communications & Applications ", Pearson edition 2

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Web references

1. https://www.classcentral.com/course/multimedia_communication
2. https://www.sciencedirect.com/topics/computer-science/multimedia-communication
3. https://www.cse.wustl.edu/~jain/refs/mul_refs.htm
4. https://www.slideshare.net/Ilyasmalik418/multimedia-communication-networks
5. https://link.springer.com/article/10.1007/s11042-010-0578-z

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CO4	3	3	3	3	2	-	3	2	3
CO5	3	3	3	2	1	-	2	1	3

Correlation Level: 1-Low, 2-Medium, 3-High

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P20NWE102	NEXT GENERATION NETWORKS	L	T	P	C	Hrs
		3	0	0	3	45

Course Objectives

- To learn the basic concepts of Mobile computing architecture and wireless network architecture
- To expose with the concepts of wireless network and technologies such as RFID, Adhoc networks ,GSM and its security
- To grasp GPRS architecture, services , Applications and how it is charged
- To explore ad-hoc network System Architecture and IEEE 802.standards
- To learn WAP and mobile security in networks

Course Outcomes

After completion of the course, the students will be able to

CO1 - Explain the basics of Mobile Computing Architecture. **(K2)**
CO2 - Explore the working principles of wireless networks. **(K2)**
CO3 - Analyze the working and performance of GPRS. **(K4)**
CO4 - Compare the performance of IEEE 802 standards. **(K2)**
CO5 - Demonstrate the concepts of WAP and security in mobile computing. **(K3)**

UNIT I INTRODUCTION (9 Hrs)

Basic history of Mobile Computing Architecture for mobile computing - Three tier architecture - design considerations for mobile computing - mobile computing through internet - Wireless network architecture - Applications – Security - Concerns and Standards – Benefits - Future - Evolution of mobile computing.

UNIT II OVERVIEW OF WIRELESS NETWORKS AND TECHNOLOGIES (9 Hrs)

Introduction - Different generations - Introduction to 1G, 2G, 3G and 4G – Bluetooth - Radio frequency identification(Rfid) - Wireless Broadband - Mobile IP: Introduction - Advertisement – Registration - TCP connections - two level addressing - abstract mobility management model - performance issue - routing in mobile host - Adhoc networks .Mobile transport layer: Indirect TCP, Snooping TCP - Mobile TCP - Time out freezing - Selective retransmission - transaction oriented TCP - IPv6 Wireless network topologies - Cell fundamentals and topologies - Global system for mobile communication - Global system for mobile communication - GSM architecture -GSM entities - call routing in GSM - PLMN interface - GSM addresses and identifiers - network aspects in GSM - GSM frequency allocation - authentication and security - Short message services - Mobile computing over SMS - value added services through SMS - accessing the SMS bearer - Security in wireless networks.

UNIT III GENERAL PACKET RADIO SERVICE (GPRS) (9 Hrs)

GPRS and packet data network - GPRS network architecture - GPRS network operation - data services in GPRS - Applications of GPRS - Billing and charging in GPRS.

UNIT IV AD-HOC NETWORK SYSTEM (9 Hrs)

Infrastructure and ad-hoc network System Architecture - Protocol Architecture - Medium Access Control layer - MAC Management - Wireless LAN advantages - IEEE 802.11a - 802.11b standards - Wireless LAN architecture - Mobility in Wireless LAN - Deploying Wireless LAN - Mobile ad hoc networks and sensor networks - wireless LAN security

UNIT V WIRELESS PROTOCOLS (9 Hrs)

Wireless Application Protocol(WAP) - MMS, GPRS application CDMA and 3G Spread-spectrum Technology-FHSS, DSSS, CDMA versus GSM - Wireless data - third generation networks - applications in 3G Wireless LAN - WiFi v/s 3G Voice over Internet protocol and convergence - Voice over IP - H.323 framework for voice over IP – SIP - comparison between H.323 ad SIP - Real time protocols - convergence technologies - call routing - call routing - voice over IP applications – IMS - Mobile VoIP - Security issues in mobile Information security - security techniques and algorithms - security framework for mobile environment.

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Text Books

1. ITI SahaMisra," Wireless Communications and Networks, 3G and beyond", TMH, 2017
2. KavehPahlavan and Prashant Krishnamurthy "Principle of wireless Networks" , Pearson 2002
3. Neill Wilkinson ," Next Generation Network Services: Technologies & Strategies ",Wiley publications, 2017

Reference Books

1. Asoke K Telukder, Roopa R Yavagal ,"Mobile Computing" , TMH 8th reprint,2008
2. Jochen Schiller ,Mobile Communications, , Pearson, 2005
3. Jason Edelman , "Network Programmability and Automation: Skills for the Next-Generation Network Engineer " ,Scott Lowe, et al. ,Oriley, March 2018
4. Jingming Li Salina, Pascal Salina ," Next Generation Networks: Perspectives and Potentials,"John Wiley & Sons,2008
5. Kartalopoulos, Stamatios ," Next Generation Intelligent Optical Networks,Springer publication,2008

Web References

1. https://www.w3.org/2004/08/ws-cc/abwspcrn-20040902
2. https://freevideolectures.com/course/nextgeneration_networks
3. https://www.sciencedirect.com/topics/engineering/next-generation-networks
4. https://www.ericsson.com/en/reports-and-papers/ericsson-technology-review/articles
5. https://onlinelibrary.wiley.com/doi/book/10.1002/0470858567

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CO4	2	3	2	1	-	-	1	-	2
CO5	3	3	3	2	1	-	2	1	3

Correlation Level: 1-Low, 2-Medium, 3-High

M.Tech. Networking

P20NWE103	SOFTWARE DEFINED NETWORKS	L	T	P	C	Hrs
		3	0	0	3	45

Course Objectives
- To understand the basis of network protocol and architecture
- To expose with Routing and Traffic analysis in network
- To learn network planning and security
- To explore internet addressing and IEEE 802 standards
- To understand wireless security and network management

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

CO1 - Understand the basics of network protocols and architecture. **(K2)**

CO2 - Analyze the performance of Network routing and traffic management algorithms. **(K4)**

CO3 - Understand the Wireless network techniques, Ad hoc network. **(K2)**

CO4 - Analyze network addressing and 802 standards. **(K4)**

CO5 - **Analyze various** Internet security and network management protocols. **(K4)**

UNIT I INTRODUCTION (9 Hrs)

Introduction – Protocols and Architecture – TCP and IP – High Speed Networks – Frame relay- ATM – High Speed LANs Performance modeling and estimation – Queuing analysis – self similarity and self similar traffic.

UNIT II INTERNET PROTOCOL (9Hrs)
Connectionless Datagram Delivery- Forwarding IP Datagrams-IPV4 data grams -Packet format – Routing Architecture –Core, Peers and Algorithms Routing between peers-Routing within Autonomous systems-Routing Information Protocol- RIP-OSPF.Congestion control in data networks and internets – Link level flow and error control – TCP traffic control – Traffic and Congestion control in ATM Networks – Internet routing – graph theory and least cost paths –Interior routing protocols.

UNIT III NETWORK PLANNING (9 Hrs)
Network planning – topologies – fundamentals – signal to interference ratio calculation – capacity expansion techniques – network planning for CDMA systems – Wireless network operations – mobility – radio resources and power management – security.

UNIT IV PROTOCOLS (9 Hrs)
Internet Addresses- Subnetting and Supernetting- ARP- ARP Packet format, Encapsulation & operation- ARP over ATM- Proxy ARP- RARP-ICMP –ICMP message types. Introduction WLANs – IEEE 802.11 WLANs – Wireless ATM and HIPERLAN – Adhoc Networking and WPAN – Wireless Geo location systems architecture

UNIT V SECURITY (9 Hrs)
IPSec- Authentication Header-Encapsulating security payload – Secure sockets-Secure Socket Layer (SSL) - Firewalls and Internet access- Packet filter firewall- Proxy firewall- IPv6-Features and packet format-IPV6 Source routing types- Comparison between IPV4 and IPV6.Network Management – Choosing a configuration method – Management Information Base – SNMP – XML – choosing a configuration protocol – COPS Advanced Applications – IP encapsulation – VPNs – Mobile IP – Header Compression – Voice over IP – IP and ATM IP over dial-up links.

Text Books
1. Paresh Shah, Syed Farrukh Hassan, RajendraChayapathi "Network Function virtualization with a touch of SDN ",Addison Wesley ,2017
2. Paul Goransson Chuck Black, "Software Defined Networks A Comprehensive Approach", Margon Kaufmann, 1st Edition , 2016
3. Paul Goransson ,Chuck Black "Software Defined Networks: A Comprehensive Approach," Kindle edition, Morgan Kaufmann publisher 2nd edition 2016

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Reference Books

1. William Stallings, "Foundations of Modern Networking: SDN, NFV, QoE, IoT, and Cloud", Addison-Wesley, 2015.
2. Jim Doherty "SDN and NFV Simplified: A Visual Guide to Understanding Software Defined Networks and Network Function Virtualization" Addison Wesley, 1st Edition, 2016.
3. Oswald Coker , Siamak Azodolmolky ,"Software-Defined Networking with OpenFlow", Packt Publishing; 2nd edition ,2017
4. Kshira Sagar Sahoo , Bibhudatta Sahoo , Brojo Kishore Mishra , "Software-Defined Networking for Future Internet Technology: Concepts and Applications ",Apple Academic Press; 1st edition 2020
5. Siamak Azodolmolky , "Software Defined Networking with OpenFlow ", Packt Publishing Limited 2013

Web References

1. https://www.sciencedirect.com/topics/engineering/network-virtualization
2. https://freevideolectures.com/course/nextgeneration_networks
3. https://www.ibm.com/services/network/software-defined-networks
4. https://www.hamburgnet.com/de/products/ethernet/cumulus-networks
5. https://opennetworking.org/sdn-definition/

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M.Tech. Networking

P20NWE104	NETWORK SYSTEM MODELLING AND SIMULATION	L	T	P	C	Hrs
		3	0	0	3	45

Course Objectives

- To understand how simulators are built.
- To learn different ways of generating random numbers
- To understand the statistical models used in simulations.
- To learn modeling of the data given as input to simulators
- To understand how computer networks are simulated using case studies.

Course Outcomes

After completion of the course, the students will be able to
CO1: Understand the modeling and development of simulations and simulators. **(K2)**
CO2: Differentiate different ways of generating random numbers. **(K2)**
CO3: Differentiate the different ways in which simulators are designed. **(K2)**
CO4: Analyze how computer networks are simulated. **(K4)**
CO5: Analyze the features of different simulators. **(K4)**

UNIT I NETWORK MODELLING   (9 Hrs)

Statistical models – Discrete, continuous and empirical distributions – Characteristics of Queuing systems – Measures of performance of queuing systems – Markovian models.

UNIT II RANDOM NUMBERS   (9 Hrs)

Properties of random numbers – Generating uniform random numbers – Generating non-uniform random numbers - Tests for random numbers – Random-variate generation

UNIT III INPUT MODELLING   (9 Hrs)

Input modeling – Identifying the distribution – Parameter estimation – Goodness-of-fit tests –Multivariate and time-series input models – Verification and validation of simulation models

UNIT IV PERFORMANCE MODELLING   (9 Hrs)

Introduction – Performance modeling – Modeling Techniques – Protocol modeling – Workload modeling – Network Topology modeling – Performance metrics in computer network simulation –Validation and verification – Discrete event simulation – GPU-based simulations – Multi-agent-based simulations –Network simulator

UNIT V SIMULATION PLATFORMS   (9 Hrs)

NS-3 based Simulative Platform - Evolved packet system – Differentiated services domain – ns-3simulator – Simulation techniques for next generation wireless heterogeneous networks - Features of common network simulators - OpNet, mininet.

Text Books

1. Mohammad S. Obaidat, PetrosNicopolitidis, FaouziZarai,"Modeling and Simulation of Computer Networks and Systems - Methodologies and Applications", Morgan Kaufmann, 2015.
2. Sheldon M. Ross," Simulation", Elsevier, Fifth Edition, 2013
3. Andreas Pyka , Andrea Scharnhorst ," Innovation Networks: New Approaches in Modelling and Analyzing (Understanding Complex Systems)", Springer; 1st ed. 2009 edition

Reference Books

1. J. B. Sinclair," Simulation of Computer Systems and Computer Networks: A Process-Oriented Approach", Cambridge University Press, 2020.
2. Jerry Banks, John S. Carson, Barry L. Nelson, David M. Nicol, "Discrete-event System Simulation", Fifth Edition, Pearson, 2010.
3. Law, Averill," Simulation Modeling and Analysis with Expert Software", McGraw Hill, 4th edition,2006
4. Sanjay K. Bose," An Introduction to Queueing Systems (Network and Systems Management) ", Springer; 2001 2nd edition
5. Vito Latora , Vincenzo Nicosia , Giovanni Russo ," Complex Networks: Principles, Methods and Applications",Cambridge University Press; 1st edition 2017

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3. https://www.oreilly.com › library › view › modeling-and-simulation
4. https://www.dl.acm.org ›
5. https://omnest.com/netsim-references

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)						Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3
CO1	2	3	2	1	-	-	1	-	2
CO2	2	3	2	1	-	-	1	-	2
CO3	2	3	2	1	-	-	1	-	2
CO4	3	3	3	3	2	-	3	2	3
CO5	3	3	3	3	2	-	3	2	3

Correlation Level: 1-Low, 2-Medium, 3-High

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P20NWE105	DISTRIBUTED AND CLOUD COMPUTING	L	T	P	C	Hrs
		3	0	0	3	45

Course Objectives

- To understand Distributed Systems.
- To be familiar with Distributed Deadlock Detection
- To study cloud computing
- To expose with Cloud Computing Technology and applications
- To understand cloud services

Course Outcomes

After completion of the course, the students will be able to

CO1 - Understand the basic concepts of Distributed Systems. **(K2)**
CO2 - Explain the Distributed Deadlock Detection. **(K2)**
CO3 - Understand the cloud computing. **(K2)**
CO4 - Understand the Cloud Computing Technology and applications. **(K2)**
CO5 - Analyze the various cloud services. **(K2)**

UNIT I DISTRIBUTED SYSTEMS   (9 Hrs)

Characterization of Distributed Systems: Introduction - Examples - Issues - System Models: Architectural models - fundamental Models -Limitation of Distributed system - Global clock - Shared memory - Logical clocks - Lampors & vectors logical clocks - global state - Termination detection - Distributed Mutual Exclusion: Classification of distributed mutual exclusion - Requirement of mutual exclusion theorem - Token based and non token based algorithms - Performance metric for distributed mutual exclusion algorithms.

UNIT II DISTRIBUTED DEADLOCK DETECTION   (9 Hrs)

Distributed Deadlock Detection : Resource Vs communication deadlocks - deadlock prevention - avoidance - detection & resolution - centralized dead lock detection - distributed dead lock detection - path pushing algorithms - edge chasing algorithms - Agreement Protocols: Introduction - System models, classification of Agreement Problem - Interactive consistency Problem - Applications of Agreement algorithms.

UNIT III CLOUD COMPUTING   (9 Hrs)

Introduction - Shift from distributed computing to cloud computing - principles and characteristics of cloud computing - IaaS, PaaS, SaaS - service oriented computing and cloud environment

UNIT IV CLOUD COMPUTING TECHNOLOGY AND APPLICATIONS   (9 Hrs)

Cloud Computing Technology - Client systems, Networks, server systems and security from services perspectives; Accessing the cloud with platforms and applications - cloud storage

UNIT V CLOUD SERVICES   (9 Hrs)

Working with Cloud- Infrastructure as a Service – conceptual model and working- Platform as a Service – conceptual model and functionalities Software as a Service – conceptual model and working Technologies and Trends in Service provisioning with clouds

Text books

1. Mukesh Singhal & Niranjan G Shivaratri ,"Advanced Concepts in Operating Systems",,Tata McGraw Hill,2001.
2. Coulouris, Dollimore, Kindberg, "Distributed System: Concepts and Design", Pearson Education ,2006
3. Kai Hwang, Geoffery C.Fox, Jack J.Dongarra ,"Distributed and Cloud Computing" , Elsevier, 2012

Reference Books

1. Anthony T.Velte, Toby J.Velte and Robert E, "Cloud Computing – A Practical Approach", TMH , 2010
2. Michael Miller, "Cloud Computing – Web based Applications", Pearson Publishing, 2011
3. John W. Rittinghouse, James F.Ransome ,"Cloud Computing: Implementation, Management and Security" , CRC Press, ,2012.

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4. Rajiv Misra , Yashwant Singh Patel ,"Cloud and Distributed Computing: Algorithms and Systems",Wiley publications 2020.
5. Thomas Erl , Ricardo Puttini , Zaigham Mahmood ," Cloud Computing: Concepts, Technology & Architecture ",Prentice Hall Service press 2013

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3. https://www.cyrusone.com/connectivity
4. https://www.adn.de/cloud/computing
5. https://www.oreilly.com › library › view › distributed-and-cloud

COs/POs/PSOs Mapping

	Program Outcomes (POs)						Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3
CO1	2	3	2	1	-	-	1	-	2
CO2	2	3	2	1	-	-	1	-	2
CO3	2	3	2	1	-	-	1	-	2
CO4	2	3	2	1	-	-	1	-	2
CO5	3	3	3	3	1	-	3	1	3

Correlation Level: 1-Low, 2-Medium, 3-High

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P20NWE206	GRAPH THEORY	L	T	P	C	Hrs
		3	0	0	3	45

Course Objectives
- To understand fundamentals of graph theory.
- To be familiar with various information and representations of Trees
- To study proof techniques related to various concepts in graphs.
- To expose with Matrix for graph
- To explore modern applications of graph theory.

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

CO1 - Understand the basic concepts of graphs, and different types of graphs. **(K2)**
CO2 - Explain the various Information Representation of Trees. **(K2)**
CO3 - Understand the properties, theorems and be able to prove theorems. **(K2)**
CO4 - Understand the concepts matrix for graph. **(K3)**
CO5 - Apply suitable graph model and algorithm for solving applications. **(K3)**

UNIT I INTRODUCTION TO GRAPH (9 Hrs)
Introduction - Graph Terminologies - Types of Graphs - Sub Graph- Multi Graph - Regular Graph - Isomorphism - Isomorphic Graphs - Sub-graph - Euler graph - Hamiltonian Graph - Related Theorems

UNIT II TREES (9 Hrs)
Trees -Properties- Distance and Centres - Types - Rooted Tree-- Tree Enumeration- Labeled Tree - Unlabeled Tree - Spanning Tree - Fundamental Circuits- Cut Sets - Properties - Fundamental Circuit and Cut-set- Connectivity- Separability -Related Theorems

UNIT III GRAPH (9 Hrs)
Network Flows - Planar Graph - Representation - Detection - Dual Graph - Geometric and Combinatorial Dual - Related Theorems - Digraph - Properties - Euler Digraph.

UNIT IV MATRIX FOR GRAPH (9 Hrs)
Matrix Representation - Adjacency matrix- Incidence matrix- Circuit matrix - Cut-set matrix - Path Matrix- Properties - Related Theorems - Correlations. Graph Coloring - Chromatic Polynomial - Chromatic Partitioning - Matching - Covering - Related Theorems.

UNIT V GRAPH ALGORITHMS (9 Hrs)
Graph Algorithms- Connectedness and Components- Spanning Tree - Fundamental Circuits- Cut Vertices- Directed Circuits- Shortest Path - Applications overview.

Text books
1. Narsingh Deo, "Graph Theory with Application to Engineering and Computer Science", Prentice-Hall of India Pvt.Ltd, 2003.
2. L.R.Foulds , "Graph Theory Applications", Springer ,2016.
3. Jonathan L. Gross, Jay Yellen , Ping Zhang, "Handbook of Graph Theory ", 2nd Edition, Chapman and Hall/CRC, December 2013.

Reference books
1. Bondy, J. A. and Murty, U.S.R., "Graph Theory with Applications", North Holland Publication,2008.
2. West, D. B.,"Introduction to Graph Theory", Pearson Education, 2011.
3. John Clark, Derek Allan Holton, "A First Look at Graph Theory", World Scientific Publishing Company, 1991.
4. Diestel, R, "Graph Theory", Springer,3rd Edition,2006.
5. Kenneth H.Rosen, "Discrete Mathematics and Its Applications", Mc Graw Hill , 2007.

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2. https://mathworld.wolfram.com/WebGraph.
3. https://www.sciencedirect.com/science/article/abs/pii/S0305054805000080
4. https://www.sciencedirect.com/topics/computer-science/spanning-tree
5. https://www.researchgate.net/publication/325831355_Euler_Digraphs

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)						Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3
CO1	2	3	2	1	-		1	-	2
CO2	3	3	3	1	-		1	-	3
CO3	3	3	3	1	-		1	-	3
CO4	3	3	3	1	-		1	-	3
CO5	3	2	3	2	1		2	1	3

Correlation Level: 1-Low, 2-Medium, 3-High

P20NWE207	ROBOTICS PROCESS AUTOMATION	L	T	P	C	Hrs
		3	0	0	3	45

Course Objectives

- To understand the role of the Artificial Intelligence in Automation
- To learn the evolution and future of Robotic Process Automation
- To Learn Web, Windows, Email, Excel, PDF, Database, API and Image Automation using UI path
- To learn Blue Prism process and operations for operating system of Digital Workforce.
- To learn Automation Anywhere and automate any business process with intelligent, scalable software robots

Course Outcomes

After completion of the course, the students will be able to

CO1 - Apply basic principles of AI in solutions that require problem solving, knowledge and automation. **(K3)**

CO2 - Identify processes suitable for RPA and recognize how RPA is transforming businesses. **(K2)**

CO3 - Design automation strategy using orchestrator, queues, and bots. **(K5)**

CO4- Achieve cost-effective through automation with improved accuracy by creating a virtual workforce. **(K5)**

CO5 - Achieve process consistency, automate workflows, create IQ bots and manage them effectively. **(K5)**

UNIT I AI AND AUTOMATION   (9Hrs)

AI Foundations- AI Data, AI Capabilities framework- Associated Technologies of AI - AI Prototyping- Industrialising AI - Cognitive Automation tools- Natural language processing- AI Resources -Future of AI.

UNIT II INTRODUCTION TO RPA   (9Hrs)

RPA Foundations- History of RPA-Difference between RPA and AI- Benefits of RPA-Components of RPA-RPA Architecture- RPA Skills- Process Methodologies in RPA- Planning for RPA-RPA Platforms- Types of Bots- Deployment platforms- Future of RPA.

UNIT III UI PATH   (9Hrs)

Introduction to UI Path: UI Path Studio-UI Path Robot-UI path Orchestrator-Task Recorder- Sequence, Flowchart, and Control Flow- Sequencing the workflow- Data Manipulation- Application with Plug-ins and Extensions Terminal Plug-in- Handling User Events and Assistant Bots- Deploying and Maintaining the Bot.

UNIT IV BLUE PRISM   (9Hrs)

Introduction-Process Studio- Pages, Actions, Decisions, Choices and collections-Implementing business objects-Spying Elements-Working with excel –Sending and receiving email, Control room and work queues-Exception Handling

UNIT -V AUTOMATION ANYWHERE   (9Hrs)

Introduction of Automation Anywhere-Tasks-Tasks Editors-Integration and collaboration with Automation Anywhere- working with web pages and JSON Data- Citrix Automation- E-mail Automation- PDF integration-Web Recorder-Creating IQ bots -Deploying and Maintaining the Bot.

Text Books

1. Tom Taulli ,"Artificial Intelligence Basics: A Non-Technical Introduction ",First Edition,Apress,2019
2. Lim Mei Ying ,"Robotic Process Automation with Blue Prism Quick Start Guide ",First Edition ,Packt Publishing ,2018
3. Tom Taulli ,"The Robotic Process Automation Handbook: A Guide to Implementing RPA Systems", First Edition,Apress,2020

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Reference Books

1. Palgrave Macmillan," The Executive Guide to Artificial Intelligence: How to identify and impement application for AI in your organization", Springer press ,2018
2. Jonathan Sireci ,"The Practitioner's Guide to RPA: A Practical Guide for Deploying Robotics Process Automation,Kindle Edition,2020
3. Alok Mani Tripathi ,"Learning Robotic Process Automation Create Software robots and automate business processes with the leading RPA tool – UiPath", First Edition, Packt Publishing ,2018
4. Grig Gheorghiu ,"Dev Ops – Volume 1 ", Pearson and Xebia Press 2018
5. Alfredo Deza, Kennedy Behrman, Noah Gift, Python for DevOps,2019

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3. https://community.blueprism.com/communities/community-home/
4. https://www.blueprism.com/
5. https://www.automationanywhere.com/in/

COs/POs/PSOs Mapping

	Program Outcomes (POs)						Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3
CO1	3	3	3	2	1	-	2	1	3
CO2	3	3	3	1	-	-	1	-	3
CO3	3	3	3	3	3	-	3	3	3
CO4	3	3	3	3	3	-	3	3	3
CO5	3	3	3	3	3	-	3	3	3

Correlation Level: 1-Low, 2-Medium, 3-High

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P20NWE208   **MACHINE LEARNING**

L	T	P	C	Hrs
3	0	0	3	45

Course Objectives

- To be able to formulate machine learning problems corresponding to different applications.
- To understand a range of machine learning algorithms along with their strengths and weaknesses.
- To understand the basic theory underlying machine learning.
- To be able to apply machine learning algorithms to solve problems of moderate complexity.
- To be able to read current research papers and understands the issues raised by current research.

Course Outcomes

After completion of the course, the students will be able to

CO1 - Describe the basic principles of machine learning. **(K2)**
CO2 - Illustrate Decision tree learning with suitable application. **(K2)**
CO3 - Apply Bayesian Learning to classify any real time data set. **(K3)**
CO4 - Summarize various types of learning rules. **(K2)**
CO5 - Develop an inductive and Analytical Learning model for any application. **(K5)**

UNIT I INTRODUCTION   **(9Hrs)**

Well-posed learning problems, Designing a learning system, Perspectives and issues in machine learning Concept learning and the general to specific ordering – Introduction, A concept learning task, Concept learning as search, Find-S: finding a maximally specific hypothesis, Version spaces and the candidate elimination algorithm, Remarks on version spaces and candidate elimination, Inductive bias

UNIT II DECISION TREE LEARNING   **(9Hrs)**

Introduction, Decision tree representation, Appropriate problems for decision tree learning, The basic decision tree learning algorithm, Hypothesis space search in decision tree learning, Inductive bias in decision tree learning, Issues in decision tree learning Artificial Neural Networks – Introduction, Neural network representation, Perceptions, Multilayer networks and the back propagation algorithm, Remarks on the back propagation algorithm, An illustrative example face recognition Advanced topics in artificial neural networks Evaluation Hypotheses – Motivation, Estimation hypothesis accuracy, Basics of sampling theory, A general approach for deriving confidence intervals, Difference in error of two hypotheses, Comparing learning algorithms

UNIT III BAYESIAN LEARNING   **(9Hrs)**

Introduction, Bayes theorem, Bayes theorem and concept learning, Maximum likelihood and least squared error hypotheses, Maximum likelihood hypotheses for predicting probabilities, Minimum description length principle, Bayes optimal classifier, Gibs algorithm, Naïve Bayes classifier, Bayesian belief networks The EM algorithm Computational learning theory – Introduction, Probability learning an approximately correct hypothesis, Sample complexity for Finite Hypothesis Space, Sample Complexity for infinite Hypothesis Spaces, The mistake bound model of learning – Instance-Based Learning- Introduction, k -Nearest Neighbour Learning, Locally Weighted Regression, Radial Basis Functions, Case-Based Reasoning, Remarks on Lazy and Eager Learning Genetic Algorithms – Motivation, Genetic Algorithms, An illustrative Example, Hypothesis Space Search, Genetic Programming, Models of Evolution and Learning, Parallelizing Genetic Algorithms

UNIT IV LEARNING SETS OF RULES   **(9Hrs)**

Introduction, Sequential Covering Algorithms, Learning Rule Sets: Summary, Learning First Order Rules, Learning Sets of First Order Rules: FOIL, Induction as Inverted Deduction, Inverting Resolution Analytical Learning – Introduction, Learning with Perfect Domain Theories: Prolog-EBG Remarks on Explanation-Based Learning, Explanation-Based Learning of Search Control Knowledge

UNIT -V COMBINING INDUCTIVE AND ANALYTICAL LEARNING (9Hrs)

Motivation, Inductive-Analytical Approaches to Learning, Using Prior Knowledge to Initialize the Hypothesis, Using Prior Knowledge to Alter the Search Objective, Using Prior Knowledge to Augment Search Operators, Reinforcement Learning – Introduction, The Learning Task, Q Learning, Non-Deterministic, Rewards and Actions, Temporal Difference Learning, Generalizing from Examples, Relationship to Dynamic Programming

Text Books

1. Tom M. Mitchell," Machine Learning ", McGraw Hill Education ,2017
2. Stephen Marsland, Taylor & Francis ,"Machine Learning: An Algorithmic Perspective", Chapman and Hall/CRC,2014
3. Jason Bell,"Machine learning – Hands on for Developers and Technical Professionals", Wiley, First Edition, 2014.

Reference Books

1. William W Hsieh ,"Machine Learning Methods in the Environmental Sciences, Neural Networks" , Cambridge Univ. Press,2009.
2. Richard o. Duda, Peter E. Hart and David G. Stork, "Pattern classification", John Wiley & Sons Inc., 2001
3. Ethem Alpaydin,"Introduction to Machine Learning 3E (Adaptive Computation and Machine Learning Series), MIT Press, Third Edition, 2014.
4. Miroslav Kubat, " An Introduction to Machine Learning", Springer Publications, 2nd Edition, 2017.
5. Peter Flach, "Machine Learning: The Art and Science of Algorithms that Make Sense of Data", Cambridge University Press, First Edition, 2012.

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2. https://towardsdatascience.com/machine-learning/home/
3. https://monkeylearn.com/blog/practical-explanation-naive-bayes-classifier/
4. https://www.analyticsvidhya.com/blog/2018/10/introduction-neural-networks-deep-learning/
5. https://courses.analyticsvidhya.com/courses/getting-started-with-decision-trees

COs/POs/PSOs Mapping

COS	Program Outcomes (POs)						Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3
CO1	2	3	2	1	-	-	1	-	2
CO2	2	3	2	1	-	-	1	-	2
CO3	3	3	3	2	1	-	2	1	3
CO4	2	3	2	1	-	-	1	-	2
CO5	3	3	3	3	3	-	3	3	3

Correlation Level: 1-Low, 2-Medium, 3-High

	L	T	P	C	Hrs
P20NWE209 **WEB ANALYTICS DEVELOPMENT**	3	0	0	3	45

Course Objectives
* To understand Web analytics development.
* To be familiar with Web analytics tools
* To study Web Search and Retrieval
* To learn how to make connection in Web development
* To understand Connection in search

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

CO1 - Illustrate the basic concepts of Web analytics development. **(K2)**
CO2 – Explain the Web analytics development. **(K2)**
CO3 – Paraphrase about various Searching and Retrieval Techniques. **(K2)**
CO4 – **Identify the various** connection techniques in Web development. **(K2)**
CO5 – Demonstrate the use of web Analytics in any application. **(K3)**

UNIT I INTRODUCTION   (9 Hrs)
Introduction – Social network and Web data and methods - Graph and Matrices - Basic measures for individuals and networks, Information Visualization

UNIT II WEB ANALYTICS TOOLS   (9 Hrs)
Web Analytics tools: Click Stream Analysis, A/B testing, Online Surveys

UNIT III WEB SEARCH AND RETRIEVAL   (9 Hrs)
Web Search and Retrieval: Search Engine Optimization, Web Crawling and indexing, Ranking Algorithms, Web traffic models

UNIT IV MAKING CONNECTION   (9 Hrs)
Making Connection: Link Analysis, Random Graphs and Network evolution, Social Connects: Affiliation and identity

UNIT V CONNECTION   (9 Hrs)
Connection: Connection Search, Collapse, Robustness Social involvements and diffusion of innovation

Text Books
1. Hansen, Derek, Ben Sheiderman, Marc Smith,"Analyzing Social Media Networks with NodeXL: Insights from a Connected World", Morgan Kaufmann, 2011.
2. Avinash Kaushik,"Web Analytics 2.0: The Art of Online Accountability", 2009
3. Jason Burby, "Actionable Data Analytics ",edition one, John Wiley & Sons, -2007

Reference Books
1. Easley, D. & Kleinberg, J. Networks, Crowds, "Markets: Reasoning About a Highly Connected World". New York: Cambridge University Press, 2010
2. Wasserman, S. & Faust, K.,"Social network analysis: Methods and applications. New York", Cambridge University Press ,1994
3. Monge, P. R. & Contractor, N. S. ,"Theories of communication networks",Oxford University Press,2003.
4. Susan Weinschenk," Neuro Web Design: What Makes Them Click?", Peachpit Press, 2009
5. Nicholas C. Zakas, Professional JavaScript for Web Developers, Wiley, 2005

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5. https://www.researchgate.net/publication/268509351_Developing_a_Framework_for_Web_Analytics

COs/POs/PSOs Mapping

	Program Outcomes (POs)						Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3
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CO2	2	3	2	1	-	-	1	-	2
CO3	2	3	2	1	-	-	1	-	2
CO4	2	3	2	1	-	-	1	-	2
CO5	3	3	3	2	1	-	2	1	3

Correlation Level: 1-Low, 2-Medium, 3-High

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		L	T	P	C	Hrs
P20NWE210	HUMAN COMPUTER INTERACTION	3	0	0	0	45

Course Objectives

- To learn the basic concepts human computer interaction
- To expose design process of human computer interaction
- To grasp models and theories of human computer interaction
- To learn interaction styles of human interaction
- To learn the design issues of human interaction

Course Outcomes

After completion of the course, the students will be able to

CO1 - Illustrate the basic concepts of human computer interaction.**(K2)**

CO2 - Explore Design of human computer interaction. **(K2)**

CO3 - Analyze the models and theories of human com puter interaction. **(K4)**

CO4 - Illustrate the interaction styles of human interaction. **(K2)**

CO5 - Paraphrase design issues of human interaction. **(K2)**

UNIT I   INTRODUCTION   (9 Hrs)

Introduction The human- The computer-The interaction-Paradigms- Usability of Interactive Systems- Guidelines- Principle and Theories

UNIT II   THE DESIGN PROCESS   (9 Hrs)

Design Process- Interaction design basics- HCI in the software process- Design rules-Implementation support, Evaluation techniques- Universal design- User support

UNIT III   MODELS AND THEORIES   (9 Hrs)

Models and Theories Cognitive models- Socio-organizational issues and stakeholder requirements- Communication and collaboration models-Task analysis-Dialogue notations and design- Models of the system- Modelling rich interaction

UNIT IV   INTERACTION STYLES   (9 Hrs)

Interaction Styles- Direct Manipulation and Virtual Environments, Menu Selection, Form Filling and Dialog Boxes, Command and Natural Languages, Interaction Devices, Collaboration and Social Media Participation

UNIT V   DESIGN ISSUES   (9 Hrs)

Design Issues - Quality of Service- Balancing Function and Fashion- User Documentation and Online Help- Information Search,-Information Visualization

Text books

1. Alan Dix , Janet Finlay ,"Human Computer Interaction" , Pearson Education ,2004
2. Ben Shneiderman ,"Designing the User Interface - Strategies for Effective Human Computer Interaction", Pearson Education ,2010.
3. Masaaki Kurosu," Human-Computer Interaction. Theories, Methods, and Human Issues", Springer , 2018

Reference books

1. Rosson, M. andCarroll ,"Usability Engineering: Scenario-Based Development of Human-Computer Interaction ,2002
2. Cooper ,"The Essentials of Interaction Design", Wiley Publishing,2007
3. Nielsen, J. Morgan Kaufmann, "Usability Engineering", 1993.
4. Heim, S ,"The Resonant Interface: HCI Foundations for Interaction Design" , Addison-Wesley,2007
5. Rosson, M.B &Carroll, J.M. , Morgan Kaufman ,"Usability engineering: scenario-based development of human-computer interaction", 2002

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2. http://www. entsci.gatech.edu › hcc1
3. http://www. slideshare.net › soniasousa › hcc-introduction
4. nteraction-design.org/literature/topics/human-computer-interaction
5. https://www.tandfonline.com/loi/hhci20

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)						Program Specific Outcomes (PSOs)		
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CO2	2	3	2	1	-	-	1	-	2
CO3	3	3	3	3	2	-	3	2	3
CO4	2	3	2	1	-	-	1	-	2
CO5	2	3	2	1	-	-	1	-	2

Correlation Level: 1-Low, 2-Medium, 3-High

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	HIGH SPEED SWITCHING	L	T	P	C	Hrs
P20NWE211	**ARCHITECTURE**	3	0	0	3	45

Course Objectives

- Introduce to ATM and Frame relay and Up-to-date High Speed Networks.
- To know techniques involved to support real-time traffic and congestion control.
- To understand the different levels of quality of service (QoS) to different applications.
- To Learn about wireless network operations
- To know how to manage networks and configuration

Course Outcomes

After completion of the course, the students will be able to

CO1 - Illustrate the basics of ATM ,Frame relay ,Survey of developments in High Speed Networks. **(K2)**

CO2 - Explain techniques involved to support real-time traffic and congestion control. **(K2)**

CO3 - Analyze the different levels of quality of service (QoS) to different applications. **(K4)**

CO4 - Implement wireless network operations. **(K3)**

CO5 – Construct network management system by choosing appropriate configuration. **(K5)**

UNIT I HIGH SPEED NETWORKS (9 Hrs)

Introduction-frame relay networks –ATM protocol architecture-ATM logical connection –ATM cells-ATM service categories -AAL- high speed LANS: the emergence of high speed LANS-Ethernets-fiber channel- wireless LANS

UNIT II CONGESTION AND TRAFFIC MANAGEMENT (9 Hrs)

Congestion control in data networks and internets-link level flow and error control- TCP traffic - congestion control in ATM networks. - Interior routing protocols.

UNIT III QOS IN IP NETWORKS (9 Hrs)

Integrated service architecture-queuing discipline -random early detection differentiated services protocol for QOS support- RSVP- multiportal Label switching - real time transport protocol- IP version six.

UNIT IV PRINCIPLES OF WIRELESS NETWORK OPERATION (9 Hrs)

Local broad band and Ad hoc networks. Introduction to wireless LANS-IEEE 802.11 WLAN-WATM-HIPERLAN-Ad hoc networking and WPAN.

UNIT V NETWORK MANAGEMENT (9 Hrs)

Network management- choosing a configuration method-MIB-SNMP-XMLCORBA- COPS-VPNS-mobile IP-voice over IP.

Text Books

1. William Stallings, High Speed Networks and Internet, Pearson Education, Fourth Edition, 2005.
2. Behrouz A. Forouzan, Data Communications and Networking, 4th edition, Tata McGraw-Hill, 2005.
3. Warland & Pravin Varaiya, High Performance Communication Networks, Jean Harcourt Asia Pvt. Ltd., II Edition, 2001.

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1. Rajiv Ramaswami and Kumar N. Sivarajan, Optical Networks: A Practical Perspective, 1st Edition, Morgan Kaufmann, USA, 2001
2. C. Siva Ram Murthy and Mohan Gurusamy, WDM Optical Networks: Concepts, Design, and Algorithms, Prentice Hall, USA, 2002.
3. Stamatios V. Kartalopoulos, Understanding SONET/SDH and ATM: Communications Networks for Next Millennium, Prentice-Hall of India, 2010.
4. IrvanPepelnjk, Jim Guichard and Jeff Apcar, MPLS and VPN architecture, Cisco Press, Volume 1 and 2, 2003.
5. Itamar Elhanany, Mounir Hamdi "High-performance Packet Switching Architectures " Springer 2006

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1. https://www.cse.wustl.edu/~jain/cis788-97/ftp/gigabit_nets/index.html
2. https://docs.lib.purdue.edu/cgi/viewcontent.cgi?referer=https://www.google.com/&httpsredir=1&article=1707&context=cstech
3. https://www.cisco.com/c/en/us/td/docs/solutions/Enterprise/Data_Center/DC_Infra2_5/DCI_SRND_2_5a_book/DCInfra_2a.html
4. https://cse.sc.edu/~srihari/reflib.html
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COs/POs/PSOs Mapping

COs	Program Outcomes (POs)						Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3
CO1	2	3	2	1	-	-	1	-	2
CO2	2	3	2	1	-	-	1	-	2
CO3	3	3	3	3	2	-	3	2	3
CO4	3	3	3	2	1	-	2	1	3
CO5	3	3	3	3	3	-	3	3	3

Correlation Level: 1-Low, 2-Medium, 3-High

M.Tech. Networking

	L	T	P	C	Hrs

P20NWE212   **INTERNET ROUTING DESIGN**

3 0 0 3 45

Course Objectives

- Study the operations of Routing and its challenges in global network.
- Understand the architecture of the Internet and VPN
- Understand the Router Architectures, algorithms. And bottle necks
- Describe IP switching and the operation of MPLS
- Understand the different levels of quality of service (QoS) to different applications

Course Outcomes

After completion of the course, the students will be able to

CO1 - Describe the functions performed by routers. **(K2)**
CO2 - Describe the architecture of the Internet and VPN. **(K2)**
CO3 - Explore Router Architectures, algorithms and bottle necks. **(K2)**
CO4 - Describe IP switching and the operation of MPLS. **(K2)**
CO5 - Elucidate the different levels of quality of service (QoS) to different applications. **(K2)**

UNIT I ROUTING PROTOCOL   (9 Hrs)

Routing Algorithm, and Routing Table, Routing Information Representation and Protocol Messages Link State Routing Protocol, Path Vector Routing, Protocol, Link Cost. Architectural View of the Internet, Allocation of IP Prefixes and AS Number

UNIT II POLICY BASED ROUTING   (9 Hrs)

Point of Presence, Traffic Engineering Implications, Internet Routing Instability Traffic Engineering of IP/MPLS Networks, VPN Traffic Engineering, Problem Illustration: Layer 3 VPN, LSP Path Determination Constrained Shortest Path Approach, LSP Path Determination: Network Flow Modeling Approach, Layer 2 VPN Traffic Engineering, Observations and General Modeling Framework, Routing/Traffic Engineering for Voice Over MPLS

UNIT III ROUTER ARCHITECTURES   (9 Hrs)

Functions, Types, Elements of a Router, Packet Flow, Packet Processing: Fast Path versus Slow Path, Router Architectures -Network Bottleneck, Network Algorithmics, Strawman solutions, Thinking Algorithmically, Refining the Algorithm, Cleaning up, Characteristics of Network Algorithms IP Address Lookup Algorithms: Impact, Address Aggregation, Longest Prefix Matching, Naïve Algorithms, Binary, Multi bit and Compressing Multi bit Tries

UNIT IV SEARCHING ALGORITHMS   (9 Hrs)

Search by Length Algorithms, Search by Value Approaches, Hardware Algorithms, Comparing Different Approaches IP Packet Filtering and Classification Classification, Classification Algorithms, Naïve Solutions, Two Dimensional Solutions, Approaches for Dimensions

UNIT V QUALITY OF SERVICE   (9 Hrs)

QoS Attributes, Adapting Routing: A Basic Framework. Update Frequency, Information Inaccuracy, and Impact on Routing, Dynamic Call Routing in the PSTN Heterogeneous Service, Single-Link Case, A General Framework for Source-Based QoS Routing with Path Caching , Routing Protocols for QoS Routing.

Text Books

1. Deepankar Medhi and Karthikeyan Ramasamy ,"Network Routing: Algorithms, Protocols, and Architectures"Morgan Kaufmann, 1st edition,2007
2. George Varghese," Network Algorithmic: An Interdisciplinary Approach to Designing Fast Networked Devices" Morgan Kaufmann Series, 2016
3. Robin Sharp, "Principles of Protocol Design" , Springer 1st ed. 2008 edition (October 2010)

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1. B.A. Ferouzan "TCP/IP Protocol Suite", Tata McGraw Hill Edition, Third Edition,2008
2. N. Richard Steveus "TCP/IP Volume 1,2,3", Addison Wesley,2012
3. A.S. Taueubaum ,"Computer Networks", Pearson Edition, 4th Edition,2005
4. Sam Halabi," Internet Routing Architectures (CISCO)" Cisco Press; 3rd edition 2003
5. Mark A. Sportac," IP Routing Fundamentals "(The Cisco Press Fundamental Series),2002

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1. https://www.cisco.com/c/en/us/td/docs/solutions/Enterprise/Security/SAFE_RG/SAFE_rg.html
2. https://www.cisco.com/c/en/us/td/docs/solutions/Enterprise/Security/IE_DG.html
3. https://web.stanford.edu/class/msande91si/www-spr04/readings
4. https://www.oreilly.com/library/view/packet-guide-to/9781449311315/ch01.html
5. https://onlinelibrary.wiley.com/doi/book/10.1002/9781119114864

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)						Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3
CO1	2	3	2	1	-	-	1	-	2
CO2	2	3	2	1	-	-	1	-	2
CO3	2	3	2	1	-	-	1	-	2
CO4	2	3	2	1	-	-	1	-	2
CO5	2	3	2	1	-	-	1	-	2

Correlation Level: 1-Low, 2-Medium, 3-High

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P20NWE213	WIRELESS SENSOR PROTOCOLS AND PROGRAMMING	L	T	P	C	Hrs
		3	0	0	3	45

Course Objectives

- Understand basic sensor network concepts
- Know physical layer issues, understand and analyse Medium Access Control Protocols
- Comprehend network and transport layer characteristics and protocols and implement conventional protocols
- Understand the network management and Middleware services
- Learn about OS For Wireless Sensor Networks: Introduction

Course Outcomes

After completion of the course, the students will be able to

CO1 - Illustrate basics of sensor network concepts. **(K2)**

CO2 - Analyze physical layer issues, and Medium Access Control Protocols. **(K4)**

CO3 - Comprehend network, transport layer protocols and implement conventional protocols. **(K2)**

CO4 – Explore various network management and Middleware services. **(K2)**

CO5 - Explain about OS for Wireless Sensor Networks. **(K2)**

UNIT I BACKGROUND OF SENSOR NETWORK TECHNOLOGY   (9 Hrs)

Basic Overview of the Technology- Basic Sensor Network Architectural Elements - Applications of Wireless Sensor Networks: Range of Applications- Examples of Category 2 WSN - Examples of Category - Another Taxonomy of WSN Technology- Basic Wireless Sensor Technology - Sensor Node Technology Hardware and Software - Sensor Taxonomy- WN Operating Environment- WN Trends

UNIT II WIRELESS TRANSMISSION TECHNOLOGY AND SYSTEMS   (9 Hrs)

Radio Technology Primer -Medium Access Control Protocols for Wireless Sensor Networks- Background - MAC Protocols for WSNs- Sensor-MAC Case Study- Routing Protocols for Wireless

UNIT III SENSOR NETWORKS   (9 Hrs)

Data Dissemination and Gathering- Routing Challenges and Design Issues in Wireless Sensor Networks- Routing Strategies in Wireless Sensor Networks Transport Control Protocols for Wireless Sensor Networks- Traditional Transport Control Protocols- Transport Protocol Design Issues - Examples of Existing Transport Control Protocols- Performance of Transport Control Protocols

UNIT IV MIDDLEWARE FOR WIRELESS SENSOR NETWORKS   (9 Hrs)

WSN Middleware Principles - Middleware Architecture- Data-Related Functions –Architectures - Existing Middleware- MiLAN (Middleware Linking Applications and Networks - Network Management for Wireless Sensor Networks - Network Management Requirements - Network Management Design Issues - Example of Management Architecture: MANNA - Other Issues Related to Network Management

UNIT V WIRELESS OPERATING SYSTEM   (9 Hrs)

Introduction - Operating System Design Issues - Examples of Operating Systems- Performance and Traffic Management – Background -WSN Design Issues - Performance Modeling of WSNs - Case Study: Simple Computation of the System Life Span.

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Text Books

1. KazemSohraby, Daniel manoli , "Wireless Sensor networks- Technology,Protocols and Applications", Wiley InterScience Publications 2010
2. Waltenegus Dargie, Christian Poellabauer , "Fundamentals of Wireless Sensor Networks, Theory and Practice", Wiley Series on wireless Communication and Mobile Computing, 2011
3. Anna Forster ," Introduction to Wireless Sensor Networks". Wiley InterScience Publications 2016

Reference Books

1. Bhaskar Krishnamachari ," Networking Wireless Sensors", Cambridge University Press, 2005
2. Azzedine Boukerche, "Algorithms and Protocols for Wireless Sensor Networks" Wiley InterScience Publications 2009
3. Holger Karl, Andreas Willig , "Protocols and Architectures for Wireless Sensor Networks",Wiley InterScience Publications 2007
4. Imad Mahgoub, Mohammad Ilyas , "Sensor Network Protocols", CRC Press 2007
5. Khaled Ragab, Azween Bin Abdullah," Wireless Sensor Networks and Energy Efficiency Protocols, Routing, and Management", Information Science Reference 2012

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2. https://www.diva-portal.org/smash/get/diva2:572787/FULLTEXT01.pdf
3. https://www.hindawi.com/journals/js/2020/9592836/
4. https://onlinelibrary.wiley.com/doi/pdf/10.1002/9780470396360.fmatter
5. http://www.science.smith.edu/~jcardell/Courses/EGR328/Readings/WSNSurvey2.pdf

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)						Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3
CO1	2	3	2	1	-	-	1	-	2
CO2	2	3	2	1	-	-	1	-	2
CO3	3	3	3	3	2	-	3	2	3
CO4	2	3	2	1	-	-	1	-	2
CO5	2	3	2	1	-	-	1	-	2

Correlation Level: 1-Low, 2-Medium, 3-High

M.Tech. Networking

P20NWE214	NEXT GENERATION INTERNETWORKING PROTOCOL	L	T	P	C	Hrs
		3	0	0	3	45

Course Objectives

- To give an overview of IPv6 and its Address Types
- To understand IPV4 and IPv6 Address Types
- To know about ICMPv6 and neighbour Discovery Protocol
- To detail about IPv6 Configuration
- To Understand the routing concept of IPV6

Course Outcomes

After completion of the course, the students will be able to

CO1 - Elucidate IPv6 and its Address Types
CO2 - Analyze about IPV4 and IPv6 Address Types
CO3 - Explain about ICMPv6 and neighbor Discovery Protocol
CO4 - Paraphrase IPv6 Configuration
CO5 - Evaluate the performance of various routing concept of IPV6

UNIT I INTRODUCTION TO IPv6   (9 Hrs)

History of IPv6- Benefits of IPv6- IPv4 Address Depletion- IPv4 Header- IPv6 Header- Comparing IPv4 IPv6 Addressing- Representation of IPv6 Addresses- Prefix Notation- Global Unicast Address- Subnetting and IPv6.

UNIT II IPv6 ADDRESS TYPES   (9 Hrs)

IPv6 Address Space- Unicast Address-Global Unicast Address-Manual Global Unicast Configuration-Dynamic Configuration-Link-local Unicast-Dynamic Linklocal Address: EUI- 64 109-Randomly Generated Interface IDs-Static Link-local Address-Link-local Addresses and Duplicate Address Detection- Link-local Addresses and Default Gateways- Isolated Link-local Address-Loopback Address-Unspecified Address- Unique Local Address-IPv4 Embedded Address-IPv4-Compatible IPv6 Addresses-IPv4-Mapped IPv6 Addresses-Multicast

UNIT III ICMPV6 AND NEIGHBOR DISCOVERY PROTOCOL   (9 Hrs)

General Message Format- ICMP Error Messages- Path MTU Discovery ICMP Informational Messages-Neighbor Discovery Protocol

UNIT IV IPv6 CONFIGURATION   (9 Hrs)

Configuring Global Unicast Addresses- Configuring Link-local Addresses- Enabling IPv6 Packet Forwarding and ND Router Advertisements- Tuning Neighbor Discovery Parameters

UNIT V IPv6 ROUTING   (9 Hrs)

Introduction to Routing IPv6 - IPv6 Routing Table- Configuring IPv6 Static Routes- RIP for IPv6-EIGRP for IPv6-OSPFv3 DHCPv6 Services- Basics of Dual-Stack and Tunneling-Basics of Network Address Translation IPv6 to IPv4 (NAT64)

Text Books

1. Rick Graziani , IPv6 Fundamentals: A Straightforward Approach to Understanding IPv6, Cisco Press Silvia Hagen, IPv6 Essentials, ISBN-13: 978-1449319212, 3rd Edition O'Reilly
2. Byrav Ramamurthy , George N. Rouskas , Krishna Moorthy Sivalingam, "Next-Generation Internet: Architectures and Protocols", Cambridge University Press; 3rd edition 2011
3. David Clark," IPng, Internet Protocol Next Generation" , Addison-Wesley Publishing Company 2nd edition 2003

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Reference Books

1. Edward Horley , Practical IPv6 for Windows Administrators, Apress, ISBN-13: 978-1430263708,First Edition
2. Eiji Oki, Roberto Rojas-Cessa, Mallikarjun Tatipamula, Christian Vogt , "Advanced Internet Protocols, Services, and Applications", Wiley publishing 2nd edition 2013
3. Han Zuidweg, Johan Zuidweg ," Next Generation Intelligent Networks " Artech House publications ,2nd edition 2002
4. Krzysztof Iniewski ," Convergence of Mobile and Stationary Next-Generation Networks", Wiley; 1st edition (June 10, 2011)
5. Paul Izzo ," Gigabit Networks: Standards and Schemes for Next-Generation Networking", Wiley; 1st edition (February 2, 2000)

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3. https://www.cse.wustl.edu/~jain/cis678-97/f18_ip6r.htm
4. https://www.itu.int/rec/T-REC-Y/en
5. https://gow.epsrc.ukri.org/NGBOViewGrant.aspx?GrantRef=EP/D033489/1

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)						Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3
CO1	2	3	2	1	-	-	1	-	2
CO2	3	3	3	3	2	-	3	2	3
CO3	2	3	2	2	-	-	2	-	2
CO4	2	3	2	2	-	-	2	-	2
CO5	3	3	3	3	2	-	3	2	3

Correlation Level: 1-Low, 2-Medium, 3-High

M.Tech. Networking

P20NWE215	PROTOCOL ENGINEERING	L	T	P	C	Hrs
		3	0	0	3	45

Course Objectives
- To study the design, operation, and challenges of communication and its protocol
- To learn SDI with examples
- To grasp the protocol verification and validation.
- To evaluate Protocol Conformance Testing
- To explore Protocol Synthesis

Course Outcomes
After completion of the course, the students will be able to
CO1 - Explain the design, operation, and challenges of communication and its protocol. **(K2)**
CO2 - Explain SD with examples. **(K4)**
CO3 - Describe the protocol verification and validation. **(K2)**
CO4 - Compare Protocol Conformance Testing. **(K2)**
CO5 - Evaluate Protocol Synthesis. **(K4)**

UNIT I INTRODUCTION   (9 Hrs)
Communication Model, Communication Software, Communication Subsystems, Communication Protocol, Communication Protocol Development Methods, Protocol Engineering Process. Layered Architecture, Network Services and Interfaces, Protocol Function, OSI Model, TCP/IP Protocol Suite, Application Protocols, Protocol Specification: Components of Protocol to be Specified, Communication Service Specification, Protocol Entity Specification, Interface Specifications, Multimedia Protocol Specifications, Internet Protocol Specifications: Examples

UNIT II SDL   (9 Hrs)
Examples of SDL Based Protocol Specifications Introduction to Other Protocol   Specification Languages.

UNIT III   PROTOCOL VERIFICATION/VALIDATION   (9 Hrs)
Verification of a Protocol Using Finite State Machines, Protocol Validation, Protocol Design Errors, Protocol Validation Approaches, and SDL based Protocol Verification, SDL based Protocol Validation.

UNIT IV PROTOCOL CONFORMANCE TESTING   (9 Hrs)
Conformance Testing Methodology and Framework, Architectures, Test Sequence Generation Methods, Distributed Architecture by Local Methods, Conformance Testing with TTCN, Systems with Semi-controllable Interfaces, Conformance Testing of RIP, Multimedia Applications Testing, SDL Based Tools for Conformance Testing, SDL Based Conformance, Testing of MPLS.

UNIT V PROTOCOL SYNTHESIS   (9 Hrs)
Protocol Synthesis, Interactive and Automatic Synthesis Algorithm, Automatic Synthesis of SDL from MSC, Protocol Re-synthesis. Protocol Implementation: Requirements of Implementation, Object based approach to Protocol Implementation, Compilers, and Tools for Protocol Engineering.

Text Books
1. Venkataram & Manvi, Pallapa Venkataram Sunilkumar S. Manvi ,"Communication Protocol Engineering "PHI Learning Pvt. Ltd ,2004
2. Eiji Oki, Roberto Rojas-Cessa, Mallikarjun Tatipamula, Christian Vogt , "Advanced Internet Protocols, Services, and Applications", Wiley publishing 2nd edition 2013
3. David Clark," IPng, Internet Protocol Next Generation" , Addison-Wesley Publishing Company 2nd edition 2003

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Reference Books

1. Miroslav Popovic ,"Communication Protocol Engineering ",CRC Press, 2006
2. Konig, Hartmut ,"Protocol Engineering", Springer, 2012
3. John Moy" OSPF: Anatomy of an Internet Routing Protocol ",Addison-Wesley Professional; 2nd edition 2007
4. Sam Halabi," Internet Routing Architectures (CISCO)" Cisco Press; 3rd edition 2003.
5. Mark A. Sportac," IP Routing Fundamentals "(The Cisco Press Fundamental Series),2002

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2. http://cs.uccs.edu/~cs522/pe/pe.html
3. https://www.eecis.udel.edu/~amer/PEL
4. https://www.sanfoundry.com/best-reference-books-protocol-engineering/
5. http://holychild.org/cgi/viewcontent.php?article=communication.protocol.engineering.by.pallap a.venkataram&context=libpubs

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)						Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3
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CO2	2	3	2	1	-	-	1	-	2
CO3	2	3	2	1	-	-	1	-	2
CO4	2	3	2	1	-	-	1	-	2
CO5	3	3	3	3	2	-	3	2	3

Correlation Level: 1-Low, 2-Medium, 3-High

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Academic curriculum and syllabi R-2020

P20NWE316	SOCIAL NETWORK ANALYSIS	L	T	P	C	Hrs
		3	0	0	3	45

Course Objectives
- To understand the components of the social network.
- To model and visualize the social network.
- To mine the users in the social network.
- To understand the evolution of the social network.
- To study different applications of social networks

Course Outcomes
After completion of the course, the students will be able to
CO1 - Explore the internals components of the social network.**(K2)**
CO2 - Model and visualize the social network. **(K3)**
CO3 - Analyze the behavior of the users in the social network. **(K4)**
CO4 - Illustrate evolution of the social network. **(K2)**
CO5 - Apply social network in real time applications. **(K3)**

UNIT I INTRODUCTION TO WEB   (9 Hrs)
Limitations of current Web – Development of Semantic Web – Emergence of the Social Web – Statistical Properties of Social Networks -Network analysis - Development of Social Network Analysis - Key concepts and measures in network analysis - Discussion networks - Blogs and online communities - Web-based networks.

UNIT II MODELING AND VISUALIZATION   (9 Hrs)
Visualizing Online Social Networks - A Taxonomy of Visualizations - Graph Representation - Centrality- Clustering - Node-Edge Diagrams - Visualizing Social Networks with Matrix- Based Representations- Node-Link Diagrams - Hybrid Representations - Modelling and aggregating social network data – Random Walks and their Applications –Use of Hadoop and Map Reduce - Ontological representation of social individuals and relationships.

UNIT III MINING COMMUNITIES   (9 Hrs)
Aggregating and reasoning with social network data, Advanced Representations – Extracting evolution of Web Community from a Series of Web Archive - Detecting Communities in Social Networks - Evaluating Communities – Core Methods for Community Detection & Mining - Applications of Community Mining Algorithms - Node Classification in Social Networks.

UNIT IV EVOLUTION   (9 Hrs)
Evolution in Social Networks – Framework - Tracing Smoothly Evolving Communities - Models and Algorithms for Social Influence Analysis - Influence Related Statistics - Social Similarity and Influence - Influence Maximization in Viral Marketing - Algorithms and Systems for Expert Location in Social Networks - Expert Location without Graph Constraints - with Score Propagation – Expert Team Formation - Link Prediction in Social Networks - Feature based Link Prediction – Bayesian Probabilistic Models - Probabilistic Relational Models.

UNIT V INSTRUCTIONAL ACTIVITY   (9 Hrs)
A Learning Based Approach for Real Time Emotion Classification of Tweets, A New Linguistic Approach to Assess the Opinion of Users in Social Network Environments, Explaining Scientific and Technical Emergence Forecasting, Social Network Analysis for Biometric Template Protection

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Text Books

1. John G. Breslin, Alexander Passant and Stefan Decker, "The Social Semantic Web",Springer, 2009.
2. Ajith Abraham, Aboul Ella Hassanien, VáclavSnášel, "Computational Social Network Analysis: Trends, Tools and Research Advances", Springer, 2012
3. BorkoFurht, "Handbook of Social Network Technologies and Applications", Springer, 1 st edition, 2011

Reference Books

1. Guandong Xu, Yanchun Zhang and Lin Li, "Web Mining and Social Networking –Techniques and applications", Springer, First Edition ,2011.
2. Dion Goh and Schubert Foo - Social information Retrieval Systems: Emerging Technologies and Applications for Searching the Web Effectively", IGI Global Snippet, 2008.
3. Max Chevalier, Christine Julien and Chantal Soulé-Dupuy, Collaborative and Social Information Retrieval and Access: Techniques for Improved user Modelling", IGI Global Snippet, 2009.
4. Peter Mika, "Social Networks and the Semantic Web,", Springer , First Edition ,2007.
5. Borko Furht, "Handbook of Social Network Technologies and Applications", Springer ,1st Edition, 2010.

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2. https://www.coursera.org/learn/social-media-data-analytics
3. https://www.tutorialspoint.com/social_media_marketing/social_media_analysis.htm
https://blockgeeks.com/
4. https://www.talkwalker.com/blog/social-media-analytics-guide
5. https://www.mynetworkmap.com/

COs/POs/PSOs Mapping

	Program Outcomes (POs)						Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3
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CO4	2	3	2	1	-	-	1	-	2
CO5	3	3	3	2	1	-	2	1	3

Correlation Level: 1-Low, 2-Medium, 3-High

M.Tech. Networking

P20NWE317	AUTONOMOUS VEHICLES &UAV	L	T	P	C	Hrs
		3	0	0	3	45

Course Objectives

- To learn the basic concepts of UAV
- To expose design to UAV systems
- To grasp avionics hardware
- To learn communication payloads and controls
- To learn the development of UAV systems

Course Outcomes

After completion of the course, the students will be able to
CO1 - Illustrate the basic concepts of UAV. **(K2)**
CO2 – Explore the design of UAV systems. **(K2)**
CO3 - Explain the avionics hardware. **(K2)**
CO4 - Analyze the communication payloads and controls. **(K4)**
CO5 – Design and development of UAV systems. **(K5)**

UNIT I   INTRODUCTION to UAV   (9 Hrs)

History of UAV – classification – Introduction to Unmanned Aircraft Systems -- models and prototypes – System Composition-applications

UNIT II   THE DESIGN OF UAV SYSTEMS   (9 Hrs)

Introduction to Design and Selection of the System - Aerodynamics and Airframe Configurations - Characteristics of Aircraft Types - Design Standards and Regulatory Aspects – UK , USA and Europe - Design for Stealth -- control surfaces-specifications.

UNIT III AVIONICS HARDWARE   (9 Hrs)

Autopilot – AGL-pressure sensors - servos - accelerometer – gyros-actuators - power supply-processor , integration, installation, configuration, and testing

UNIT IV AUTONOMOUS VEHICLE SYSTEMS   (9 Hrs)

Intelligent Transport Systems- Radar Sensor Detectors for Vehicle Safety Systems - Airborne Ultrasonic Imaging: SONAR Based Image Generation for Autonomous Vehicles- Autonomous Underwater Vehicle Dynamics- Environment Sensing and Perception Technologies - Algorithms for Autonomous Ground Vehicles

UNIT V AUTONOMOUS VEHICLE MANAGEMENT   (9Hrs)

Intelligent Highway Surveillance and Safety Systems- Cyber Security Evaluation of Critical Infrastructures Systems- Sustainable Information Systems Management for Spatial Governance - Standards of Communications in the Intelligent Transport Systems- Smart Technologies applied in the Electrical and Hybrid Vehicles

Text books

1. Nicu Bizon, Lucian Dascalescu, Naser Mahdavi Tabatabaei ,"Autonomous Vehicles: Intelligent Transport Systems and Smart Technologies", Nova Science Pub Inc,2014
2. Shaoshan Liu, Liyun Li, "Creating autonomous vehicle systems", Morgan & Claypool Publishers,2017
3. Fossen, thor, Kristin y. Pettersen, and Henk nijmeijer. *Sensing and control for autonomous vehicles*. Springer international pu, 2017.

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1. Yasmina Bestaoui Sebbane," Smart Autonomous Aircraft: Flight Control and Planning for UAV", CRC Press ,2015
2. Wilde GA, Murphy RR. User interface for unmanned surface vehicles used to rescue drowning victims. In2018 IEEE International Symposium on Safety, Security, and Rescue Robotics (SSRR) 2018
3. Maurer, Markus, et al. *Autonomous driving: technical, legal and social aspects*. Springer Nature, 2016.
4. Shaoshan Liu, "Engineering Autonomous Vehicles and Robots: The DragonFly Modular-based Approach" John Wiley & Sons, 11-May-2020
5. Alex Salkever, Vivek Wadhwa, The Driver in the Driverless Car: How Our Technology Choices Will Create the Future, Berrett-Koehler Publishers, 2017

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2. https://www.vtpi.org/avip.pdf

COs/POs/PSOs Mapping

	Program Outcomes (POs)						Program Specific Outcomes (PSOs)		
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CO2	2	3	2	1	-	-	1	-	2
CO3	2	3	2	1	-	-	1	-	2
CO4	3	3	3	3	2	-	3	2	3
CO5	3	3	3	3	3	-	3	3	3

Correlation Level: 1-Low, 2-Medium, 3-High

P20NWE318	HUMAN COMPUTER INTERACTION	L	T	P	C	Hrs
		3	0	0	3	45

Course Objectives
- To learn the basic concepts human computer interaction
- To expose design process of human computer interaction
- To grasp models and theories of human computer interaction
- To learn interaction styles of human interaction
- To learn the design issues of human interaction

Course Outcomes
After completion of the course, the students will be able to
   CO1 - Illustrate the basic concepts of human computer interaction. **(K2)**
   CO2 - Describe the design of human computer interaction. **(K2)**
   CO3 - Analyze the models and theories of human computer interaction. **(K4)**
   CO4 - Analyze the interaction styles of human interaction. **(K4)**
   CO5 - Evaluate design issues of human interaction. **(K4)**

UNIT I   INTRODUCTION   (9 Hrs)
Introduction The human- The computer-The interaction-Paradigms- Usability of Interactive Systems-Guidelines- Principle and Theories

UNIT II   THE DESIGN PROCESS   (9 Hrs)
Design Process- Interaction design basics- HCI in the software process- Design rules-Implementation support, Evaluation techniques- Universal design- User support

UNIT III   MODELS AND THEORIES   (9 Hrs)
Models and Theories Cognitive models- Socio-organizational issues and stakeholder requirements- Communication and collaboration models-Task analysis-Dialogue notations and design- Models of the system- Modelling rich interaction

UNIT IV   INTERACTION STYLES   (9 Hrs)
Interaction Styles- Direct Manipulation and Virtual Environments, Menu Selection, Form Filling and Dialog Boxes, Command and Natural Languages, Interaction Devices, Collaboration and Social Media Participation

UNIT V   DESIGN ISSUES   (9 Hrs)
Design Issues- Quality of Service- Balancing Function and Fashion- User Documentation and Online Help- Information Search,-Information Visualization

Text books
1. Alan Dix , Janet Finlay ,"Human Computer Interaction" , Pearson Education ,2004
2. Ben Shneiderman ,"Designing the User Interface - Strategies for Effective Human Computer Interaction", Pearson Education ,2010.
3. NElla Hassianien, A &Azar.A.T (Editors), —Brain-Computer Interfaces Current Trends and Applicationsll, Springer, 2015

Reference books
1. Rosson, M. andCarroll ,"Usability Engineering: Scenario-Based Development of Human-Computer Interaction ,2002
2. Nielsen, J. Morgan Kaufmann, "Usability Engineering", 1993.
3. Heim, S ,"The Resonant Interface: HCI Foundations for Interaction Design" , Addison-Wesley,2007
4. Rosson, M.B &Carroll, J.M. , Morgan Kaufman ,"Usability engineering: scenario-based development of human-computer interaction", 2002
5. Andrew Webb, "Statistical Pattern Recognition", Wiley International, Second Edition, 2002

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2. http://www. entsci.gatech.edu › hcc1
3. http://www. slideshare.net › soniasousa › hcc-introduction
4. https://www.interaction-design.org/literature/topics/human-computer-interaction

COs/POs/PSOs Mapping

	Program Outcomes (POs)						Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3
CO1	2	3	2	1	-	-	1	-	2
CO2	2	3	2	1	-	-	1	-	2
CO3	3	3	3	3	2	-	3	2	3
CO4	3	3	3	3	2	-	3	2	3
CO5	3	3	3	3	2	-	3	2	3

Correlation Level: 1-Low, 2-Medium, 3-High

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P20NWE319	SMART SENSORS AND INTERNET OF THINGS	L	T	P	C	Hrs
		3	0	0	3	45

Course Objectives
- To understand the need of IoT.
- To understand the application areas of IoT
- To realize the revolution of Internet in Mobile Devices, Cloud & Sensor Networks
- To understand building blocks of Internet of Things and characteristics.
- To understand the challenges and trends in IoT

Course Outcomes
After completion of the course, the students will be able to
CO1 -- Explore the vision of IoT from a global context. **(K2)**
CO2 – Determine the Market perspective of IoT. **(K2)**
CO3 – Outline the use of Devices, Gateways and Data Management in IoT. **(K2)**
CO4 – Analyze the architecture of various smart sensors. **(K4)**
CO5 – Build state of the art IoT architecture for a rteal time application. **(K5)**

UNIT I   INTRODUCTION   (9 Hrs)
Environmental Parameters Measurement and Monitoring: Why measurement and monitoring are important- effects of adverse parameters for the living being for IOT

UNIT II SENSORS   (9 Hrs)
Working Principles: Different types; Selection of Sensors for Practical Applications Introduction of Different Types of Sensors such as Capacitive- Resistive- Surface Acoustic Wave for Temperature- Pressure- Humidity- Toxic Gas etc

UNIT III ADOPTION OF SMART SENSORS   (9 Hrs)
Determination of the Characteristics Fractional order element: Constant Phase Impedance for sensing applications such as humidity, water quality, milk quality Impedance Spectroscopy: Equivalent circuit of Sensors and Modelling of Sensors

UNIT IV   ARCHITECTURE OF SMART SENSORS   (9 Hrs)
Important components, their features Fabrication of Sensor and Smart Sensor: Electrode fabrication: Screen printing, Photolithography, Electroplating Sensing film deposition: Physical and chemical Vapor, Anodization, Sol-gel

UNIT V CASE STUDY   (9 Hrs)
Interface Electronic Circuit for Smart Sensors and Challenges for Interfacing the Smart Sensor- Usefulness of Silicon Technology in Smart Sensor And Future scope of research in smart sensor- Recent trends in smart sensor for day to day life, evolving sensors and their architecture.

Text books
1. Yasuura, H., Kyung, C.-M., Liu, Y., Lin, Y.-L., Smart Sensors at the IoT Frontier, Springer International Publishing
2. ArshdeepBahga, Vijay Madisetti, "Internet of Things, A Hands -on Approach", 1st Edition 2015, University Press, ISBN: 978-81-7371- 954-7
3. Oliver Hersent, David Boswarthick, Omar Elloumy, "The Internet of Things",1st Edition, 2017,ISBN: 978-81-265-5686-1

Reference Books
1. Kyung, C.-M., Yasuura, H., Liu, Y., Lin, Y.-L., Smart Sensors and Systems, Springer International Publishing
2. ArshdeepBahga, Vijay Madisetti, "Internet of Things, A Hands -on Approach", 1st Edition 2015, University Press, ISBN: 978-81-7371- 954-7

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3. Oliver Hersent, David Boswarthick, Omar Elloumy, "The Internet of Things",1st Edition, 2017,ISBN: 978-81- 265-5686-1
4. Dieter Uckelmann, Mark Harrison, Florian Michahelles, —"Architecting the Internet of Things", Springer, 2011.
5. Donald Norris,"The Internet of Things: Do-It-Yourself at Home Projects for Arduino, Raspberry Pi and BeagleBone Black", Mc.Graw Hill, 2015.

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1. https:\\www.abouttheInternetofThings.com
2. https://www.ibm.com/blogs/internet-of-things/what-is-the-iot/
3. https://www.ericsson.com/en/internet-of-things
4. https://aws.amazon.com/iot
5. https://www.mendix.com/examples-of-iot-applications/

COs/POs/PSOs Mapping

	Program Outcomes (POs)						Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3
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CO2	2	3	2	1	-	-	1	-	2
CO3	2	3	2	1	-	-	1	-	2
CO4	3	3	3	3	2	-	3	2	3
CO5	3	3	3	3	3	-	3	3	3

Correlation Level: 1-Low, 2-Medium, 3-High

M.Tech. Networking

	L	T	P	C	Hrs
P20NWE320 **MULTICORE ARCHITECTURE**	3	0	0	3	45

Course Objectives
- To understand the need for Multi-core processors
- To learn the parallel program challenges
- To understand shared memory programming with OPENMP
- To learn about distributed memory programming with MPI.
- To understand parallel program development.

Course Outcomes
After completion of the course, the students will be able to
  CO1 - Illustrate the need of Multi-core processors. **(K2)**
  CO2 - Explore the challenges in parallel program challenges. **(K2)**
  CO3 - Explain shared memory programming with OPENMP. **(K2)**
  CO4 - Apply distributed memory programming with MPI. **(K3)**
  CO5 - Develop a case study for parallel programming. **(K5)**

UNIT I   MULTI-CORE PROCESSORS   (9 Hrs)
Single core to Multi-core architectures – SIMD and MIMD systems – Interconnection networks - Symmetric and Distributed Shared Memory Architectures – Cache coherence - Performance Issues – Parallel program design.

UNIT II   PARALLEL PROGRAM CHALLENGES   (9 Hrs)
Performance – Scalability – Synchronization and data sharing – Data races – Synchronization primitives mutexes, locks, semaphores, barriers – deadlocks and livelocks – communication between threads condition variables, signals, message queues and pipes).

UNIT III SHARED MEMORY PROGRAMMING WITH OpenMP   (9 Hrs)
OpenMP Execution Model – Memory Model – OpenMP Directives – Work-sharing Constructs - Library functionsb– Handling Data and Functional Parallelism –Handling Loops - Performance Considerations.

UNIT IV DISTRIBUTED MEMORY PROGRAMMING WITH MPI   (9 Hrs)
MPI program execution – MPI constructs – libraries – MPI send and receive – Point-to-point and Collective communication–MPI derived datatype Performance evaluation

UNIT V   PARALLEL PROGRAM DEVELOPMENT   (9 Hrs)
Case studies - n-Body solvers – Tree Search – OpenMP and MPI implementations and comparison.

Text books
1. Yan Solihin," Fundamentals of Parallel Multicore Architecture ",Chapman & Hall/CRC Computational Science.
2. Rajeev Balasubramonian, Norman P. Jouppi, and Naveen Muralimanohar, Multi-Core Cache Hierarchies, Morgan & Claypool Publishers, 2011
3. Patrick Stakem," Multicore Computer Architectures *Volume 11 of Computer Architecture Series* Independently Published, 2017

Reference books
1. SanguthevarRajasekaran,Lance Fiondella,Mohamed Ahmed,RedaA.Ammar," Multicore Computing Algorithms, Architectures, and Applications"
2. James R. Larus and Ravi Rajwar, Transactional Memory, Morgan & Claypool Publishers, 2007
3. David B. Kirk, Wen-mei W. Hwu, Programming Massively Parallel Processors: A Hands-on Approach, 2010
4. Peter and Pach Eco, An Introduction to Parallel Programming, Elsevier, 2011

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5. Barbara Chapman, F. Desprez, Gerhard R. Joubert, Alain Lichnewsky, Frans Peters Parallel Computing: From Multicores and GPU's to Petascale, 2010

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2. http://www.cs.iit.edu/~virgil/cs470/Book/
3. https://www.embedded.com/high-performance-embedded-computing-multiprocessor-and-multicore-architectures/
4. http://accel.cs.vt.edu/files/lecture2.pdf
5. http://www.cs.umd.edu/~meesh/411/CA-online/chapter/case-studies-of-multicore-architectures-i/index.html

COs/POs/PSOs Mapping

	Program Outcomes (POs)						Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3
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CO2	2	3	2	1	-	-	1	-	2
CO3	2	3	2	1	-	-	1	-	2
CO4	3	3	3	2	1	-	2	1	3
CO5	3	3	3	3	3	-	3	3	3

Correlation Level: 1-Low, 2-Medium, 3-High

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P20NWE321	INFORMATION SECURITY AND RISK MANAGEMENT	L	T	P	C	Hrs
		3	0	0	3	45

Course Objectives

-
- To understand basis of Risks
- To Learn Risk Management Cycle
- To study Security policies and How to apply it
- To learn systems design process, and life cycle security management of information systems.
- To grasp Contingency Planning

Course Outcomes

After completion of the course, the students will be able to

CO1 - Identifying and categorizing risks. **(K2)**
CO2 - Implement Risk Management Cycle. **(K3)**
CO3 - Explore the purpose of security policies. **(K2)**
CO4 - Deploy security management systems. **(K4)**
CO5 - Implement Contingency Planning. **(K3)**

UNIT I RISK I   (9 Hrs)

Identifying and categorizing risks: Risk Management – Risk Identification – Risk Assessment - Documenting the Results

UNIT II RISK II   (9 Hrs)

Risk Management: Introduction – Control Strategies – Managing Risk – Feasibility and Cost Benefit Analysis – Risk Control Practices.

UNIT III POLICY   (9 Hrs)

Security Policy: Purpose of security policies -Enterprise Information – Issue Specific – System Specific – Guidelines.

UNIT IV MANAGEMENT OF DEPLOYED SYSTEMS   (9 Hrs)

Organizing For Security - Within an Organization – Components – Security Roles- Education – Training and Awareness – Security Management Models: Access Control – Architecture Models – Management Models - Benchmarking – Performance Measures.

UNIT V INSTRUCTIONAL ACTIVITY   (9 Hrs)

Fundamentals - Components: Business Impact - Incident Response - Disaster Recovery – Business Continuity - Timing and Sequence - Crisis Management - Business Resumption Planning – Testing Contingency Planning.

Text Books

1. Michael E. Whitman and Herbert J. Mattord, "Management of Information Security" Cengage Learning Second edition,2013
2. Ross Anderson,"Security Engineering", John Wiley & Sons, Second edition, 2008.
3. Thomas R. Peltier Information Security Policies, Procedures, and Standards: Guidelines for Effective Information Security Management", CRC Press, 2016

Reference Books

1. Evan Wheeler,"Security Risk Management: Building an Information Security Risk Management Program from the Ground Up" Elsevier, 2011
2. Jill Slay, Andy Koronios," Information Technology Security & Risk Management", John Wiley & Sons,2007
3. Manish Agarwal, Alex Campoe,Eric Pierce"Information Security and IT Risk Management", Second Edition,John Wiley and Sons, Incorporated, 2014
4. Robert Johnson, "Security Policies and Implementation Issues", Second Edition, Jones & Bartlett Publishers, 2014.
5. Jack Freund,Jack Jones,"Measuring and Managing Information Risk", Elsevier Science , August 2014

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2. https://blog.netwrix.com/2018/08/02/how-to-create-an-effective-information-security-risk-management
3. https://docs.microsoft.com/en-us/power-platform/admin/security-roles-privileges
4. https://www.youtube.com/watch?v=GW1qmSOhEJk
5. https://www2.deloitte.com/content/dam/Deloitte/global/Documents/Risk/gx-cm-cyber-pov.pdf

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)						Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3
CO1	2	3	2	1	-	-	1	-	2
CO2	3	3	3	2	1	-	2	1	3
CO3	2	3	2	1	-	-	1	-	2
CO4	3	3	3	3	2	-	3	2	3
CO5	3	3	3	2	1	-	2	1	3

Correlation Level: 1-Low, 2-Medium, 3-High

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	L	T	P	C	Hrs
P20NWE322 MULTIMEDIA SECURITY & FORENSICS	3	0	0	3	45

- Understand the basis of Digital Watermarking
- How to Design a Good Digital Watermark.
- Study Image Watermarking Video Watermarking Audio Watermarking. And 3D water mark
- Grasp Digital Watermarking Protocols and how it works
- Grasp about Cryptography and Multimedia Encryption

Course Outcomes
After completion of the course, the students will be able to
CO1 - Explore the basic knowledge of Digital Watermarking. **(K2)**
CO2 - Gain hands-on experience in Design a Good Digital Watermark. **(K5)**
CO3 - Implement Image ,Video and Audio Watermarking. And 3D water mark **(K3)**
CO4 - Explain Digital Watermarking Protocols and how it works. **(K2)**
CO5 - Explain Cryptography and Multimedia Encryption. **(K2)**

UNIT I DIGITAL WATERMARKING   (9 Hrs)
Digital Watermarking Basics Models of Watermarking Basic Message Coding Error Correction Coding ,Digital Watermarking and Digital Communications: Mutual Information and Channel Capacity.

UNIT II DESIGNING DIGITAL WATERMARK   (9 Hrs)
How to Design a Good Digital Watermark Spread Spectrum Watermarking Block DCT-domain Watermarking Watermarking with Side-Information (Dirty-paper Coding) Improved Spread Spectrum Watermarking Affine-Resistant Watermarking.

UNIT III MEDIA SPECIFIC DIGITAL WATERMARKING   (9 Hrs)
Image Watermarking Video Watermarking Audio Watermarking- Watermarking for CG-models watermarking for Binary Images Watermarking for 3D Contents Data Hiding through watermarking techniques.

UNIT IV DIGITAL WATERMARKING PROTOCOLS   (9 Hrs)
A Buyer-Seller Watermarking Protocol an Efficient and Anonymous Buyer-Seller Watermarking Protocol Extensions of Watermarking Protocols for Secure Computation.

UNIT V INSTRUCTIONAL ACTIVITY   (9 Hrs)
Introduction to Cryptography Multimedia Processing in the Encryption Domain Privacy preserving Information Processing , Information Theory and Digital Forensics Forgeries Detection A new ways for making Forgeries.

Text Books
1. Cox, Miller, Bloom, Fridrich, and Kalker," Digital Watermarking and Steganography",Morgan Kaufmann 2nd Edition, 2008
2. BorkoFurht,DarkoKirovski,"Multimedia Security Handbook", CRC Press, 2004
3. Aboul Ella Hassanien,Mohamed Mostafa Fouad,Mazdak Zamani,"Multimedia Forensics and Security", Springer; 1st edition, October 2016

Reference Books
1. WenjunZeng, Heather Yu, Ching-Yung Lin,Multimedia Security Technologies for Digital Rights Management, Elsevier, 2006
2. Al-Haj, Ali Mohammad ,"Advanced Techniques in Multimedia Watermarking: Image, Video and Audio Applications.
3. Xiaodong Lin,"Introductory Computer Forensics",Springer; 1st edition, November 2018.
4. Frank Y. Shih,"Multimedia Security: Watermarking, Steganography, and Forensics" 1st Edition, Kindle Edition CRC Press , August 2012
5. Anthony T. S. Ho, Shujun Li , "Handbook of Digital Forensics of Multimedia Data and Devices ",1st Edition, Wiley-IEEE Press,August 2015

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1. https://link.springer.com/book/10.1007/978-3-319-44270-9
2. https://www.nist.gov/topics/forensic-science/digital-and-multimedia-evidence
3. https://www.sciencedirect.com/science/article/abs/pii/S0923596502001443
4. https://ieeexplore.ieee.org/document/736467.
5. https://link.springer.com/chapter/10.1007/978-3-642-02900-4_16.

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)						Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3
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CO3	3	3	3	2	1	-	2	1	3
CO4	2	3	2	1	-	-	1	-	2
CO5	2	3	2	1	-	-	1	-	2

Correlation Level: 1-Low, 2-Medium, 3-High

P20NWE323	SECURITY IN CLOUD COMPUTING	L	T	P	C	Hrs
		3	0	0	3	45

- Understand the Architectural Concepts of cloud computing
- Assess the Data Classification and Security
- Evaluate the Responsibilities and Application Security
- Understand the Operations Appraise compliance issues that arise from cloud computing
- Study Legal and Compliance Issues

Course Outcomes

After completion of the course, the students will be able to

CO1 - Compare modern security concepts as they are applied to cloud computing. **(K2)**
CO2 - Design the security of virtual systems. **(K5)**
CO3 - Analyze the security issues related to multi-tenancy. **(K4)**
CO4 - Implement the Operations Appraise compliance issues that arise from cloud computing. **(K3)**
CO5 - Explore various Legal and Compliance Issues. **(K2)**

UNIT I ARCHITECTURAL CONCEPTS   (9 Hrs)

Business Requirements - Cloud Evolution, Vernacular, and Definitions - Roles and Responsibilities - Definitions - Foundational Concepts - Business Requirements Analysis - Boundaries of Cloud Models - Protecting Sensitive Data.

UNIT II DATA CLASSIFICATION AND SECURITY   (9 Hrs)

Data Inventory and Discovery - Jurisdictional Requirements - Data Rights Management - Cloud Data Life Cycle - Cloud Storage - Cloud Data Security Foundational Strategies - Security in the Cloud - Virtualization - Cloud Attack Surface - Disaster Recovery (DR).

UNIT III RESPONSIBILITIES AND APPLICATION SECURITY   (9 Hrs)

Foundations of Managed Services - Business Requirements - Shared Responsibilities by Service Type - Shared Administration of OS - Share Responsibilities - Lack of Physical Access - Training and Awareness - Common Cloud Application Deployment Pitfalls – Cloud SDLC - 148 ISO/IEC 27034-1 - Cloud Application Architecture - Assurance and Validation.

UNIT IV OPERATIONS   (9 Hrs)

Physical/Logical - Security Training and Awareness - Basic Operational Application Security - Monitoring, Capacity, and Maintenance - Change and Configuration - Business Continuity and Disaster.

UNIT V INSTRUCTIONAL ACTIVITY   (9 Hrs)

Legal Requirements and Unique Risks in the Cloud Environment Potential Personal and Data Privacy Issues in the Cloud Environment Audit Processes, Methodologies, and Cloud - The Impact of Diverse Geographical Locations and Legal Jurisdictions - Business Requirements - Cloud Contract Design and Management for Outsourcing

Text Books

1. Brian T. O"Hara , "Certified Cloud Security Professional" John Wiley & Sons, 2017
2. Ronald L. Krutz, Russell Dean Vines, "Cloud Security" , Wiley, 2010.
3. Charles P. Pfleeger ,Shari Lawrence Pfleeger, "Security in Computing", 5th Edition , Pearson India, October 2018.

Reference Books

1. Anthony T.Velte, Toby J.Velte and Robert E, "Cloud Computing – A Practical Approach", TMH , 2010
2. John W. Rittinghouse, James F.Ransome ,"Cloud Computing: Implementation, Management and Security" , CRC Press, ,2012.
3. Despotov,Zraki,Marijana, "Handbook of Research on High Performance and Cloud Computing in

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Scientific Research and Education" IGI Global, 2014

4. Ryan Ko, Raymond Choo," The Cloud Security Ecosystem: Technical, Legal, Business and Management Issues" Syngress, 2015.

5. Theo Lynn ,John G. Mooney , Lisa van der Werff , "Data Privacy and Trust in Cloud Computing: Building trust in the cloud through assurance and accountability " , 1st edition. Palgrave Macmillan, October 2020.

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1. https://www.omg.org/cloud/deliverables/CSCC-Security-for-Cloud-Computing-10-Steps-to-Ensure-Success.pdf
2. https://tsapps.nist.gov/publication/get_pdf.cfm?pub_id=919233.
3. https://www.sciencedirect.com/science/article/abs/pii/S0167739X16303788.
4. https://www.researchgate.net/publication/272797948_Addressing_Security_and_Privacy_Issues_in _Cloud_Computing.
5. https://www.researchgate.net/publication/221613317_Contract-based_cloud_architecture

COs/POs/PSOs Mapping

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CO5	2	3	2	1	-	-	1	-	2

Correlation Level: 1-Low, 2-Medium, 3-High

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Academic curriculum and syllabi R-2020

P20NWE324	CYBER LAWS AND SECURITY POLICIES	L	T	P	C	Hrs
		3	0	0	3	45

- To learn the basic information on cyber security.
- To understand the issues those are specific to amendment rights.
- To have knowledge on copy right issues of software's.
- To understand ethical laws of computer for different countries.
- To evaluate Case Studies in Security Policy

Course Outcomes

After completion of the course, the students will be able to

CO1 - Explain the basic information on cyber security. **(K2)**
CO2 - Analyze the issues those are specific to amendment rights. **(K4)**
CO3 - Outline copy right issues of software. **(K2)**
CO4 - Evaluate the ethical laws of computer for different countries. **(K4)**
CO5 - Analyze case studies in Security Policy. **(K4)**

UNIT I INTRODUCTION   (9 Hrs)

Cyber Security and its problem-Intervention Strategies: Redundancy, Diversity and Autarchy.

UNIT II PRIVATE ORDERING SOLUTIONS   (9 Hrs)

Regulation and Jurisdiction for global Cyber security - Copy Right source of risks – Pirates- Internet Infringement - Fair Use – postings - criminal liability - First Amendments - Data Losing.

UNIT III COPY RIGHT   (9 Hrs)

Source of risks – Trademarks – Defamation - Privacy-Common Law Privacy - Constitutional law - Federal Statutes – Anonymity - Technology expanding privacy rights

UNIT IV DUTY OF CARE AND ETHICS   (9 Hrs)

Criminal Liability - Procedural issues- Electronic Contracts & Digital Signatures- Misappropriation of information - Civil Rights, Tax, Evidence- Legal Developments, Late 1990 to early 1966, Cyber security in Society, Security in cyber laws case studies, General Law and Cyber Law-a Swift Analysis.

UNIT V INSTRUCTIONAL ACTIVITY   (9 Hrs)

Indian National Cyber Security Policy-2013 – UK National Cyber Security Strategy 2016 to 2021 – US Cyber Security Policy.

Text Books

1. Jonathan Rosenoer,"Cyber Law: The law of the Internet", Springer-Verlag, 1997
2. Mark F Grady, FransescoParisi, "The Law and Economics of Cyber Security", Cambridge University Press, 2006

Reference Books

1. SunitBelapure Nina Godbole, " Cyber Security: Understanding Cyber Crimes, Computer Forensics And Legal Perspectives", Wiley India Pvt Ltd, 2011.
2. Jeff Kosseff , "Cybersecurity Law" , 2nd Edition, Wiley, 2nd edition ,November, 2019)
3. Amos N. Guiora , "Cybersecurity", 1st Edition , Routledge, March 2017.
4. Douglas J. Landoll   , "Information Security Policies, Procedures, and Standards: A Practitioner's Reference", 1st Edition, Auerbach Publications,September 2020
5. Yuri Diogenes, Erdal Ozkaya, "Cybersecurity – Attack and Defense Strategies, 2nd Edition, Packt Publishing,December 2019

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2. https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/567242/national_cyber_security_strategy_2016.pdf
3. http://meity.gov.in/sites/upload_files/dit/files/National%20Cyber%20Security%20Policy%20%281%29.pdf
4. https://iclg.com/practice-areas/cybersecurity-laws-and-regulations
5. https://www.securityroundtable.org/global-model-uks-national-cyber-security-strategy/

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COs/POs/PSOs Mapping

COs	Program Outcomes (POs)						Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3
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CO5	3	3	3	3	2	-	3	2	3

Correlation Level: 1-Low, 2-Medium, 3-High

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	L	T	P	C	Hrs
P20NWE325 **DIGITAL FORENSICS**	3	0	0	3	45

- Learn the security issues of network layer and transport layer
- Be exposed to security issues of the application layer
- Learn computer forensics
- Be familiar with forensics tools
- Learn to analyses and validate forensics data

Course Outcomes
After completion of the course, the students will be able to
CO1 - Explore the security issues of network layer and transport layer. **(K2)**
CO2 - Analyze various network and email attacks. **(K4)**
CO3 - Elucidate forensic investigation. **(K2)**
CO4 - Use forensic tools and collect evidences of a computer crime. **(K3)**
CO5 - Analyze and validate Forensic data. **(K24**

UNIT I NETWORK LAYER SECURITY &TRANSPORT LAYER SECURITY   (9 Hrs)
IPSec Protocol - IP Authentication Header - IP ESP - Key Management Protocol for IPSec. Transport layer Security: SSL protocol, Cryptographic Computations – TLS Protocol.

UNIT II E-MAIL SECURITY & FIREWALLS   (9 Hrs)
S/MIME - Internet Firewalls for Trusted System: Roles of Firewalls – Firewall related terminology-Types of Firewalls - Firewall designs - SET for E-Commerce Transactions.

UNIT III INTRODUCTION TO COMPUTER FORENSICS   (9 Hrs)
Introduction to Traditional Computer Crime, Traditional problems associated with Computer Crime. Introduction to Identity Theft & Identity Fraud. Types of CF techniques - Incident and incident response methodology - Forensic duplication and investigation. Preparation for IR: Creating response tool kit and IR team. - Forensics Technology and Systems - Understanding Computer Investigation – Data Acquisition.

UNIT IV EVIDENCE COLLECTION AND FORENSICS TOOLS   (9 Hrs)
Processing Crime and Incident Scenes – Working with Windows and DOS Systems. Current Computer Forensics Tools: Software/ Hardware Tools.

UNIT V INSTRUCTIONAL ACTIVITY   (9 Hrs)
Validating Forensics Data – Data Hiding Techniques – Performing Remote Acquisition – Network Forensics – Email Investigations – Cell Phone and Mobile Devices Forensics.

Text Books
1. John Sammons ,"The Basics of Digital Forensics: The Primer for Getting Started in Digital Forensics " 2nd Edition, Syngress , December 2014.
2. Bill Nelson, Christopher Steuart, Amelia Philips, "Computer Forensics and Investigations", Delmar Cengage Learning; 5th edition January 2015
3. Chuck Eastom, "Certified Cyber Forensics Professional Certification:, McGraw Hill, July 2017

Reference Books
1. MarjieT.Britz, "Computer Forensics and Cyber Crime": An Introduction", 3rd Edition, Prentice Hall, 2013.
2. John R.Vacca, "Computer Forensics: Computer Crime Scene Investigation", Laxmi Publications, 2015
3. Xiaodong Lin,"Introductory Computer Forensics",Springer; 1st edition, November 2018.
4. Anthony T. S. Ho, Shujun Li , "Handbook of Digital Forensics of Multimedia Data and Devices ",1st Edition, Wiley-IEEE Press,August 2015.
5. Richard Boddington ,"Practical Digital Forensics", Packt Publishing, May 2016.

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1. https://www.nist.gov/programs-projects/digital-forensics
2. https://www.open.edu/openlearn/science-maths-technology/digital-forensics
3. https://www.guru99.com/computer-forensics-tools.html.
4. https://www.sciencedirect.com/topics/computer-science/network-forensics.
5. https://www.researchgate.net/project/Data-hiding-Techniques-and-Forensics-Tools

COs/POs/PSOs Mapping

COs	Program Outcomes (POs)						Program Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3
CO1	2	3	2	1	-	-	1	-	2
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CO3	2	3	2	1	-	-	1	-	2
CO4	3	3	3	2	1	-	2	1	3
CO5	3	3	3	3	2	-	3	2	3

Correlation Level: 1-Low, 2-Medium, 3-High

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P20NWE326	ETHICAL HACKING	L	T	P	C	Hrs
		3	0	0	3	45

- To explore the concepts of security testing and the knowledge required to protect against the hacker and attackers.
- To understand reconnaissance and the publicly available tools used to gather information on potential targets.
- To discover the scanning techniques used to identify network systems open ports.
- To identify network system vulnerabilities and confirm their exploitability.
- To explore techniques for identifying web application vulnerabilities and attacks

Course Outcomes

After completion of the course, the students will be able to

CO1 - Explain the need for security. **(K2)**

CO2 - Use appropriate foot printing to collect information about an incident. **(K3)**

CO3 - Explore various types of attacks. **(K2)**

CO4 - Analyze various Web application vulnerabilities. **(K4)**

CO5 - Demonstrate ethical hacking in WLAN. **(K3)**

UNIT I IMPORTANCE OF SECURITY   (9 Hrs)

Understanding the importance of security, Concept of ethical hacking and essential TerminologiesThreat, Attack, Vulnerabilities, Target of Evaluation, Exploit. Phases involved in hacking

UNIT II FOOTPRINTING   (9 Hrs)

Introduction to foot printing, Understanding the information gathering methodology of the hackers,Tools used for the reconnaissance phase.Port Scanning - Introduction, using port scanning tools, ping sweeps, Scripting Enumeration-Introduction, Enumerating windows OS & Linux OS.

UNIT III ATTACKS   (9 Hrs)

Aspect of remote password guessing, Role of eavesdropping ,Various methods of password cracking, Keystroke Loggers, Understanding Sniffers ,Comprehending Active and Passive Sniffing, ARP Spoofing and Redirection, DNS and IP Sniffing, HTTPS Sniffing.

UNIT IV WEB APPLICATION VULNERABILITIES   (9 Hrs)

Web application vulnerabilities, application coding errors, SQL injection into Back-end Databases, cross-site scripting, cross-site request forging, authentication bypass, web services and related flaws, protective http headers Understanding Session Hijacking, Phases involved in Session Hijacking,Types of Session Hijacking, Session Hijacking Tools.

UNIT V HACKING IN WIRELESS WNVIRONMENT   (9 Hrs)

Introduction to 802.11, Role of WEP, Cracking WEP Keys, Sniffing Traffic,Wireless DOS attacks, WLAN Scanners, WLAN Sniffers, Hacking Tools, Securing Wireless Networks.

Text Books

1. Kevin Mandia, Jason T. Luttgens, Matthew Pepe, "Incident Response and Computer Forensics", 3 rd. Edition Tata McGraw-Hill, 2014.
2. Bill Nelson, Amelia Philips, Christopher Steuart, "Guide to Computer Forensics and Investigations", 6th Edition Cengage Learning, 2018
3. Jon Erickson ,"Hacking: The Art of Exploitation", No Starch Press; 2nd edition 2008

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Reference Books

1. John R. Vacca, "Computer Forensics", Firewall Media, 2009. 3. RafayBaloch, "Ethical Hacking and Penetration Testing Guide", Auerbach Publications, First Edition, 2014
2. Michael T. Simpson and Nicholas Antill ," Hands-On Ethical Hacking and Network Defense",Course Technology PTR; 1st edition, 2012
3. Dafydd Stuttard, Marcus Pinto," The Web Application Hacker's Handbook Discovering and Exploiting Security Flaws " · Wiley 2011
4. Patrick Engebretson ," The Basics of Hacking and Penetration Testing Ethical Hacking and Penetration Testing Made Easy", Elsevier Science 2013
5. Harsha Bothra,"Hacking – Be a hacker with ethics",Khanna book publishing First edition 2016

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1. https://swayam.gov.in/nd1_noc19_cs68/preview
2. https://www.tutorialspoint.com/ethical_hacking/index.htm
3. https://www.reed.co.uk/courses/ethical-hacking/online
4. https://www.simplilearn.com/tutorials/cyber-security-tutorial/what-is-ethical-hacking
5. https://www.veracode.com/security/ethical-hacking

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CO5	3	3	3	2	1	-	2	1	3

Correlation Level: 1-Low, 2-Medium, 3-High

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P20NWE327	INTRUSION DETECTION SYSTEMS AND PREVENTION	L	T	P	C	Hrs
		3	0	0	3	45

- Understand when, where, how, and why to apply Intrusion Detection tools and techniques in order to improve the security posture of an enterprise.
- Apply knowledge of the fundamentals and history of Intrusion Detection
- Understand intrusion prevention system and snort
- Avoid common pitfalls in the creation and evaluation of new Intrusion Detection Systems
- Analyse intrusion detection alerts and logs to distinguish attack types from false alarms

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

CO1 - Explain the basics of intrusion detection system. **(K2)**

CO2 - Analyze the intrusion prevention system and work with Snort. **(K3)**

CO3 - Extrapolate with the Snort rules. **(K3)**

CO4 - Evaluate the various types of firewalls. **(K4)**

CO5 - Design and develop firewall for a network. **(K5)**

UNIT I HISTORY OF INTRUSION DETECTION   (9 Hrs)
Audit, Concept and definition, Internal and external threats to data, attacks, Need and types of IDS, Information sources Host based information sources, Network based information sources.

UNIT II INTRUSION PREVENTION SYSTEM AND SNORT   (9 Hrs)
Network IDs protocol based IDs, Hybrid IDs, Analysis schemes, thinking about intrusion. A model for intrusion analysis- Incident Responses – Incident Response Process – IDS ad IPS response Phases Forensics –Corporate Issues - Snort Installation Scenarios, Installing Snort, Running Snort on Multiple Network Interfaces, Snort Command Line Options. Step-By-Step Procedure to Compile and Install Snort Location of Snort Files, Snort Modes Snort Alert Modes

UNIT III SNORT RULES AND ACID   (9 Hrs)
Rule Headers, Rule Options, the Snort Configuration File etc. Plugins, Pre-processors and Output Modules, Using Snort with MySQL - Using ACID and Snort Snarf with Snort -Agent development for intrusion detection - Architecture models of IDs and IPs

UNIT IV FIREWALL INTRODUCTION AND TECHNOLOGIES   (9 Hrs)
Why Internet Firewalls - Internet Services - Security Strategies - Building Firewalls - Packets and Protocols - What Does a Packet Look Like? - IP - Protocols Above IP - Protocols Below IP - Application Layer Protocols - IP Version - Non-IP Protocols - Attacks Based on Low-Level Protocol Details - Firewall Technologies - Some Firewall Definitions - Packet Filtering - Proxy Services - Network Address Translation - Virtual Private Networks

UNIT V INSTRUCTIONAL ACTIVITY   (9 Hrs)
Firewall Architectures - Firewall Design - Packet Filtering - Proxy Systems - Bastion Hosts - UNIX and Linux Bastion Hosts 176 - Windows NT and Windows 2000 Bastion Hosts

Text Books
1. Rafeeq Rehman, " Intrusion Detection with SNORT, Apache, MySQL, PHP and ACID," 1st Edition, Prentice Hall , 2003.
2. Carl Endorf, Eugene Schultz and Jim Mellander "Intrusion Detection & Prevention", 1st Edition, Tata McGraw-Hill, 2004.
3. Elizabeth D. Zwicky, Simon Cooper & D. Brent Chapman, "Building Internet Firewalls" O"Reilly

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Reference Books

1. Christopher Kruegel,FredrikValeur, Giovanni Vigna: "Intrusion Detection and Correlation Challenges and Solutions", 1st Edition, Springer, 2005.

2. Stephen Northcutt, Judy Novak: "Network Intrusion Detection", 3rd Edition, New Riders Publishing, 2002.

3. Ryan Trost ," Practical Intrusion Analysis: Prevention and Detection for the Twenty-First Century ",Addison-Wesley Professional; 1st edition 2009

4. Al-Sakib Khan Pathan," The State of the Art in Intrusion Prevention and Detection",CRC Press 1st edition· 2014

5. Endorf , "Intrusion Detection & Prevention", McGraw-Hill Education (India) Pvt Limited 1st edition 2006

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2. https://www.imperva.com/learn/application-security/intrusion-detection-prevention/
3. https://www.forcepoint.com/cyber-edu/intrusion-prevention-system-ips
4. https://www.sciencedirect.com/topics/computer-science/intrusion-detection-and-prevention
5. https://dl.acm.org/doi/book/10.5555/1658181

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CO4	3	3	3	3	2	-	3	2	3
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Correlation Level: 1-Low, 2-Medium, 3-High

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P20NWE328	SOFTWARE ARCHITECTURES AND DESIGN	L	T	P	C	Hrs
		3	0	0	3	45

Course Objectives

- To understand the need, design approaches for software architecture to bridge the dynamic requirements and implementation.
- To learn the design principles and to apply for large scale systems
- To design architectures for distributed heterogeneous systems ,environment through brokerage interaction
- To build design knowledge on service oriented and model driven architectures and the aspect oriented architecture.
- To develop appropriate architectures for various Case studies like semantic web services, supply chain cloud services.

Course Outcomes

After completion of the course, the students will be able to

CO1 - Explore the need of software architecture for sustainable dynamic systems. **(K2)**
CO2 - Apply design principles for large scale systems. **(K3)**
CO3 - Design architectures for distributed heterogeneous systems. **(K5)**
CO4 - Explain service oriented and model driven architectures and the aspect oriented architecture. **(K2)**
CO5 - Develop appropriate architectures through various case studies. **(K5)**

UNIT I INTRODUCTION   (9 Hrs)

Introduction to Software Architecture - Bridging Requirements and Implementation - Design Guidelines- Software Quality attributes - Software Architecture Design Space - Agile Approach to Software Architecture Design – Models for Software Architecture Description Languages (ADL).

UNIT II DESIGN PRINCIPLES IN LARGE SCALE SYSTEMS   (9 Hrs)

Object-Oriented Paradigm - Design Principles. Data-Centered Software Architecture : Repository Architecture - Blackboard Architecture. Hierarchical Architecture Main-Subroutine - Master-Slave - Layered, Virtual Machine -. Interaction-Oriented Software Architectures: Model-View-Controller (MVC) - Presentation-Abstraction-Control (PAC).

UNIT III ARCHITECTURES FOR DISTRIBUTED HETEROGENEOUS SYSTEMS   (9 Hrs)

Distributed Architecture: Client-Server, Middleware, Multi-tiers, Broker Architecture – MOM,CORBA Message Broker Architecture- Service-Oriented Architecture (SOA), SOAP, UDDI, SOA Implementation in Web Services, Grid/cloud Service Computing. Heterogeneous Architecture- Methodology of Architecture Decision Quality Attributes

UNIT IV SERVICE ORIENTED AND MODEL DRIVEN ARCHITECTURES   (9 Hrs)

Architecture of User Interfaces containers - case study - web service - Product Line Architectures - methodologies, processes and tools - Software Reuse and Product Lines -Product Line Analysis, Design and implementation, configuration Models - Model Driven Architectures (MDA) –why MDA- Model transformation and software architecture - SOA and MDA. Eclipse modeling framework.

UNIT V CASE STUDIES   (9Hrs)

Aspect Oriented Architectures- AOP in UML,AOP tools, Architectural aspects and middleware Selection of Architectures, Evaluation of Architecture Designs, Case Study: Online Computer Vendor, order processing, manufacture &shipping –inventory, supply chain cloud service Management, semantic web services

Text books

1. Ion Gorton,"Essentials of software Architecture", Second Edition, Springer-verlag, 2011
2. Humberto Cervantes, Rick Kazman," Designing Software Architectures: A Practical Approach" Pearson Education 1st edition · 2016

3. Mark Richards, Neal Ford ," Fundamentals of Software Architecture: An Engineering Approach" O'Reilly Media 3rd edition· 2020

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Reference books

1. Kai Qian Jones ,"Software Architecture Design Illuminated", Bartlett Publishers Canada, 2010
2. Mary Shaw, David Garlan," Software Architecture: Perspectives on an Emerging Discipline",Prentice Hall 1st edition ·2000 ·
3. Arthur M. Langer," Analysis and Design of Next-Generation Software Architecture ",Springer International Publishing 1st edition · 2020
1. Len Bass, Paul Clements, Rick Kazman," Software Architecture in Practice", "Pearson Education 3rd edition · 2013
2. Dominic Duggan ," Enterprise Software Architecture and Design - Entities, Services, and Resources", Wiley – 1st edition· 2012

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1. https://www.udacity.com/course/software-architecture-design--ud821
2. http://kti.tugraz.at/staff/rkern/courses/sa
3. https://www.tutorialspoint.com/software_architecture_design/introduction.html
4. https://martinfowler.com/architecture/
5. https://medium.com/better-programming/how-to-design-a-web-application-software-architecture-101-df568b88da76

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Correlation Level: 1-Low, 2-Medium, 3-High

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P20NWE329	STATISTICAL SWITCHING AND MULTIPLEXING	L	T	P	C	Hrs
		3	0	0	3	45

Course Objectives
- To understand basic concepts of Switching and multiplexing.
- To explore different transmission technology.
- To understand the statistical concepts of Electronic Space Division Switching,
- To understand Basic Division Space and Time Switching.
- To understand Network Traffic Engineering

Course Outcomes
After completion of the course, the students will be able to
CO1 -.Illustrate switching and multiplexing. **(K2)**
CO2 - Explore the knowledge about different transmission technology. **(K2)**
CO3 - Demonstrate statistical concepts of Electronic Space Division Switching. **(K3)**
CO4 - Apply Basic Division Space and Time Switching. **(K3)**
CO5 - Analyze Network Traffic for campus network. **(K4)**

UNIT I INTRODUCTION   (9 Hrs)
Evolution of Telecommunication, Simple Telephone Communication, Basics of a Switching System, Manual Switching System, Major Telecommunication Networks. Why Digital: Advantages of Digital Voice Networks, Digital Signal Processing, Disadvantages of Digital Voice Networks.

UNIT II SWITCHING   (9 Hrs)
Crossbar Switching, Principles of Common Control, Touch Tone Dial Telephone, Principles of Crossbar Switching, Crossbar Switch Configurations, Crosspoint Technology, Crossbar Exchange Organization

UNIT III ELECTRONIC SPACE DIVISION SWITCHING   (9 Hrs)
Stored Program Control, Centralized SPC, Distributed SPC, Software Architecture, Application Software, Enhanced Services, Two-stage, Three-stage and n-stage Networks. Digital Transmission and Multiplexing: Sampling, Quantization and Binary Coding, Quantization Noise, Companding, Differential Coding, Vocoders, Pulse Transmission, Line Coding, Time Division Multiplexing.

UNIT IV TIME DIVISION SWITCHING   (9 Hrs)
Basic Division Space and Time Switching, Time Multiplexed Space and Time Switching, Combination Switching, Three-stage and n-stage Combination Switching.

UNIT V TRAFFIC ENGINEERING   (9 Hrs)
Network Traffic Load and Parameters, Grade of Service and Blocking Probability, Modeling Switching Systems, Incoming Traffic and Service Time Characterization, Blocking Models and Loss Estimates, Delay Systems.

Text Books
1. Thiagarajan Viswanathan," Telecommunication Switching Systems and Networks", PHI, 2015.
2. John Edward Flood, "Telecommunications Switching, Traffic and Networks",2016
3. John.C.Bellamy," Digital Telephony" , John Wiley and Sons Inc., 3rd Edition 2012

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Reference Books

1. V.S.Bagad ,"Telecommunication Switching Systems and Networks, Technical Publications, 2009
2. Regis J. Bates, "Optical Switching and Networking Handbook", McGraw-Hill Education 5th edition 2015
3. Itamar Elhanany, Mounir Hamdi "High-performance Packet Switching Architectures ",Springer London 2nd edition · 2006
4. John C. McDonald , "Fundamentals of Digital Switching",Springer 1 st edition · 2013
5. K.Chandrashekhar, "Digital Switching Systems", Technical publications -1st edition - · 2009

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2. http://user.it.uu.se/~carle/Notes/20_Switching_and_Multiplexing.html
3. http://users.ece.northwestern.edu/~rberry/ECE333/Lectures/lec21.pdf
4. https://www.igi-global.com/dictionary/statistical-multiplexing/28237
5. https://www.spiedigitallibrary.org/conference-proceedings-of-spie/4585/0000/Statistical-multiplexing-in-optical-flow-switching-networks/10.1117/12.445187.short?SSO=1

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Correlation Level: 1-Low, 2-Medium, 3-High

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	L	T	P	C	Hrs
P20NWE330 **NETWORK EMBEDDED APPLICATION**	3	0	0	3	45

Course Objectives

- To Understand the basics of networks of embedded system
- To learn the wireless sensor networks and test the networks.
- To automate the network embedded system
- To understand the areas of industrial automation using embedded system.
- To understand the application area of the embedded system

Course Outcomes

After completion of the course, the students will be able to

CO1 - Explore the basics of networked embedded system. **(K2)**
CO2 - Analyze and test various wireless sensor networks. **(K4)**
CO3 - Illustrate automation in networked embedded system. **(K2)**
CO4 - Apply automated networked embedded systems in industrial application. **(K3)**
CO5 - Design wireless embedded network application. **(K5)**

UNIT I   NETWORKED EMBEDDED SYSTEMS   (9 Hrs)

Introduction- Networked Embedded Systems: An Overview -Middleware Design and Implementation for Networked Embedded Systems.

UNIT II WIRELESS SENSOR NETWORKS   (9 Hrs)

Introduction to Wireless Sensor Networks Architectures for Wireless Sensor Networks - Overview of Time Synchronization Issues in Sensor Networks -Resource-Aware Localization in Sensor Networks-Power-Efficient Routing in Wireless Sensor Networks-Energy-Efficient MAC Protocols for Wireless Sensor Networks -Distributed Signal Processing in Sensor Networks-Sensor Network Security-Wireless Sensor Networks Testing and Validation-Developing and Testing of Software for Sensor Networks.

UNIT III AUTOMOTIVE NETWORKED EMBEDDED SYSTEMS   (9 Hrs)

Trends in Automotive Communication Systems-Time-Triggered Communication-Controller Area Network-Flex Ray Communication Technology-The LIN Standard-Standardized Basic System Software for Automotive Applications-Volcano Technology—Enabling Correctness by Design.

UNIT IV NETWORKED EMBEDDED SYSTEMS IN INDUSTRIAL AUTOMATION   (9 Hrs)

Field Area Networks in Industrial Automation-Fieldbus Systems—Embedded Networks for Automation - Real-Time Ethernet for Automation Applications-Configuration and Management of Networked Embedded Devices-Networked Control Systems for Manufacturing: Parameterization, Differentiation, Evaluation, and Application.

UNIT V INSTRUCTIONAL ACTIVITY   (9 Hrs)

Wireless Network Technologies in Industrial Automation-Network-Embedded Systems in Building Automation and Control-Data Communications for Distributed Building Automation.

Text Books

1. R.Zurawski, "Network Embedded Systems- Volume II", CRC press, 2009.
2. Gregory J. Pottie,"Principles of Embedded Networked Systems Design " Cambridge university Press,2005 edition 1
3. Alexander Clemm, Ralf Wolter, Advances in Network-Embedded Management and Applications, Springer US edition 1 2011,

Reference Books

1. Gul N. Khan, Krzysztof Iniewski, "Embedded and Networking Systems: Design, Software, and Implementation ".Taylor & Francis publication 1st edition· 2013
2. Francine Krief ," Communicating Embedded Systems: Networks Applications", Wiley· 1st edition 2013
3. Dimitrios Hristu-Varsakelis, William S. Levine ," Handbook of Networked and Embedded Control Systems ",Birkhäuser Boston publisher 1 st edition · 2007

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4. Olaf Pfeiffer, Andrew Ayre, Christian Keydel ," Embedded Networking with CAN and CAN open", Copperhill Technologies Corporation·1st edition 2008

5. Michel Banatre, Pedro Jose Marron, Anibal Ollero , " Cooperating Embedded Systems and Wireless Sensor Networks" – Wiley 1st edition · 2010

Web References

3. https://swayam.gov.in/nd1_noc20_cs15/preview
4. https://www.isi.gr/research-area/real-time-and-networked-embedded-systems
3. https://referenceglobe.com/knowledge-center/upload-pdf/Shankar_cps08-sss.pdf
4. https://www.w3.org/2014/02/wot/papers/heuer.pdf
5. https://www.intechopen.com › books › networking-applications

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AUDIT COURSES

		L	T	P	C	Hrs
P20ADC101	**ENGLISH FOR RESEARCH PAPER WRITING**	2	0	0	0	30

Course Objectives

- Teach improve writing skills and level of readability.
- Tell about what to write in each section.
- Summarize the skills needed when writing a Title.
- Infer the skills needed when writing the Conclusion.
- Ensure the quality of paper at very first-time submission.

Course Outcomes

After completion of the course, the students will be able to

CO1 - Understand that how to improve your writing skills and level of readability.
CO2 - Learn about what to write in each section.
CO3 - Understand the skills needed when writing a Title.
CO4 - Understand the skills needed when writing the Conclusion.
CO5 - Ensure the good quality of paper at very first-time submission.

UNIT I INTRODUCTION TO RESEARCH PAPER WRITING   (6 Hrs)

Planning and Preparation, Word Order, Breaking up long sentences, Structuring Paragraphs and Sentences, Being Concise and Removing Redundancy, Avoiding Ambiguity and Vagueness.

UNIT II PRESENTATION SKILLS   (6 Hrs)

Clarifying Who Did What, Highlighting Your Findings, Hedging and Criticizing, Paraphrasing and Plagiarism, Sections of a Paper, Abstracts, Introduction.

UNIT III TITLE WRITING SKILLS   (6 Hrs)

Key skills are needed when writing a Title, key skills are needed when writing an Abstract, key skills are needed when writing an Introduction, skills needed when writing a Review of the Literature, Methods, Results, Discussion, Conclusions, The Final Check.

UNIT IV RESULT WRITING SKILLS   (6 Hrs)

Skills are needed when writing the Methods, skills needed when writing the Results, skills are needed when writing the Discussion, skills are needed when writing the Conclusions.

UNIT V VERIFICATION SKILLS   (6 Hrs)

Useful phrases, checking Plagiarism, how to ensure paper is as good as it could possibly be the first- time submission

Reference Books

1. Adrian Wallwork , English for Writing Research Papers, Springer New York Dordrecht Heidelberg London, 2011.
2. Day R How to Write and Publish a Scientific Paper, Cambridge University Press, 2006.
3. Goldbort R Writing for Science, Yale University Press (available on Google Books), 2006.
4. Highman N, Handbook of Writing for the Mathematical Sciences, SIAM. Highman's book, 1998.

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				L	T	P	C	Hrs
P20ADC102		**DISASTER MANAGEMENT**		2	0	0	0	30

Course Objectives
- Summarize basics of disaster explain a critical understanding of key concepts in disaster risk reduction and humanitarian response.
- Illustrate disaster risk reduction and humanitarian response policy and practice from multiple perspectives.
- Describe an understanding of standards of humanitarian response and practical relevance in specific types of disasters and conflict situations.
- Develop the strengths and weaknesses of disaster management approaches.

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

CO1 - Ability to summarize basics of disaster.

CO2 - Ability to explain a critical understanding of key concepts in disaster risk reduction and humanitarian response.

CO3 - Ability to illustrate disaster risk reduction and humanitarian response policy and practice from multiple perspectives.

CO4 - Ability to describe an understanding of standards of humanitarian response and practical relevance in specific types of disasters and conflict situations.

CO5 - Ability to develop the strengths and weaknesses of disaster management approaches.

UNIT I INTRODUCTION   (6 Hrs)
Disaster: Definition, Factors and Significance; Difference between Hazard And Disaster; Natural and Manmade Disasters: Difference, Nature, Types and Magnitude.

UNIT II REPERCUSSIONS OF DISASTERS AND HAZARDS   (6 Hrs)
Economic Damage, Loss of Human and Animal Life, Destruction of Ecosystem. Natural Disasters: Earthquakes, Volcanisms, Cyclones, Tsunamis, Floods, Droughts and Famines, Landslides and Avalanches, Man-made disaster: Nuclear Reactor Meltdown, Industrial Accidents, Oil Slicks and Spills, Outbreaks Of Disease And Epidemics, War And Conflicts.

UNIT III DISASTER PRONE AREAS IN INDIA   (6 Hrs)
Study of Seismic Zones; Areas Prone To Floods and Droughts, Landslides And Avalanches; Areas Prone To Cyclonic and Coastal Hazards with Special Reference To Tsunami; Post-Disaster Diseases and Epidemics.

UNIT IV DISASTER PREPAREDNESS AND MANAGEMENT   (6 Hrs)
Preparedness: Monitoring Of Phenomena Triggering a Disaster or Hazard; Evaluation of Risk: Application of Remote Sensing, Data from Meteorological And Other Agencies, Media Reports: Governmental and Community Preparedness.

UNIT V RISK ASSESSMENT   (6 Hrs)
Disaster Risk: Concept and Elements, Disaster Risk Reduction, Global and National Disaster Risk Situation. Techniques of Risk Assessment, Global Co-Operation in Risk Assessment and Warning, People's Participation in Risk Assessment. Strategies for Survival

Reference Books
1. Goel S. L., Disaster Administration And Management Text And Case Studies",Deep & Deep Publication Pvt. Ltd., New Delhi,2009.
2. NishithaRai, Singh AK, "Disaster Management in India: Perspectives, issues and strategies 'New Royal book Company,2007.
3. Sahni, Pardeep Et.Al. , "Disaster Mitigation Experiences And Reflections", Prentice Hall Of India, New Delhi,2001.

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P20ADC103	SANSKRIT FOR TECNICAL KNOWLEDGE	L	T	P	C	Hrs
		2	0	0	0	30

Course Objectives
- Illustrate the basic Sanskrit language.
- Recognize Sanskrit, the scientific language in the world.
- Appraise learning of Sanskrit to improve brain functioning.
- Relate Sanskrit to develop the logic in mathematics, science & other subjects enhancing the memory power.
- Extract huge knowledge from ancient literature.

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

CO1 - Understanding basic Sanskrit language.
CO2 - Write sentences.
CO3 - Know the order and roots of Sanskrit.
CO4 - Know about technical information about Sanskrit literature.
CO5 - Understand the technical concepts of Engineering.

UNIT I ALPHABETS   (6 Hrs)
Alphabets in Sanskrit.

UNIT II TENSES AND SENTENCES   (6 Hrs)
Past/Present/Future Tense - Simple Sentences.

UNIT III ORDER AND ROOTS   (6 Hrs)
Order - Introduction of roots of Engineering-Electrical, Mechanical, Architecture, Mathematics.

UNIT IV SANSKRIT LITERATURE   (6 Hrs)
Technical information about Sanskrit Literature.

UNIT V TECHNICAL CONCEPTS OF ENGINEERING   (6 Hrs)
Technical concepts.

References
1. "Abhyaspustakam" – Dr. Vishwas, Samskrita-Bharti Publication, New Delhi.
2. "Teach Yourself Sanskrit" Prathama Deeksha-Vempati Kutumbshastri, Rashtriya Sanskrit Sansthanam, New Delhi Publication.
3. "India's Glorious Scientific Tradition" Suresh Soni, Ocean books (P) Ltd., New Delhi, 2017.

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P20ADC104	VALUE EDUCATION	L	T	P	C	Hrs
		2	0	0	0	30

Course Objectives
- Understand value of education and self-development.
- Imbibe good values in students.
- Let the should know about the importance of character.

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

CO1 - Knowledge of self-development.

CO2 - Learn the importance of Human values.

CO3 - Developing the overall personality.

UNIT I
Values and self-development–Social values and individual attitudes. Work ethics, Indian vision of humanism. Moral and non-moral valuation. Standards and principles. Value judgements of Women. All religions and same message. Mind your Mind, Self-control. Honesty, Studying effectively.

UNIT II
Importance of cultivation of values. Sense of duty. Devotion, Self-reliance. Confidence, Concentration. Truthfulness, Cleanliness. Honesty, Humanity. Power of faith, National Unity. Patriotism. Love for nature, Discipline

UNIT III
Personality and Behavior Development-Soul and Scientific attitude. Positive Thinking. Integrity and discipline. Punctuality, Love and Kindness. Avoid fault Thinking. Free from anger, Dignity of labour. Universal brother hood and religious tolerance. True friendship. Happiness Vs suffering, love for truth. Aware of self-destructive habits. Association and Cooperation. Doing best for saving nature.

UNIT IV
Character and Competence–Holy books vs Blind faith. Self-management and Good health. Science of reincarnation. Equality, Nonviolence, Humility, Role.

Reference Books
1. Chakroborty, S.K."Values and Ethics for organizations Theory and practice", Oxford University Press, New Delhi.

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P20ADC105	CONSTITUTION OF INDIA	L	T	P	C	Hrs
		2	0	0	0	30

Course Objectives

- Understand the premises informing the twin themes of liberty and freedom from a civil rights Perspective.
- To address the growth of Indian opinion regarding modern Indian intellectuals' constitutional.
- Role and entitlement to civil and economic rights as well as the emergence nation hood in the early years of Indian nationalism.
- To address the role of socialism in India after the commencement of the Bolshevik Revolutionin1917and its impact on the initial drafting of the Indian Constitution.

Course Outcomes

After completion of the course, the students will be able to

CO1 - Discuss the growth of the demand for civil rights in India for the bulk of Indians before the arrival of Gandhi in Indian politics.

CO2 - Discuss the intellectual origins of the framework of argument that informed the conceptualization of social reforms leading to revolution in India.

CO3 - Discuss the circumstances surrounding the foundation of the Congress Socialist Party[CSP] under the leadership of Jawaharlal Nehru and the eventual failure of the proposal of direct elections.

CO4 - Discuss the passage of the Hindu Code Bill of 1956.

UNIT I HISTORY OF MAKING OF THE INDIAN CONSTITUTION (5 Hrs)

History, Drafting Committee, (Composition & Working).

UNIT II PHILOSOPHY OF THE INDIAN CONSTITUTION (5 Hrs)

Preamble, Salient Features.

UNIT III CONTOURS OF CONSTITUTIONAL RIGHTS AND DUTIES (5 Hrs)

Fundamental Rights, Right to Equality, Right to Freedom, Right against Exploitation, Right to Freedom of Religion, Cultural and Educational Rights, Right to Constitutional Remedies, Directive Principles of State Policy, Fundamental Duties.

UNIT IV ORGANS OF GOVERNANCE (5 Hrs)

Parliament, Composition, Qualifications and Disqualifications, Powers and Functions, Executive, President, Governor, Council of Ministers, Judiciary, Appointment and Transfer of Judges, Qualifications, Powers and Functions.

UNIT V LOCAL ADMINISTRATION (5 Hrs)

District's Administration head: Role and Importance, Municipalities: Introduction, Mayor and role of Elected Representative, CEO, Municipal Corporation. Pachayati raj: Introduction, PRI: Zila Pachayat. Elected officials and their roles, CEO Zila Pachayat: Position and role. Block level: Organizational Hierarchy(Different departments), Village level:Role of Elected and Appointed officials, Importance of grass root democracy.

UNIT VI ELECTION COMMISSION (5 Hrs)

Election Commission: Role and Functioning. Chief Election Commissioner and Election Commissioners - Institute and Bodies for the welfare of SC/ST/OBC and women.

Reference Books

1. "The Constitution of India,1950 (Bare Act),Government Publication.
2. Dr.S.N.Busi, Dr.B. R.Ambedkar framing of Indian Constitution,1st Edition, 2015.
3. M.P. Jain, Indian Constitution Law, 7th Edition, Lexis Nexis,2014.
4. D.D. Basu, Introduction to the Constitution of India, Lexis Nexis, 2015 "India's Glorious Scientific Tradition" Suresh Soni, Ocean books (P) Ltd., New Delhi, 2017.

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		L	T	P	C	Hrs
P20ADC106	**PEDAGOGY STUDIES**	2	0	0	0	30

Course Objectives
- Review existing evidence on their view topic to inform programme design and policy.
- Making under taken by the DfID, other agencies and researchers.
- Identify critical evidence gaps to guide the development.

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

CO1 - What pedagogical practices are being used by teachers informal and informal classrooms in developing countries?

CO2 - What is the evidence on the effectiveness of these pedagogical practices, in what conditions, and with what population of learners?

CO3 - How can teacher education (curriculum and practicum) and the school curriculum and guidance materials best support effective pedagogy?

UNIT I INTRODUCTION AND METHODOLOGY: (6 Hrs)
Aims and rationale, Policy background, Conceptual framework and terminology - Theories of learning, Curriculum, Teacher education - Conceptual framework, Research questions – Overview of methodology and Searching.

UNIT II THEMATIC OVERVIEW (6 Hrs)
Pedagogical practices are being used by teachers in formal and informal classrooms in developing countries - Curriculum, Teacher education.

UNIT III EVIDENCE ON THE EFFECTIVENESS OF PEDAGOGICAL PRACTICES (6 Hrs)
Methodology for the in depth stage: quality assessment of included studies - How can teacher education (curriculum and practicum) and the school curriculum and guidance materials best support effective pedagogy? - Theory of change - Strength and nature of the body of evidence for effective pedagogical practices - Pedagogic theory and pedagogical approaches - Teachers' attitudes and beliefs and Pedagogic strategies.

UNIT IV PROFESSIONAL DEVELOPMENT (6 Hrs)
Professional development: alignment with classroom practices and follows up support – Peer support - Support from the head teacher and the community - Curriculum and assessment - Barriers to learning: limited resources and large class sizes.

UNIT V RESEARCH GAPS AND FUTURE DIRECTIONS (6 Hrs)
Research design – Contexts – Pedagogy - Teacher education - Curriculum and assessment - Dissemination and research impact.

Reference Books
1. Ackers J, HardmanF (2001) Classroom interaction in Kenyan primary schools, Compare, 31(2): 245- 261.
2. Agrawal M (2004) Curricular reform in schools: The importance of evaluation, Journal of Curriculum Studies, 36(3):361-379.
3. Akyeampong K (2003) Teacher training in Ghana-does it count? Multi-site teacher education research project (MUSTER) country report 1.London:DFID.
4. Akyeampong K, Lussier K, Pryor J, Westbrook J (2013) Improving teaching and learning of basic maths and reading in Africa: Does teacher preparation count? International Journal Educational Development, 33(3): 272–282.
5. Alexander RJ(2001) Culture and pedagogy: International comparisons in primary education. Oxford and Boston: Blackwell.

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6. Chavan M(2003) Read India: Amass scale, rapid, 'learning to read' campaign.
7. www.pratham.org/images/resource%20working%20paper%202.pdf.

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	L	T	P	C	Hrs
P20ADC107 **STRESS MANAGEMENT BY YOGA**	2	0	0	0	30

Course Objectives

- To achieve overall health of body and mind.
- To overcome stress.

Course Outcomes

After completion of the course, the students will be able to

CO1 - Develop healthy mind in a healthy body thus improving social health also

CO2 - Improve efficiency.

UNIT I

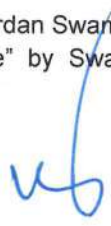Definitions of Eight parts of yoga.(Ashtanga).

UNIT II

Yam and Niyam - Do`s and Don't's in life - i) Ahinsa, satya, astheya, bramhacharya and aparigraha, ii) Ahinsa, satya, astheya, bramhacharya and aparigraha.

UNIT III

Asan and Pranayam - Various yog poses and their benefits for mind & body - Regularization of breathing techniques and its effects-Types of pranayam.

Reference Books

1. 'Yogic Asanas for Group Tarining-Part-I":Janardan Swami Yoga bhyasi Mandal, Nagpur.
2. "Rajayoga or conquering the Internal Nature" by Swami Vivekananda, Advaita Ashrama (Publication Department), Kolkata.

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P20ADC108	PERSONALITY DEVELOPMENT THROUGH LIFE ENLIGHTENMENT SKILLS	L	T	P	C	Hrs
		2	0	0	0	30

Course Objectives

- To learn to achieve the highest goal happily.
- To become a person with stable mind, pleasing personality and determination.
- To awaken wisdom in students.

Course Outcomes

After completion of the course, the students will be able to

CO1 - Study of Shrimad-Bhagwad-Geeta will help the student in developing his personality and achieve the highest goal in life.

CO2 - The person who has studied Geeta will lead the nation and mankind to peace and prosperity.

CO3 - Study of Neet is hatakam will help in developing versatile personality of students.

UNIT I

Neetisatakam-holistic development of personality - Verses- 19,20,21,22 (wisdom) - Verses- 29,31,32 (pride & heroism) – Verses- 26,28,63,65 (virtue) - Verses- 52,53,59 (dont's) - Verses- 71,73,75,78 (do's) 4-Verses 18, 38,39 Chapter18 – Verses37,38,63.

UNIT II

Approach to day to day work and duties - Shrimad Bhagwad Geeta: Chapter 2-Verses 41, 47,48 - Chapter 3-Verses 13, 21, 27, 35 Chapter 6-Verses 5,13,17,23, 35 - Chapter 18-Verses 45, 46, 48.model – shrimad bhagwad geeta - Chapter2- Verses 17, Chapter 3-Verses 36,37,42 – Chapter.

UNIT III

Statements of basic knowledge – Shrimad Bhagwad Geeta: Chapter2 - Verses 56, 62, 68 Chapter12 - Verses 13, 14, 15, 16,17, 18 - Personality of role.

Reference Books

1. Gopinath, Rashtriya Sanskrit Sansthanam P, Bhartrihari's Three Satakam, Niti-sringar- vairagya, New Delhi,2010.
2. Swami Swarupananda ,Srimad Bhagavad Gita, Advaita Ashram, Publication Department, Kolkata, 2016.

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P20ACTX09	UNNAT BHARATH ABHIYAN	L	T	P	C	Hrs
		2	0	0	0	30

Course Objectives

- To develop an appreciation of rural culture, life-style and wisdom amongst students.
- To learn about the status of various agricultural and rural development programmes.
- To understand causes for rural distress and poverty and explore solutions for the same
- To apply classroom knowledge of courses to field realities and thereby improve quality of learning.

Course Outcomes

After completion of the course, the students will be able to
CO1- Gain an understanding of rural life, culture and social realities
CO2- Develop a sense of empathy and bonds of mutuality with local community
CO3- Appreciate significant contributions of local communities to Indian society and economy
CO4- Learn to value the local knowledge and wisdom of the community
CO5- Identify opportunities for contributing to community's socio-economic improvements.

UNIT I APPRECIATION OF RURAL SOCIETY (4 Hrs)

Rural life style, rural society, caste and gender   relations, rural values with respect to community, nature and resources, elaboration of "soul of India lies in villages' (Gandhi), rural infrastructure.

UNIT II UNDERSTANDING RURAL ECONOMY & LIVELIHOOD (4 Hrs)

Agriculture, farming, landownership, water management, animal husbandry, non-farm livelihoods and artisans, rural entrepreneurs, rural markets.

UNIT III RURAL INSTITUTIONS (4 Hrs)

Traditional rural organizations, Self-help Groups, Panchayati raj institutions (Gram Sabha, Gram Panchayat, Standing Committees), local civil society, local administration.

UNIT IV RURAL DEVELOPMENT PROGRAMMES (4 Hrs)

History of rural development in India, current national programmes: Sarva Shiksha Abhiyan, Beti Bachao, Beti Padhao, Ayushman Bharat, Swatchh Bharat, PM Awaas Yojana, Skill India, Gram Panchayat Decentralized Planning, NRLM, MNREGA, etc.

UNIT V FIELD BASED PRACTICAL ACTIVITIES (14 Hrs)

Visit MGNREGS project sites. Swachh Bharat project sites, Conduct Mission Antyodaya surveys, Interactive community exercise with local leaders, Panchayat functionaries, Visit Rural Schools / mid-day meal centres, study Academic and infrastructural resources and gaps, Participate in Gram Sabha meetings, Visit local Anganwadi Centre, Conduct soil health test, drinking water analysis.

Reference Books

1. Singh, Katar, "Rural Development : Principles, Policies and Management", Sage Publications, New Delhi, 2015.
2. A Hand book on Village Panchayat Administration, Rajiv Gandhi Chair for Panchayati Raj Studies, 2002.
3. United Nations, "Sustainable Development Goals", 2015.
4. M.P.Boraian, "Best Practices in Rural Development", Shanlax Publishers, 2016.

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