BMS COLLEGE OF ENGINEERING, BENGALURU-19

Autonomous College under VTU

Department of Information Science and Engineering

DEPARTMENT VISION

Promote Quality Human Resource Capital by inculcating in every student the art of Creativity and Productivity in the field of Information Technology.

DEPARTMENT MISSION

Offer High Quality Graduate, Post Graduate Programme in Information Technology to prepare students for higher studies and professional career in industry.

Provide good Teaching and Research environment for Quality Education in the field of Information Technology.

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POST GRADUATE PROGRAMME IN COMPUTER NETWORK ENGINEERING

Programme Outcomes (POs):

PO1	Acquire in-depth knowledge of specific discipline or professional area, including wider and global perspective, with an ability to discriminate, evaluate, analyze and synthesize existing and new knowledge, and integration of the same for enhancement of knowledge.
PO2	Analyze complex engineering problems critically, apply independent judgment for synthesizing information to make intellectual and/or creative advances for conducting research in a wider theoretical, practical and policy context.
PO3	Think laterally and originally, conceptualize and solve engineering problems, evaluate a wide range of potential solutions for those problems and arrive at feasible, optimal solutions after considering public health and safety, cultural, societal and environmental factors in the core areas of expertise.
PO4	Extract information pertinent to unfamiliar problems through literature survey and experiments, apply appropriate research methodologies, techniques and tools, design, conduct experiments, analyze and interpret data, demonstrate higher order skill and view things in a broader perspective, contribute individually/in group(s) to the development of scientific/technological knowledge in one or more domains of engineering.
PO5	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	Possess knowledge and understanding of group dynamics, recognize opportunities and contribute positively to collaborative-multidisciplinary scientific research, demonstrate a capacity for self-management and teamwork, decision-making based on open-mindedness, objectivity and rational analysis in order to achieve common goals and further the learning of themselves as well as others.
PO7	Demonstrate knowledge and understanding of engineering and management principles and apply the same to one's own work, as a member and leader in a team, manage projects efficiently in respective disciplines and multidisciplinary environments after consideration of economical and financial factors.
PO8	Communicate with the engineering community, and with society at large, regarding complex engineering activities confidently and effectively, such as, being able to comprehend and write effective reports and design documentation by adhering to appropriate standards, make effective presentations, and give and receive clear instructions.
PO9	Recognize the need for, and have the preparation and ability to engage in life-long learning independently, with a high level of enthusiasm and commitment to improve knowledge and competence continuously.
PO10	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.
PO11	Observe and examine critically the outcomes of one's actions and make corrective measures subsequently, and learn from mistakes without depending on external feedback.

PROGRAMME EDUCATIONAL OBJECTIVES (PEOs):

PEO1	Excel in their professional career in computer network engineering and allied disciplines
PEO2	Achieve Proficiency in Industry or Academia and Research for Development.
PEO3	Exhibit professionalism, team work and adapt to the latest technologies through continuous learning.

BMS COLLEGE OF ENGINEERING, BENGALURU-19

Autonomous College under VTU

Department of Information Science and Engineering

SCHEME OF INSTRUCTION

Programme: Computer Network and Engineering **Semester: I**

Course Code	Name of the Course	Credits					Contact Hours	Marks			SEE Duration in Hours
		L	T	P	S	Total		CIE	SEE	Total	
16ISCNPCWN	Wireless Adhoc Network	3	0	1	0	4	5	50	50	100	3
16ISCNPCCN	Advanced Computer Network	3	0	0	0	3	3	50	50	100	3
16ISCNPCIN	Information and Network Security	3	0	0	0	3	3	50	50	100	3
16ISCNPCCS	Client Server Programming	3	0	1	0	4	5	50	50	100	3
16ISCNPEXX	Elective – I	3	1	0	0	4	4	50	50	100	3
16ISCNPEYY	Elective – II	3	0	0	0	3	3	50	50	100	3
16APRDICRM	Research Methodology	2	0	0	0	2	2	50	50	100	3
16ISCNPCS1	Technical Seminar - I	0	0	0	2	2	2	50	50	100	3
Total		**20**	**1**	**2**	**2**	**25**	**27**				

Elective - I - XX	
16ISCNPESA	Advanced Storage Area Network
16ISCNPECA	Computer System Performance Analysis
16ISCNPESN	Social Network Analysis
16ISCNPEPR	Protocol Engineering

Elective – II – YY	
16ISCNPEPQ	Probability Statistics and Queuing Theory
16ISCNPEAA	Advanced Algorithms
16ISCNPEMA	Multicore Architecture and Programming
16ISCNPESC	Soft Computing

BMS COLLEGE OF ENGINEERING, BENGALURU-19

Autonomous College under VTU

Department of Information Science and Engineering

SCHEME OF INSTRUCTION

Programme: Computer Network and Engineering **Semester: II**

Course Code	Name of the Course	Credits					Contact Hours	Marks			SEE Duration in Hours
		L	T	P	S	Total		CIE	SEE	Total	
16ISCNPCCL	Cyber Security and Law	3	0	1	0	4	5	50	50	100	3
16ISCNPCDC	Distributed Computing	3	0	0	0	3	3	50	50	100	3
16ISCNPCNM	Network Management	3	0	0	0	3	3	50	50	100	3
16ISCNPEZZ	Elective III	3	0	0	0	3	3	50	50	100	3
16ISCNPEAA	Elective IV	3	0	1	0	4	5	50	50	100	3
16XXXXIEXX	Institution Elective	4	0	0	0	4	4	50	50	100	3
16ISCNPCPF	Software Project Management and Finance	2	0	0	0	2	2	50	50	100	3
16ISCNPCGP	Group Project	0	0	2	0	2	4	50	50	100	3
Total		**21**	**0**	**4**	**0**	**25**	**29**				

Elective III - ZZ	
16ISCNPEON	Optical Network
16ISCNPENR	Network Routing Algorithms
16ISCNPEMC	Multimedia Communications
16ISCNPESD	Software Defined Network

Elective IV – AA	
16ISCNPECC	Cloud Computing
16ISCNPEIO	Internet of Things
16ISCNPEWT	Web Technologies
16ISCNPEMD	Mobile Application Development

BMS COLLEGE OF ENGINEERING, BENGALURU-19

Autonomous College under VTU

Department of Information Science and Engineering

SCHEME OF INSTRUCTION

Programme: Computer Network and Engineering **Semester: III**

Course Code	Name of the Course	Credits					Contact Hours	Marks			SEE Duration in Hours
		L	T	P	S	Total		CIE	SEE	Total	
16ISCNPCIT	Internship/Industrial Training	0	0	0	21	21	0	50	50	100	3
16ISCNPCP1	Project Work (Phase – I)	0	0	0	4	4	4	50	50	100	3
Total		**0**	**0**	**0**	**25**	**25**	**4**				

SCHEME OF INSTRUCTION

Programme: Computer Network and Engineering **Semester: IV**

Course Code	Name of the Course	Credits					Contact Hours	Marks			SEE Duration in Hours
		L	T	P	S	Total		CIE	SEE	Total	
16ISCNPCP2	Project Work (Phase – II)	0	0	23	0	23	0	50	50	100	3
16ISCNPCS2	Technical Seminar - II	0	0	0	2	2	0	50	50	100	3
Total		**0**	**0**	**23**	**2**	**25**	**0**				

BMS COLLEGE OF ENGINEERING, BENGALURU-19

Autonomous College under VTU

Department of Information Science and Engineering

LIST OF INSTITUTIONAL ELECTIVES OFFERED BY VARIOUS M.TECH. PROGRAMMES FOR 2ND SEMESTER 2017

SNo	Name of the M.Tech. Programme	Course details	
		Code	Name
1	*Biochemical Engineering*	16CHBC2ITQ	Total Quality Management
2		16CHBC2IPM	Project Engineering Management
3		16CHBC2IFT	Fermentation Technology
4		16CHBC2IBM	Biomaterials
5	*Biomedical Signal Processing & Instrumentation*	16MLBI2EMD	Medical device development
6		16MLBI2ENN	Neural Networks & Fuzzy logic applications
7		16MLBI2EPR	Pattern recognition and applications
8	*Computer Science & Engineering*	16CSCS2EBD	Big Data Analytics
9		16CSCS2EIT	Internet of Things
10	*Construction Technology*	-	-
11	*Digital Communication*	16 CDC2EQRE	Quality and Reliability of Engineering systems
12	*Electronics*	16ECEL2ESM	Simulation, Modelling and Analysis
13	*Environmental Engineering*	-	-
14	*Machine Design*	16MEMD2ECA	Computer Applications in Design
15		16MEMD2ECG	Computer Graphics
16		16MEMD2ESS	Smart Materials and Structures

17	*Manufacturing Science & Engineering*	16MEMS2ECM	Computational methods in Engineering analysis
18		16MEMS2EDE	Design of Experiments
19		16MEMS2EDM	Design for Manufacture
20	*Power Electronics*	16EEPE2ERE	Renewable Energy & Photovoltaics
21		16EEPE2EMS	Micro & Smart Systems
22	*Transportation Engineering & Management*	-	-
23	*VLSI Design & Embedded System*	16ECVE2IMN	Advanced Micro and Nano devices
24		16ECVE2IRB	Robotics
25	*Computer Network Engineering*	16ISCNIECN	Computer Network
26		16ISCNIEWN	Wireless Network
27		16ISCNIECP	Computer System Performance Analysis

BMS COLLEGE OF ENGINEERING, BENGALURU-19

Autonomous College under VTU

Department of Information Science and Engineering

General Guidelines:

- **Theory Core:** would be evaluated for 30 Marks as a part of Internal Assessment. Remaining 20 marks would be evaluated using alternative assessment tools. CIE for the theory courses would be 30+20=50 Marks. SEE for will be conducted for 50 Marks. The final would be CIE+SEE (50+50) = 100 Marks.
- **Integrated Core:** would be evaluated for 30 Marks as a part of Internal Assessment. Laboratory Work would be evaluated for 20 Marks. The corresponding Lab Journals must be prepared as part of the assessment. Total internal assessment (CIE) for the comprehensive courses would be 30+20=50 Marks. SEE for will be conducted for 50 Marks. The final would be CIE+SEE (50+50) = 100 Marks.
- **Elective courses:** would be evaluated for 30 Marks as a part of Internal Assessment. Remaining 20 marks would be evaluated using alternative assessment tools for courses without lab. Otherwise, the elective course with lab work would be evaluated for 20 Marks. The corresponding Lab Journals must be prepared as part of the assessment. CIE for the theory courses would be 30+20=50 Marks. SEE will be conducted for 50 Marks. The final would be CIE+SEE (50+50) = 100 Marks.
- **Tutorial Classes:** for any course included would be evaluated for 20 Marks using only alternative assessment tools. Assessment would be part of theory or elective course.
- **Technical Seminar 1 and 2:** topics should be Chosen form Scientific Citation Index based (SCI) /IEEE/ACM/Springer/Elsevier/Science Direct/ Transactions/ Any Peer-reviewed Nonpaid Journals. The students could convert the chosen seminar topic either into a Survey Paper or Technical Paper. The students must make a presentation on the scheduled dates and this will be evaluated by the committee for 25 Marks. Finally, the students must submit a technical seminar report and it will be evaluated for 25 Marks by the internal guide based on the seminar rubrics. Total internal assessment for the seminar would be 25+25=50 Marks. SEE will be conducted for 50 Marks. The final would be CIE+SEE (50+50) = 100 Marks.
- **Group Project** must be implemented in a team of not more than three students and not less two students on a trending topic. The students must make a regular presentation of their work to the internal guides and report their progress of the project. The students must make a presentation on the scheduled dates and this will be evaluated by the committee for 25 Marks. Finally, the students must submit a group project report and it will be evaluated for 25 Marks by the internal guide. All the evaluation shall be done based on group project rubrics. Total internal assessment for the group project would be 25+25=50 Marks. SEE will be conducted for 50 Marks. The final would be CIE+SEE (50+50) = 100 Marks
- **Project Phase – I**
    - **Problem formulation** and submission of **synopsis** within 8 weeks from the commencement of 3rd semester, which shall be evaluated for 25 marks by the committee constituted for the purpose.
    - **Literature survey and progress** done after 16 weeks, which shall be evaluated for 25 marks by the committee constituted for the purpose.

  All the evaluation shall be done based on the rubrics of project phase – I. Total internal assessment for the project phase - I would be 25+25=50 Marks. SEE will be conducted for 50 Marks. The final would be CIE+SEE (50+50) = 100 Marks.

- **Internship/ Industrial Training:** The student shall undergo internship for 16 weeks.
    - **Preliminary Report** submission and evaluation after 8 week of Internship carried out, which shall be evaluated for 25 marks by the committee constituted for the purpose.
    - **Final Report** submission and evaluation after 16 week of Internship carried out, which shall be evaluated for 25 marks by the internal guide.
    - **Viva-Voce on Internship** – The SEE shall be conducted by the Internship Guide (from the college) and the External Guide (from the internship company) within 2 weeks of submission for 50 marks.

  The final would be CIE+SEE (25+25+50) = 100 Marks.
- **Project Phase - II**: The student should have satisfied Project Phase – I in their III semester before starting their Project Phase II. The student shall continue their project in the Internship Company they are offered or shall work on their project in the PG laboratory of the college. The student doing their project in the college must mandatorily published their work in a referred or non-paid journal. However, the students doing their project in the company would publish their work in a referred or non-paid journal subject to the preapproval of the company.
    - **Midterm Report** submission and evaluation after 8 week of project phase – II, which shall be evaluated for 25 marks by the committee constituted for the purpose.
    - **Plagiarism Check:** Before submission of the report, all the students must clear plagiarism check. The certificate along with plagiarism report shall be submitted to their guide before printing the report. Maximum acceptable plagiarism shall be 25%, beyond that the students must resubmit the report after some modification. A due care shall be taken by the students to follow the professional code of ethics and conduct. After which, the reports shall be prepared and printed as per the guidelines of MTech dissertation format.
    - **Project Presentation:** After plagiarism checking process, the students shall make a presentation in the department, which shall be evaluated for 25 marks by the committee constituted for the purpose.
    - **Final Report** submission and evaluation after 16 week of project phase - II, which shall be evaluated for 25 marks by the internal guide. This would be part of SEE.
    - **Viva-Voce on Project** – The SEE shall be conducted by the Internship Guide (from the college) and the External Guide (company or nominated) within 2 weeks of submission for 25 marks.

  All the evaluation shall be done based on the rubrics of project phase – II. The final would be CIE (Midterm + Presentation) + SEE (Report + VIVA) (25+25+25+25) = 100 Marks.

BMS COLLEGE OF ENGINEERING, BENGALURU-19

Autonomous College under VTU

Department of Information Science and Engineering

Course Title	WIRELESS ADHOC NETWORK				
Course Code	16ISCNPCWN	Credits	04	L-T-P-S	3-0-1-0
CIE	50 Marks	SEE	100 Marks (50% Weightage)		
Contact Hours / Week	5	Total Lecture Hours	39		

UNIT – 1

Ad-hoc Wireless Networks : Introduction, Issues in Ad-hoc Wireless Networks, Ad-hoc Wireless Internet; MAC Protocols for Ad-hoc Wireless Networks: Introduction, Issues in Designing a MAC Protocol, Design Goals of MAC Protocols, Classification of MAC protocols, Contention-Based Protocols, Contention-Based Protocols with Reservation Mechanisms, Contention-Based Protocols with Scheduling Mechanisms, Reservation Mechanisms, Contention-Based Protocols with Scheduling Mechanisms, MAC Protocols that Use Directional Antennas.

9 Hours

UNIT – 2

Routing Protocols for Ad-hoc Wireless Networks: Introduction, Issues in Designing a Routing Protocol for Ad-hoc Wireless Networks; Classification of Routing Protocols; Table Driven Routing Protocols.

7 Hours

UNIT – 3

On-Demand Routing Protocols, Hybrid Routing Protocols, Hierarchical Routing Protocols and Power-Aware Routing Protocols. Multicast Routing in Ad-hoc Wireless Networks: Introduction, Issues in Designing a Multicast Routing Protocol, Operation of Multicast Routing Protocols, An Architecture Reference Model for Multicast Routing Protocols.

8 Hours

UNIT – 4

Classifications of Multicast Routing Protocols, Tree-Based Multicast Routing Protocols and Mesh-Based Multicast Routing Protocols. Transport Layer and Security Protocols for Ad-hoc Networks: Introduction, Issues in Designing a Transport Layer Protocol; Design Goals of a Transport Layer Protocol; Classification of Transport Layer Solutions.

8 Hours

BMS COLLEGE OF ENGINEERING, BENGALURU-19

Autonomous College under VTU

Department of Information Science and Engineering

UNIT – 5

TCP over Transport Layer Solutions; Other Transport Layer Protocols for Ad-hoc Networks; Security in Ad-hoc Wireless Networks, Issues and Challenges in Security Provisioning, Network Security Attacks, Key Management and Secure Routing Ad-hoc Wireless Networks.

7 Hours

TEXT BOOK:

1. C. Siva Ram Murthy & B. S. Manoj: Ad-hoc Wireless Networks, 2nd Edition, Pearson Education, 2011

REFERENCE BOOKS:

1. Ozan K. Tonguz and Gianguigi Ferrari: Ad-hoc Wireless Networks, John Wiley, 2007.

2. Xiuzhen Cheng, Xiao Hung, Ding-Zhu Du: Ad-hoc Wireless Networking, Kluwer Academic Publishers, 2004.

3. C.K. Toh: Ad-hoc Mobile Wireless Networks- Protocols and Systems, Pearson Education, 2002.

COURSE OUTCOMES (COs):

At the end of the course, the student will be able to

CO1	Explore the design issues of different MAC protocols.
CO2	Apply different design techniques in routing and multicast routing.
CO3	Evaluate various transport and security mechanisms in Adhoc Networks.
CO4	Analyse Energy Management Schemes for achieving QoS
CO5	Use modern tools to conduct trade-off analysis among various protocols in Ad-hoc network.

BMS COLLEGE OF ENGINEERING, BENGALURU-19

Autonomous College under VTU

Department of Information Science and Engineering

Course Title	ADVANCED COMPUTER NETWORK				
Course Code	16ISCNPCCN	Credits	03	L-T-P-S	3-0-0-0
CIE	50 Marks	SEE	100 Marks (50% Weightage)		
Contact Hours / Week	3	Total Lecture Hours	39		

UNIT – 1

Foundation: Building a Network, Requirements, Perspectives, Scalable Connectivity, - Cost Effective Resource sharing, Support for Common Services, Manageability, Protocol layering, Performance, Bandwidth and Latency, Delay X Bandwidth Product, Perspectives on Connecting, Classes of Links, Reliable Transmission, Stop-and-Wait , Sliding Window, Concurrent Logical Channels.

8 Hours

UNIT – 2

Internetworking I: Switching and Bridging, Datagram's, Virtual Circuit Switching, Source Routing, Bridges and LAN Switches, Basic Internetworking (IP), What is an Internetwork?, Service Model, Global Addresses, Datagram Forwarding in IP, Subnetting and classless addressing, Address Translation (ARP) Host Configuration(DHCP), Error Reporting(ICMP), Virtual Networks and Tunnels

8 Hours

UNIT – 3

Internetworking- II: Network as a Graph, Distance Vector(RIP), Link State(OSPF), Metrics, The Global Internet, Routing Areas, Routing among Autonomous systems(BGP), IP Version 6(IPv6), Mobility and Mobile IP

7 Hours

UNIT – 4

End-to-End Protocols: Simple Demultiplexer (UDP), Reliable Byte Stream(TCP), End-to-End Issues, Segment Format, Connecting Establishment and Termination, Sliding Window Revisited, Triggering Transmission, Adaptive Retransmission, Record Boundaries, TCP Extensions, Queuing Disciplines, FIFO, Fair Queuing, TCP Congestion Control, Additive Increase/ Multiplicative Decrease, Slow Start, Fast Retransmit and Fast Recovery.

8 Hours

BMS COLLEGE OF ENGINEERING, BENGALURU-19

Autonomous College under VTU

Department of Information Science and Engineering

UNIT – 5

Congestion Control and Resource Allocation: Congestion-Avoidance Mechanisms, DEC bit, Random Early Detection (RED), Source-Based Congestion Avoidance. The Domain Name System(DNS),Electronic Mail(SMTP,POP,IMAP,MIME),World Wide Web(HTTP),Network Management(SNMP)

8 Hours

TEXT BOOKS:

1. **T1: Larry Peterson and Bruce S Davis** "Computer Networks :A System Approach" 5 th Edition , Elsevier -2014
2. **T2: Douglas E Comer, "** Internetworking with TCP/IP, Principles, Protocols and Architecture" 6th Edition, PHI - 2014

REFERENCE BOOKS:

1. **Uyless Black** "Computer Networks, Protocols , Standards and Inte rfaces" 2 nd Edition - PHI
2. **Behrouz A Forouzan** "TCP /IP Protocol Suite" 4 th Edition – Tata McGraw-Hill

COURSE OUTCOMES (COs):

The students should be able to:

CO1	Apply the knowledge of networking architectures and technologies in Designing/building a computer network and evaluating its performance.
CO2	Demonstrate various protocols, global addressing, Subnetting, VLAN, forwarding and routing in Internetworking.
CO3	Design various Internetworking applications (e.g. Client Server applications, Web Services)
CO4	Perform in a team to implement network applications using networking tool.

BMS COLLEGE OF ENGINEERING, BENGALURU-19

Autonomous College under VTU

Department of Information Science and Engineering

Course Title	INFORMATION AND NETWORK SECURITY				
Course Code	16ISCNPCIN	Credits	03	L-T-P-S	3-0-0-0
CIE	50 Marks	SEE	100 Marks (50% Weightage)		
Contact Hours / Week	3	Total Lecture Hours	39		

UNIT – 1

Classical Encryption Techniques: Symmetric Cipher Model, Cryptography, Cryptanalysis and Brute-Force Attack, Substitution Techniques, Caesar Cipher, Monoalphabetic Cipher, Playfair Cipher, Hill Cipher, Polyalphabetic Cipher, One Time Pad. **Block Ciphers and the data encryption standard:** Traditional block Cipher structure, stream Ciphers and block Ciphers, Motivation for the feistel Cipher structure, the feistel Cipher, The data encryption standard, DES encryption, DES decryption, A DES example, results, the avalanche effect, the strength of DES, the use of 56-Bit Keys, the nature of the DES algorithm, timing attacks, Block cipher design principles, number of rounds, design of function F, key schedule algorithm

8 Hours

UNIT – 2

Public-Key Cryptography and RSA: Principles of public-key cryptosystems. Public- key cryptosystems. Applications for public-key cryptosystems, requirements for public-key cryptosystems. Public-key cryptanalysis. The RSA algorithm, description of the algorithm, computational aspects, the security of RSA. **Other Public-Key Cryptosystems:** Diffie-hellman key exchange, The algorithm, key exchange protocols, man in the middle attack, Elgamal Cryptographic systems, Elliptic curve arithmetic, abelian groups, elliptic curves over real numbers, elliptic curves over Zp, elliptic curves over GF(2m), Elliptic curve cryptography, Analog of Diffie-hellman key exchange, Elliptic curve encryption/ decryption, security of Elliptic curve cryptography, Pseudorandom number generation based on an asymmetric cipher, PRNG based on RSA.

8 Hours

UNIT – 3

Key Management and Distribution: Symmetric key distribution using Symmetric encryption, A key distribution scenario, Hierarchical key control, session key lifetime, a transparent key control scheme, Decentralized key control, controlling key usage, Symmetric key distribution using asymmetric encryption, simple secret key distribution, secret key distribution with confidentiality and authentication, A hybrid scheme, distribution of public keys, public announcement of public keys, publicly available directory, public key authority, public keys certificates, X-509 certificates. Certificates, X-509 version 3, public key infrastructure

7 Hours

UNIT – 4

Wireless network security: Wireless security, Wireless network threats, Wireless network measures, mobile device security, security threats, mobile device security strategy, IEEE 802.11 Wireless LAN overview, the Wi-Fi alliance, IEEE 802 protocol architecture. Security, IEEE 802.11i services, IEEE 802.11i phases of operation, discovery phase, Authentication phase, key management phase, protected data transfer phase, the IEEE 802.11i pseudorandom function.

8 Hours

UNIT – 5

Web Security Considerations: Web Security Threats, Web Traffic Security Approaches. **Secure Sockets Layer:** SSL Architecture, SSL Record Protocol, Change Cipher Spec Protocol, Alert Protocol, and shake Protocol, Cryptographic Computations. **Transport Layer Security:** Version Number, Message Authentication Code, Pseudorandom Functions, Alert Codes, Cipher Suites, Client Certificate Types, Certificate Verify And Finished Messages, Cryptographic Computations, Padding **HTTPS** Connection Initiation, Connection Closure. **Secure Shell (SSH)** Transport Layer Protocol, User Authentication Protocol, Connection Protocol.

8 Hours

TEXT BOOK:

1. William Stallings: Cryptography and Network Security, Pearson 6th edition. 2013

REFERENCE BOOK:

1. V K Pachghare: Cryptography and Information Security, PHE ,2013.

COURSE OUTCOMES (COs):

The students should be able to:

CO1	Apply knowledge of classical encryption technique to analyse, solve, and evaluate crypto problems.
CO2	Evaluate public key crypto systems.
CO3	Demonstrate key management and distribution schemes in the field of Information Security
CO4	Identify the threats and counter measures in Wireless and Web security domain

BMS COLLEGE OF ENGINEERING, BENGALURU-19

Autonomous College under VTU

Department of Information Science and Engineering

Course Title	CLIENT SERVER PROGRAMMING				
Course Code	16ISCNPCCS	Credits	4	L-T-P-S	3-0-1-0
CIE	50 Marks	SEE	100 Marks (50% Weightage)		
Contact Hours / Week	5	Total Lecture Hours	39		

UNIT – 1

The Client Server Model and Software Design: Introduction, Motivation, Terminology and Concepts. **Concurrent Processing in Client-Server software:** Terminology and Concepts. **Concurrent Processing in Client-Server software:** Introduction, Concurrency in Networks, Concurrency in Servers, Terminology and Concepts, An example of Concurrent Process Creation, Executing New Code, Context Switching and Protocol Software Design, Concurrency and Asynchronous I/O. **Program Interface to Protocols:** Introduction, Loosely Specified Protocol Software Interface, Interface Functionality, Conceptual Interface Specification, System Calls, Two Basic Approaches to Network Communication, The Basic I/O Functions available in UNIX, Using UNIX I/O with TCP/IP.

7 Hours

UNIT – 2

The Socket Interface: Introduction, Berkley Sockets, Specifying a Protocol Interface, The Socket Abstraction, Specifying an End Point Address, A Generic Address Structure, Major System Calls used with Sockets, Utility Routines for Integer Conversion, Using Socket Calls in a Program, Symbolic Constants for Socket Call Parameters. **Algorithms and Issues in Client Software Design:** Introduction, Learning Algorithms instead of Details, Client Architecture, Identifying the Location of a Server, Parsing an Address Argument, Looking up a Domain Name, Looking up a well-known Port by Name, Port Numbers and Network Byte Order, Looking up a Protocol by Name, The TCP Client Algorithm, Allocating a Socket, Choosing a Local Protocol Port Number, A fundamental Problem in choosing a Local IP Address, Connecting a TCP Socket to a Server, Communicating with the Server using TCP, Reading a response from a TCP Connection, Closing a TCP Connection, Programming a UDP Client, Connected and Unconnected UDP Socket, Using Connect with UDP, Communicating with a Server using UDP, Closing a Socket that uses UDP, Partial Close for UDP, A Warning about UDP Unreliability.

8 Hours

UNIT- 3

Example Client Software: Introduction, The Importance of Small Examples, Hiding Details, An Example Procedure Library for Client Programs, Implementation of Connect TCP, Implementation of Connect UDP, A Procedure that Forms Connections, Connect TCP, Implementation of Connect UDP, A Procedure that Forms Connections, Using the Example Library, The DAYTIME Service, Implementation of a TCP Client for DAYTIME, Reading from a TCP Connection, The Time Service, Accessing the TIME Service, Accurate Times and Network Delays, A UDP Client for the TIME Service, The ECHO Service, A TCP Client for the ECHO Service, A UDP Client for the ECHO Service.

8 Hours

UNIT – 4

Algorithms and Issues in Server Software Design: Introduction, The Conceptual Server Algorithm, Concurrent Vs Iterative Servers, Connection-Oriented Vs Connectionless Access, Connection-Oriented Servers, Connectionless Servers, Failure, Reliability and Statelessness, Optimizing Stateless Servers, Four Basic Types of Servers, Request Processing Time, Iterative Server Algorithms, An Iterative Connection-Oriented Server Algorithm, Binding to a Well Known Address using INADDR_ANY, Placing the Socket in Passive Mode, Accepting Connections and using them. An Iterative Connectionless Server Algorithm, Forming a Reply Address in a Connectionless Server, Concurrent Server Algorithms, Master and Slave Processes, A Concurrent Connectionless Server Algorithm, A concurrent Connection-Oriented Server Algorithm, Using separate Programs as Slaves, Apparent Concurrency using a Single Process, When to use each Server Types, The Important Problem of Server Deadlock, Alternative Implementations.

8 Hours

UNIT- 5

Iterative, Connectionless Servers (UDP): Introduction, Creating a Passive Socket, Process Structure, An example TIME Server. **Iterative, Connection-Oriented Servers(TCP):** Introduction, Allocating a Passive TCP Socket, A Server for the DAYTIME Service, Process Structure, An Example DAYTIME Server, Closing Connections, Connection Termination and Server Vulnerability. **Concurrent, Connection-Oriented Servers (TCP):** Introduction, Concurrent ECHO, Iterative Vs Concurrent **Servers (TCP):** Introduction, Concurrent ECHO, Iterative Vs Concurrent **Servers (TCP):** Introduction, Concurrent ECHO, Iterative Vs Concurrent

8 Hours

TEXT BOOK:

1. Douglas E.Comer, David L. Stevens: Internetworking with TCP/IP – Vol. 3, Client-Server Programming and Applications, BSD Socket Version with ANSI C, 2nd Edition, Pearson, 2001.

PRACTICAL WORK:

1. Designing, developing and executing various client and server programs in C for different services and demonstrating its functioning.

2. Designing, developing and executing client and server software for different services using JAVA/Python networking facilities and demonstrate its functioning.

COURSE OUTCOMES (COs):

The students should be able to:

CO1	Apply the knowledge of various Client-Server Models, protocol Software and network communication approaches in designing client and server software
CO2	Identify the necessary socket interfaces and Client-Server Models to design application based TCP, UDP Client and server software
CO3	Analyse the design issues of TCP, UDP Client and server software with required socket interfaces to develop application
CO4	Design concurrent and iterative, connection oriented and connectionless Client-Server models for various services
CO5	Develop and demonstrate concurrent and iterative, connection oriented and connectionless Client-Server software for various services using System Calls, I/O Functions available in UNIX-C, Java and Python

BMS COLLEGE OF ENGINEERING, BENGALURU-19

Autonomous College under VTU

Department of Information Science and Engineering

Course Title	ADVANCED STORAGE AREA NETWORK				
Course Code	16ISCNPESA	Credits	04	L-T-P-S	3-1-0-0
CIE	50 Marks	SEE	100 Marks (50% Weightage)		
Contact Hours / Week	4	Total Lecture Hours	39		

UNIT – 1

Introduction: Server Centric IT Architecture and its Limitations; Storage – Centric IT Architecture and its advantages Intelligent Disk Subsystems: Architecture of Intelligent Disk Subsystems; Hard disks and Internal I/O Channels; JBOD, Storage virtualization using RAID and different RAID levels; Caching: Acceleration of Hard Disk Access; Intelligent disk subsystems, Availability of disk subsystems.

8 Hours

UNIT – 2

I/O Techniques: The Physical I/O path from the CPU to the Storage System; SCSI; Fibre Channel Protocol Stack; Fibre Channel SAN; IP Storage. Network SCSI; Fibre Channel Protocol Stack; Fibre Channel SAN; IP Storage. Network SCSI; Fibre Channel Protocol Stack; Fibre Channel SAN; IP Storage.

8 Hours

UNIT – 3

Storage Virtualization: Definition of Storage virtualization; Implementation Considerations; Storage virtualization on Block or file level; Storage virtualization on various levels of the storage Network; Symmetric and Asymmetric storage virtualization in the Network.

8 Hours

UNIT – 4

NAS Architecture: Network Attached Storage: The NAS Architecture, The NAS hardware Architecture, The NAS Software Architecture, Network connectivity, NAS as a storage system. File System and NAS: Local File Systems; Network file Systems and file servers; Shared Disk file systems; Comparison of fibre Channel and NAS

8 Hours

UNIT – 5

Management of Storage Network: System Management, Requirement of management System, Support by Management System, Management Interface, Standardized Mechanisms, Property Mechanisms, In-band Management, Use of SNMP, CIM and WBEM, Storage Management Initiative Specification (SMI-S), CMIP and DMI, Optional Aspects of the

Management of Storage Networks, Summary

7 Hours

TEXT BOOK:

1. Ulf Troppens, Rainer Erkens and Wolfgang Muller: Storage Networks Explained, Wiley India, 2013.

REFERENCE BOOKS:

1. Robert Spalding: "Storage Networks The Complete Reference", Tata McGraw-Hill, 2011.
2. Marc Farley: Storage Networking Fundamentals – An Introduction to Storage Devices, Subsystems, Applications, Management, and File Systems, Cisco Press, 2005.
3. Richard Barker and Paul Massiglia: "Storage Area Network Essentials A Complete Guide to understanding and Implementing SANs", Wiley India, 2006.

COURSE OUTCOMES (COs):

The students should be able to:

CO1	Understand different types of logical and physical components of a storage infrastructure
CO2	Analyse the policies for LUN masking, file systems
CO3	Comprehend the different architectures of backup / recovery and virtualization technologies
CO4	Extract information and make effective presentations on the benefits of the different network storage options for various application environments
CO5	Develop awareness on different applications of Storage Area Networks Management in IT industry

BMS COLLEGE OF ENGINEERING, BENGALURU-19

Autonomous College under VTU

Department of Information Science and Engineering

Course Title	COMPUTER SYSTEMS PERFORMANCE ANALYSIS				
Course Code	16ISCNPECA	Credits	04	L-T-P-S	3-1-0-0
CIE	50 Marks	SEE	100 Marks (50% Weightage)		
Contact Hours / Week	4	Total Lecture Hours	39		

UNIT – 1

Introduction: The art of Performance Evaluation; Common Mistakes in Performance Evaluation, A Systematic Approach to Performance Evaluation, Selecting an Evaluation Technique, Selecting Performance Metrics, Commonly used Performance Metrics, Utility Classification of Performance Metrics, Setting Performance Requirements.

7 Hours

UNIT – 2

Workloads, Workload Selection and Characterization: Types of Workloads, addition instructions, Instruction mixes, Kernels; Synthetic programs, Application benchmarks, popular benchmarks. Work load Selection: Services exercised, level of detail; Representativeness; Timeliness, Other considerations in workload selection. Work load characterization Techniques: Terminology; Averaging, Specifying dispersion, Single Parameter Histograms, Multi Parameter Histograms, Principle Component Analysis, Markov Models, Clustering.

8 Hours

UNIT – 3

Monitors, Program Execution Monitors and Accounting Logs: Monitors: Terminology and classification; Software and hardware monitors, Software versus hardware monitors, Firmware and hybrid monitors, Distributed System Monitors, Program Execution Monitors and Accounting Logs, Program Execution Monitors Techniques for Improving Program Performance

Capacity Planning and Benchmarking: Steps in capacity planning and management; Problems in Capacity Planning; Common Mistakes in Benchmarking; Benchmarking Games

8 Hours

UNIT – 4

The Art of Data Representation: Guidelines for drawing good graphic charts, common mistakes in preparing charts, Pictorial games, Gantt Charts, Kiviat charts.

Summarizing Measured Data: Basic Probability and Statistics Concepts, Summarizing Data by a Single Number, Selecting among the Mean, Median and Mode, Common misuses of Means, Geometric Mean, Harmonic Mean, Mean of a Ratio, Summarizing Variability, Selecting the Index of Dispersion, Determining Distribution of Data.

8 Hours

BMS COLLEGE OF ENGINEERING, BENGALURU-19

Autonomous College under VTU

Department of Information Science and Engineering

UNIT – 5

Experimental Design and Analysis: Terminology, Common mistakes in experiments, Types of experimental designs, 2k Factorial Designs, Computation of effects, Sign table method for computing effects, Allocation of variance, General 2k Factorial Designs.

Queuing Models: Queuing Notation; Rules for all Queues; Little's Law, Types of Stochastic Process. Analysis of Single Queue: Birth-Death Processes; M/M/1 Queue; M/M/m Queue; Limitations of Queuing Theory

8 Hours

TEXT BOOK:

1. Raj Jain: The Art of Computer Systems Performance Analysis, John Wiley and Sons, 2013.

REFERENCE BOOKS:

1. Paul J Fortier, Howard E Michel: Computer Systems Performance Evaluation and prediction, Elsevier, 2003.
2. Trivedi K S: Probability and Statistics with Reliability, Queuing and Computer Science Applications, 2nd Edition, Wiley India, 2001

COURSE OUTCOMES (COs):

The students should be able to:

CO1	Apply different evaluation techniques to computer system performance problems
CO2	Analyse diverse evaluation techniques and performance metrics for performance evaluation of Computer Systems
CO3	Recognize techniques to characterize the workloads of Computer Systems and articulate of how monitors are used to observe, analyse and report system performance
CO4	Analyse collections of measured performance data and present it in a meaningful manner
CO5	Design approaches for conduction of experiments and analytical techniques to predict the performance of future loads

BMS COLLEGE OF ENGINEERING, BENGALURU-19

Autonomous College under VTU

Department of Information Science and Engineering

Course Title	SOCIAL NETWORK ANALYSIS				
Course Code	16ISCNPESN	Credits	04	L-T-P-S	3-1-0-0
CIE	50 Marks	SEE	100 Marks (50% Weightage)		
Contact Hours / Week	4	Total Lecture Hours	39		

UNIT – 1

Introduction to social network analysis and Descriptive network analysis: Introduction to new science of networks. Networks examples. Graph theory basics. Statistical network properties. Degree distribution, clustering coefficient. Frequent patterns. Network motifs. Cliques and k-cores

7 Hours

UNIT – 2

Network structure, Node centralities and ranking on network: Nodes and. edges, network diameter and average path length. Node centrality metrics: degree, closeness and betweenness centrality. Eigenvector centrality and PageRank. Algorithm HITS

8 Hours

UNIT – 3

Network communities and Affiliation Graph partitioning and cut metrics. Edge Affiliation network and bipartite graphs. 1-mode projections. Recommendation systems

8 Hours

UNIT – 4

Information and influence propagation on networks and Network visualization: Social Diffusion. Basic cascade model. Influence maximization. Most influential nodes in network. Network visualization and graph layouts. Graph sampling. Low –dimensional projections

8 Hours

UNIT – 5

Social media mining and SNA in real world: FB/VK and Twitter analysis: Natural language processing and sentiment mining. Properties of large social networks: friends, connections, likes, re-tweets

8 Hours

TEXT BOOKS:

1. David Easley and John Kleinberg. "Networks, Crowds, and Markets: Reasoning About a Highly Connected World." Cambridge University Press 2010.
2. Eric Kolaczyk, Gabor Csardi. "Statistical Analysis of Network Data with R (Use R!)". Springer, 2014.
3. Stanley Wasserman and Katherine Faust. "Social Network Analysis. Methods and Applications." Cambridge University Press, 1994

COURSE OUTCOMES (COs):

The students should be able to:

CO1	Understand basic notation and terminology used in network science
CO2	Visualize, summarize and compare networks
CO3	Comprehend network analysis algorithms
CO4	Analyze real world social networks

BMS COLLEGE OF ENGINEERING, BENGALURU-19

Autonomous College under VTU

Department of Information Science and Engineering

Course Title	PROTOCOL ENGINEERING				
Course Code	16ISCNPEPR	Credits	04	L-T-P-S	3-1-0-0
CIE	50 Marks	SEE	100 Marks (50% Weightage)		
Contact Hours / Week	4	Total Lecture Hours	39		

UNIT – 1

Introduction, Communication Model, Software, Subsystems, Protocol, Communication protocol development methods, Protocol Engineering Process, Layered Architecture, Network services and interfaces, Protocol functions, OSI, TCP/IP, Wireless Protocol Challenges, Application Protocols.

8 Hours

UNIT – 2

Protocol Specification, Components, Services, Protocol Entity, Interface, Interactions, Multimedia, Internet. Protocol Specification Languages, SDL, SPIN, Estelle, E-Lotus, CPN, Uppal, UML.

8 Hours

UNIT – 3

Protocol Verification and Validation, Finite State Machines, Design Errors, Approaches, SDL based, Communication Protocol Conformance Test Principle, Test Execution, Methodology and Framework, Architectures, Generation Methods

7 Hours

UNIT – 4

Protocol Performance Testing, SDL based TCP and OSPF, Interoperability, SDL based CSMA/CD and CSMA/CA, Scalability, Protocol Synthesis, Interactive and Automatic, SDL from MSC, Re-synthesis.

8 Hours

UNIT – 5

Protocol implementation, requirement, Object based, compilers, Tool for Protocol Engineering

8 Hours

TEXT BOOK:

1. Pallapa Venkataram, Sunil Kumar S Manvi, B. Sathish Babu " Communication Protocol Engineering, PHI, Learning, 2014.

REFERENCE BOOK:

1. Mohammed G. Gouda: Elements of Protocol Design, Wiley Student Edition, 2004.

COURSE OUTCOMES (COs):

The students should be able to:

CO1	Understand the communication protocol development methods
CO2	Apply protocol specification languages for the given problems
CO3	Validate and verify using tools
CO4	Demonstrate protocol performance testing
CO5	Implement protocol based on the tools

BMS COLLEGE OF ENGINEERING, BENGALURU-19

Autonomous College under VTU

Department of Information Science and Engineering

Course Title	PROBABILITY STATISTICS AND QUEUING THEORY				
Course Code	16ISCNPEPQ	Credits	03	L-T-P-S	3-0-0-0
CIE	50 Marks	SEE	100 Marks (50% Weightage)		
Contact Hours / Week	3	Total Lecture Hours	39		

UNIT – 1

Axioms of probability, Conditional probability, Total probability, Baye's theorem, Discrete Random variable, Probability mass function, Continuous Random variable Probability density function, Cumulative Distribution Function, and its properties, Two-dimensional Random variables

8 Hours

UNIT – 2

Probability Distributions / Discrete distributions: Binomial, Poisson Geometric. Continuous distributions: Uniform, Normal, exponential distributions and their properties.

8 Hours

UNIT – 3

Random Processes: Classification, Methods of description, Special classes, Average values of Random Processes, Analytical representation of Random Process, Markov Process, Markov chain.

8 Hours

UNIT – 4

Testing Hypothesis: Testing of Hypothesis: Formulation of Null hypothesis, critical region, level of significance, errors in testing, Tests of significance for Large and Small Samples, t-distribution, its properties and uses, Chi-square distribution, its properties and uses, $\chi 2$ – test for goodness of fit

8 Hours

UNIT – 5

Symbolic Representation of a Queuing Model, Poisson Queue system, Little Law, Independence Types of Stochastic Processes, Birth-Death Process, The M/M/1 Queuing System, The M/M/s Queuing System, The M/M/s Queuing with Finite buffers.

7 Hours

TEXT BOOK:

1. Probability, Statistics and Random Processes, 3rd Edition by T. Veerarajan, Tata McGraw Hill, 2009

REFERENCE BOOKS:

1. Probability & Statistics with Reliability, Queuing and Computer Applications, 2nd Edition by Kishor S. Trivedi , Prentice Hall of India ,2004

2. Probability, Statistics and Random Processes, 1st Edition by P Kausalya, Pearson Education, 2013.

COURSE OUTCOMES (COs):

The students should be able to:

CO1	Understand the basics of probability theory, random variables, probability distributions & queuing models.
CO2	Apply the knowledge of probability theory to compute posterior likelihood Information.
CO3	Analyze and solve problems using right probability distributions and hypothesis testing.
CO4	Synthesize the information using random processes and translate real-world problems into probability models.
CO5	Conduct experiments using computer programs to facilitate the analysis and representation of data.

BMS COLLEGE OF ENGINEERING, BENGALURU-19

Autonomous College under VTU

Department of Information Science and Engineering

Course Title	ADVANCED ALGORITHMS				
Course Code	16ISCNPEAA	Credits	03	L-T-P-S	3-0-0-0
CIE	50 Marks	SEE	100 Marks (50% Weightage)		
Contact Hours / Week	3	Total Lecture Hours	39		

UNIT – 1

Review of Analysis Techniques: Growth of Functions: Asymptotic notations; Standard notations and common functions; Recurrences and Solution of Recurrence equations- The substitution method, The recurrence – tree method, The master method; Amortized Analysis: Aggregate, Accounting and Potential Methods.

8 Hours

UNIT – 2

Graph Algorithms: Bellman - Ford Algorithm; Single source shortest paths in a DAG; Flow networks and Ford-Fulkerson method;
Maximum bipartite matching. **Polynomials and the FFT:** Representation of Maximum bipartite matching. Representation of polynomials; The DFT and FFT

8 Hours

UNIT – 3

Number -Theoretic Algorithms: Elementary notions; GCD; Modular Arithmetic; Solving modular linear equations; The Chinese remainder theorem; Powers of an element; RSA cryptosystem; Primality testing

8 Hours

UNIT – 4

String-Matching Algorithms: Naïve string Matching; Rabin - Karp algorithm; Knuth-Morris-Pratt algorithm; Boyer – Moore algorithms.

8 Hours

UNIT – 5

Probabilistic and Randomized Algorithms: Probabilistic algorithms; Randomizing deterministic algorithms, Monte Carlo and Las Vegas algorithms

7 Hours

TEXT BOOKS:

1. T. H Cormen, C E Leiserson, R L Rivest and C Stein: Introduction to Algorithms, 3rd Edition, Prentice-Hall of India, 2010.

2. Kenneth A. Berman, Jerome L. Paul: Algorithms, Cengage Learning, 2002.

REFERENCE BOOK:

1. Ellis Horowitz, Sartaj Sahni, S.Rajasekharan: Fundamentals of Computer Algorithms, 2nd Edition, Universities press, 2007

COURSE OUTCOMES (COs):

The students should be able to:

CO1	Understand Graph and Number theoretic based algorithms
CO2	Understand String matching and Probabilistic oriented algorithms
CO3	Design and apply iterative and recursive algorithms
CO4	Design and implement optimization algorithms in specific applications
CO5	Design appropriate shared objects and concurrent objects for applications

BMS COLLEGE OF ENGINEERING, BENGALURU-19

Autonomous College under VTU

Department of Information Science and Engineering

Course Title	MULTI-CORE ARCHITECTURE AND PROGRAMMING				
Course Code	16ISCNPEMA	Credits	03	L-T-P-S	3-0-0-0
CIE	50 Marks	SEE	100 Marks (50% Weightage)		
Contact Hours / Week	3	Total Lecture Hours	39		

UNIT-1

Introduction to Multi-core Architecture: Motivation for Concurrency in software, Parallel Computing Platforms, Parallel Computing in Microprocessors, Differentiating Multi-core Architectures from Hyper- Threading Technology, Multi-threading on Single-Core versus Multi-Core Platforms Understanding Performance, Amdahl's Law, Growing Returns: Gustafson's Law. **System Overview of Threading:** Defining Threads, System View of Threads, Threading above the Operating System, Threads inside the OS, Threads inside the Hardware, What Happens When a Thread Is Created, Application Programming Models and Threading, Virtual Environment: VMs and Platforms, Runtime Virtualization, System Virtualization.

5 Hours

UNIT -2

Fundamental Concepts of Parallel Programming: Designing for Threads, Task Decomposition, Data Decomposition, Data Flow Decomposition, Implications of Different Decompositions, Challenges You'll Face, Parallel Programming Patterns, A Motivating Problem: Error Diffusion, Analysis of the Error Diffusion Algorithm, An Alternate Approach: Parallel Error Diffusion, Other Alternatives.

Threading and Parallel Programming Constructs: Synchronization, Critical Sections, Deadlock, Synchronization Primitives, Semaphores, Locks, Condition Variables, Messages, Flow Control- based Concepts, Fence, Barrier, Implementation-dependent Threading Features.

8 Hours

UNIT -3

Threading APIs : Threading APIs for Microsoft Windows, Win32/MFC Thread APIs, Threading APIs for Microsoft. NET Framework, Creating Threads, Managing Threads, Thread Pools, Thread Synchronization, POSIX Threads, Creating Threads, Managing Threads, Thread Synchronization, Signaling, Compilation and Linking.

8 Hours

BMS COLLEGE OF ENGINEERING, BENGALURU-19

Autonomous College under VTU

Department of Information Science and Engineering

UNIT -4

OpenMP: A Portable Solution for Threading: Challenges in Threading a Loop, Loop-carried Dependence, Data-race Conditions, Managing Shared and Private Data, Loop Scheduling and Portioning, Effective Use of Reductions, Minimizing Threading Overhead, Work-sharing Sections, Performance-oriented Programming, Using Barrier and No wait, Interleaving Single-thread and Multi-thread Execution, Data Copy-in and Copy-out, Protecting Updates of Shared Variables, Intel Task queuing Extension to OpenMP, OpenMP Library Functions, OpenMP Environment Variables, Compilation, Debugging, performance.

9 Hours

UNIT -5

Solutions to Common Parallel Programming Problems: Too Many Threads, Data Races, Deadlocks, and Live Locks, Deadlock, Heavily Contended Locks, Priority Inversion, Solutions for Heavily Contended Locks, Non-blocking Algorithms, ABA Problem, Cache Line Ping-ponging, Memory Reclamation Problem, Recommendations, Thread-safe Functions and Libraries, Memory Issues, Bandwidth, Working in the Cache, Memory Contention, Cache-related Issues, False Sharing, Memory Consistency, Current IA-32 Architecture, Itanium Architecture, High-level Languages, Avoiding Pipeline Stalls on IA-32,Data Organization for High Performance.

9 Hours

TEXT BOOK :

1. Multicore Programming, Increased Performance through Software Multi-threading by Shameem Akhter and Jason Roberts , Intel Press , 2006

REFERENCE BOOKS:

1. Calvin Lin, Lawrence Snyder: Principles of Parallel Programming, Pearson Education, 2009.
2. Michael J. Quinn: Parallel Programming in C with MPI and OpenMP, Tata McGraw Hill, 2004.

COURSE OUTCOMES (COs):

The students should be able to:

CO1	Understand the basics of parallel computing like ILP, Multicore, hyper threading and need for parallel computing
CO2	Identify parts of the programme that can be parallelized, examine different techniques for achieving multithreading and estimate their performance benefits
CO3	Apply threading APIs for exploiting parallelism in multicore environment
CO4	Design and Implement parallel algorithm using multithreading in Open MP
CO5	Able to Identify and Analyse solutions to common parallel programming problems

BMS COLLEGE OF ENGINEERING, BENGALURU-19

Autonomous College under VTU

Department of Information Science and Engineering

Course Title	SOFT COMPUTING				
Course Code	16ISCNPESC	Credits	03	L-T-P-S	3-0-0-0
CIE	50 Marks	SEE	100 Marks (50% Weightage)		
Contact Hours / Week	3	Total Lecture Hours	39		

UNIT – 1

Introduction to Soft computing: Neural networks, Fuzzy logic, Genetic algorithms, Hybrid systems and its applications.

ANN: Evolution, basic Model of ANN, Terminologies used in ANN, MP model-Theory and Architecture, Linear Separability, Hebb Network.

8 Hours

UNIT – 2

Supervised Learning Network: Perceptron Networks, Adaptive linear neuron, Multiple adaptive linear neurons, Back propagation Network (Theory, Architecture, Algorithm for training, learning factors, testing and applications of all the above NN models).

8 Hours

UNIT – 3

Unsupervised Learning Networks: Introduction, Fixed weight competitive nets, Kohonen Self-Organizing Feature Maps, Learning Vector Quantization, Adaptive Resonance Theory Network.

8 Hours

UNIT – 4

Introduction to classical sets and fuzzy sets: Classical sets – Operations and properties, Fuzzy sets-Operations and properties, Fuzzy relations – Cardinality, operations, properties, fuzzy composition, Tolerance and equivalence relations – Fuzzy equivalence relation, Fuzzy tolerance relation.

8 Hours

UNIT – 5

Membership functions and Defuzzification: Features of membership functions, Fuzzification, Methods of membership value assignment, Lambda-Cuts for fuzzy sets, relations, Defuzzification methods.

7 Hours

TEXT BOOK:

1. Principles of Soft computing, Shivanandam, Deepa S. N Wiley India, ISBN 13: 9788126527410, 2011 (Chapters 1, 2, 3(Upto 3.5), 7, 8, 9, 10, 13, 15 (upto 15.6 & 15.9,15,10)

REFERENCE BOOK:

1. Neuro-fuzzy and soft computing, J.S.R. JANG, C.T. SUN, E. MIZUTANI, Phi (EEE edition), 2012.

COURSE OUTCOMES (COs):

The students should be able to:

CO1	Implement machine learning through soft computing techniques.
CO2	Analyze soft computing algorithms to solve the optimization problems
CO3	Apply supervised and unsupervised learning for classification and clustering.
CO4	Design fuzzy systems based on fuzzy composition and membership functions.

BMS COLLEGE OF ENGINEERING, BENGALURU-19

Autonomous College under VTU

Department of Information Science and Engineering

Course Title	CYBER SECURITY AND LAW				
Course Code	16ISCNPCCL	Credits	4	L-T-P-S	3-0-1-0
CIE	50 Marks	SEE	100 Marks (50% Weightage)		
Contact Hours / Week	5	Total Lecture Hours	39		

UNIT – 1

Introduction to Cybercrime: Cybercrime: Definition and Origins of the Word, Cybercrime and Information Security, Who are Cybercriminals?, Classifications of Cybercrimes, Cybercrime: The Legal Perspectives, Cybercrimes: Perspective, Cybercrime and the Indian ITA 2000, A Global Perspective on Cybercrimes, Cybercrime Era: Survival Mantra for the Netizens. **Cyber offenses: How Criminals Plan Them:** How Criminals Plan the Attacks, Social Cyber stalking Cyber cafe and Cybercrimes, Botnets: The Fuel for Cybercrime, Attack Vector, Cloud Computing.

7 Hours

UNIT – 2

Cybercrime: Mobile and Wireless Devices: Introduction, Proliferation of Mobile and Wireless Devices, Trends in Mobility, Credit Card Frauds in Mobile and Wireless Computing Era, Security Challenges Posed by Mobile Devices, Registry Settings for Mobile Devices, Authentication Service Security, Attacks on Mobile/Cell Phones, Mobile Devices: Security Implications for organizations, Organizational Measures for Handling Mobile, Organizational Security Policies and Measures in Mobile Computing Era, Laptops.

8 Hours

UNIT – 3

Tools and Methods Used in Cybercrime: Introduction, Proxy Servers and Anonymizers, Phishing, Password Cracking, Key loggers and Spywares, Virus and Worms, Trojan Horses and Backdoors, Steganography, DoS and DDoS Attacks, SQL Injection, Buffer Overflow, Attacks on Wireless Networks. **Phishing and Identity Theft:** Introduction, Phishing, Identity Theft (ID Theft).

8 Hours

UNIT – 4

Understanding Computer Forensics: Introduction, Historical Background of Cyber forensics, Digital Forensics Science, The Need for Computer Cyber forensics and Digital Evidence, Forensics Analysis of E-Mail, Digital Forensics Life Cycle, Chain of Custody Concept, Network Forensics, Approaching a Computer Forensics Investigation, Setting up a Computer Forensics

Laboratory: Understanding the Requirements, Computer Forensics and Steganography, Relevance of the OSI 7 Layer Model to Computer Forensics, Forensics and Social Networking Sites: The Security/Privacy Threats, Computer Forensics from Compliance Perspective, Challenges in Computer Forensics, Special Tools and Techniques, Forensics Auditing, Anti forensics.

8 Hours

UNIT – 5

The Legal Perspectives on Cybercrimes and Cyber security: The legal landscape around the world. Need of Cyber laws in the Indian context. The Indian IT Act. Digital signatures and The Indian IT Act. Amendments to The Indian IT Act. Cybercrime and Punishment.

8 Hours

TEXT BOOKS:

1. Sunit Belapure and Nina Godbole, "Cyber Security: Understanding Cyber Crimes, Computer Forensics And Legal Perspectives", Wiley India Pvt Ltd, ISBN: 978-81-265-21791, Publish Date 2013
2. Dr. Surya Prakash Tripathi, Ritendra Goyal, Praveen Kumar Shukla, KLSI. "Introduction to information security and cyber laws". Dreamtech Pre ss. ISBN: 9789351194736, 2015

REFERENCE BOOKS:

1. Thomas J. Mowbray, "Cybersecurity: Managing Systems , Conducting Testing, and Investigating Intrusions", Copyright © 2014 by John Wiley & Sons, Inc, ISBN: 91-118 - 84965 -1
2. James Graham, Ryan Olson, Rick Howard, "Cyber Secur ity Essentials", CRC Press, 15-Dec-2010

COURSE OUTCOMES (COs):

The students should be able to:

CO1	Discriminate and analyze problems involved in cybercrime
CO2	Synthesis cybercrime issues on wireless and mobile devices
CO3	Use and apply modern cyber forensics tools
CO4	Analyze the computer forensic problems for a feasible solution
CO5	Develop cyber security policies for given type of organization
CO6	Apply cyber law for a given type of cyber issues

BMS COLLEGE OF ENGINEERING, BENGALURU-19

Autonomous College under VTU

Department of Information Science and Engineering

Course Title	DISTRIBUTED COMPUTING				
Course Code	16ISCNPCDC	Credits	3	L-T-P-S	3-0-0-0
CIE	50 Marks	SEE	100 Marks (50% Weightage)		
Contact Hours / Week	3	Total Lecture Hours	39		

UNIT – 1

Distributed System management: Introduction, Resource management, Task Assignment Approach, Load-Balancing Approach, Load-Sharing Approach, Process management in a Distributed Environment, Process Migration, Threads, Fault Tolerance.

6 Hours

UNIT – 2

Distributed Shared Memory: Introduction, Basic Concepts of DSM, Hardware DSM, Design Issue in DSM Systems, Issue in Implementing DSM Systems, Heterogeneous DSM Systems.

8 Hours

UNIT – 3

Distributed File System: Introduction to DFS, File Models, Distributed File System Design, Semantics of File Sharing, DFS Implementation, File Caching in DFS, Replication in DFS. **Naming:** Introduction, Desirable features of a good naming system, Basic concepts, System-oriented names, Object-locating mechanisms, Issues in designing human-oriented names.

9 Hours

UNIT – 4

Security in distributed systems: Introduction, Cryptography, Secure channels, Access control, Security Management.

8 Hours

UNIT – 5

Real-Time Distributed operating Systems: Introduction, Design issues in real-time distributed systems, Real-time communication, Real-time scheduling.

Emerging Trends in distributed Computing: Grid Computing, SOA, Cloud computing.

8 Hours

TEXT BOOK:

1. Sunitha Mahajan , Seema Shah: Distributing Computing, Oxford University press 2010.

REFERENCE BOOKS:

1. George Couloris, Jean Dollimore, Tim Kindberg, Gordon Blair, Distributed Systems: Concepts and Design, 5th Edition, Pearson, 2012.

2. Andrew S. Tanenbaum, Maarten Van Steen, Distributed Systems: Principles and Paradigms, 2nd Edition, Pearson 2007.

COURSE OUTCOMES (COs):

The students should be able to:

CO1	Apply the concepts of operating system and networking to realize distributed systems
CO2	Apply the techniques in distributed computing to support transparency, scalability, security and fault tolerance
CO3	Analyze the existing large distributed system architectures that have been designed in terms of synchronization, communication, security and fault tolerance
CO4	Analyze the alternatives for devising distributed computing solutions considering the various design issues
CO5	Make effective oral presentation on past and current research issues in the field of distributed computing

BMS COLLEGE OF ENGINEERING, BENGALURU-19

Autonomous College under VTU

Department of Information Science and Engineering

Course Title	NETWORK MANAGEMENT				
Course Code	16ISCNPCNM	Credits	3	L-T-P-S	3-0-0-0
CIE	50 Marks	SEE	100 Marks (50% Weightage)		
Contact Hours / Week	3	Total Lecture Hours	39		

UNIT – 1

Introduction: Analogy of Telephone Network Management, Data and Telecommunication Network Distributed computing Environments, TCP/IP- Based Networks: The Internet and Intranets, Communications Protocols and Standards- Communication Architectures, Protocol Layers and Services; Case Histories of Networking and Management – The Importance of topology, Filtering Does Not Reduce Load on Node, Some Common Network Problems; Challenges of Information Technology Managers, Network Management: Goals, Organization, and Functions- Goal of Network Management, Network Provisioning, Network Operations and the NOC, Network Installation and Maintenance; Network and System Management, Network Management System platform, Current Status and Future of Network Management.

9 Hours

UNIT – 2

Basic Foundations: Standards, Models and Language: Network Management Standards, Network Management Model, Organization Model, Information Model – Management Information Trees, Managed Object Perspectives, Communication Model.

7 Hours

UNIT – 3

ASN.1- Terminology, Symbols, and Conventions, Objects and Data Types, Object Names, An Example of ASN.1 from ISO 8824; Encoding Structure; Macros, Functional Model. SNMPv1 **Network Management:** Managed Network: The History of SNMP Management, Internet Organizations and standards, Internet Documents, The SNMP Model, The Organization Model, System Overview. The Information Model – Introduction, The Structure of Management Information, Managed Objects, Management Information Base. **7 Hours**

UNIT – 4

The SNMP Communication Model – The SNMP Architecture, Administrative Model, SNMP Specifications, SNMP Operations, SNMP MIB Group, Functional Model. SNMP Management – RMON: Remote Monitoring, RMON SMI and MIB, RMONI1- RMON1 Textual Conventions, RMON1 Groups and Functions, Relationship Between Control and Data Tables, RMON1 Common and Ethernet Groups, RMON Token Ring Extension Groups, RMON2 – The RMON2

Management Information Base, RMON2 Conformance Specifications. Broadband Network Management: Broadband Access Networks and HFCT Technology.

6 Hours

UNIT – 5

Network Management Applications: Configuration Management- Network Provisioning, Inventory Management, Network Topology, Fault Management Fault Detection, Fault Location and Isolation Techniques, Performance Management – Performance Metrics, Data Monitoring, Management – Performance Metrics, Data Monitoring, Problem Isolation, Problem Isolation, Performance Statistics; Event Correlation Techniques – Rule-Based Reasoning, Model-Based Reasoning, Case-Based Reasoning, Codebook correlation Model, State Transition Graph Model, Finite State Machine Model, Security Management – Policies and Procedures, Security Brea ches and the Resources Needed to Prevent Them, Firewalls, Cryptography, Authentication and Authorization, Client/Server Authentication Systems, Messages Transfer Security, Protection of Networks from Virus Attacks, Accounting Management, Report Management, Policy- Based Management, Service Level Management

10 Hours

TEXT BOOK:

1. Mani Subramanian: Network Management- Principles and Practice, 2nd Pearson Education, 2010.

REFERENCE BOOK:

1. J. Richard Burke: Network management Concepts and Practices: a Hands-On Approach, PHI, 2008.

COURSE OUTCOMES (COs):

The students should be able to:

CO1	Understand TCP/IP based networks, protocol layers and services, network operations and network management system platform
CO2	Comprehend network management model, organization model, information model and communication model
CO3	Analyse SNMP model, information model and Management Information Base
CO4	Comprehend SNMP management using remote monitoring
CO5	Apply the knowledge of broadband network management, DSL technology, ADSL architecture and configuration management
CO6	Explore configuration management, network topology, performance management, correlation techniques, cryptography, authentication, authorization and protection of networks

BMS COLLEGE OF ENGINEERING, BENGALURU-19

Autonomous College under VTU

Department of Information Science and Engineering

Course Title	OPTICAL NETWORK				
Course Code	16ISCNPEON	Credits	3	L-T-P-S	3-0-0-0
CIE	50 Marks	SEE	100 Marks (50% Weightage)		
Contact Hours / Week	3	Total Lecture Hours	39		

UNIT – 1

Client Layers of the Optical Layer: SONET/SDH: Multiplexing, CAT and LCAS, Sonnet/SDH Layers, SONET Frame Structure, SONET/SDH Physical Layer , Elements of a SONET/SDH Infrastructure, Optical Transport Network: Hierarchy, Frame Structure, Multiplexing, Generic Framing Procedure Ethernet: Frame Structure, Switches, Ethernet Physical Layer, Carrier Transport IP: Routing and Forwarding, Quality of Service Multiprotocol Label Switching: Labels and Forwarding, Quality of Service, Signaling and Routing, Carrier Transport.

8 Hours

UNIT – 2

WDM Network Elements: Optical Line Terminals, Optical Line Amplifiers, Optical Add/Drop Multiplexers: OADM Architectures, Reconfigurable OADMs Optical Cross connects: All-Optical OXC Configurations.

8 Hours

UNIT – 3

Control and Management: Network Management Functions: Management Framework, Information Model, Management Protocols. Optical Layer Services and Interfacing, Layers within the Optical Layer, Multivendor Interoperability, Performance and Fault Management: The Impact of Transparency, BER Measurement, Optical Trace, Alarm Management, Data Communication Network (DCN) and Signaling, Policing, Optical Layer Overhead, Client Layers.

8 Hours

UNIT – 4

Basic Concepts: Protection in SONET/SDH: Point-to-Point Links, Self-Healing Rings, Unidirectional Line-Switched Rings, Bidirectional Line-Switched Rings, Ring Interconnection and Dual Homing. Protection in the Client Layer: Protection in Resilient Packet Rings, Protection in Ethernet, Protection in IP, Protection in MPLS, Why Optical Layer Protection: Service Classes Based on Protection.

7 Hours

BMS COLLEGE OF ENGINEERING, BENGALURU-19

Autonomous College under VTU

Department of Information Science and Engineering

UNIT – 5

WDM Network Design: Cost Trade-OFFS: A Detailed Ring Network Example LTD and RWA Problems, Light path Topology Design, Routing and Wavelength Assignment, Wavelength Conversion. Dimensioning Wavelength-Routing Networks, Statistical Dimensioning Models: First-Passage Model, Blocking Model.

8 Hours

TEXT BOOK:

1. Optical Networks by Rajeev Ramaswamy, Kumar N Sivarajan, Galen H Sasaki, Elsevier Publication 3rd Edition, 2009.

REFERENCE BOOK:

1. Uyless Black, Optical Networks-Third generation transport system: Pearson 2013.

COURSE OUTCOMES (COs):

The students should be able to:

CO1	Acquire in depth knowledge on fundamentals of optical network
CO2	Analyze the various optical network architectures like optical access networks and backbone optical transport networks
CO3	Analyze the control and management methodologies of optical network used in designing effective framework
CO4	Make effective presentation and documentation on optical network models
CO5	Develop problem solving skills and critical thinking in the designing of optical networks

BMS COLLEGE OF ENGINEERING, BENGALURU-19

Autonomous College under VTU

Department of Information Science and Engineering

Course Title	NETWORK ROUTING ALGORITHMS				
Course Code	16ISCNPENR	Credits	3	L-T-P-S	3-0-0-0
CIE	50 Marks	SEE	100 Marks (50% Weightage)		
Contact Hours / Week	3	Total Lecture Hours	39		

UNIT – 1

NETWORK ROUTING: BASICS AND FOUNDATIONS: Networking and Network Routing: An Introduction: Addressing and Internet Service: An Overview, Network Routing: An Overview, IP Addressing, On Architectures, Service Architecture, Protocol Stack Architecture, Router Architecture, Network Topology Architecture, Network Management Architecture, Public Switched Telephone Network, Communication Technologies,.

Routing Algorithms: Shortest Path and Widest Path: Bellman–Ford Algorithm and the Distance Vector Approach, Dijkstra's Algorithm, Comparison of the Bellman–Ford Algorithm and Dijkstra's Algorithm, Shortest Path Computation with Candidate Path Caching, Widest Path Computation with Candidate Path Caching, Widest Path Algorithm, k-Shortest Paths Algorithm

Routing Protocols: Framework and Principles: Routing Protocol, Routing Algorithm, and Routing Table, Routing Information Representation and Protocol Messages, Distance Vector Routing Protocol, Link State Routing Protocol, Path Vector Routing Protocol, Link Cost

8 Hours

UNIT – 2

ROUTING IN IP NETWORKS: IP Routing and Distance Vector Protocol Family : Routers, Networks, and Routing Information: Some Basics, Static Routes, Routing Information Protocol, Version 1 (RIPv1), Routing Information Protocol, Version 2 (RIPv2), Interior Gateway Routing Protocol (IGRP), Enhanced Interior Gateway Routing Protocol (EIGRP), Route Redistribution

OSPF and Integrated IS-IS : From a Protocol Family to an Instance of a Protocol, OSPF: Protocol Features, OSPF Packet Format, Examples of Router LSAs and Network LSAs, Integrated IS-IS, Similarities and Differences Between IS-IS and OSPF **Internet Routing Architectures:** Internet Routing Evolution, Addressing and Routing: Illustrations, Current Architectural View of the Internet, Allocation of IP Prefixes and A S Number, Policy-Based Routing, Point of Presence, Traffic Engineering Implications, Internet Routing Instability

9 Hours

UNIT – 3

Router Architectures: Functions of a Router, Types of Routers, Elements of a Router, Packet Flow, Packet Processing: Fast Path versus Slow Path, Router Architectures. **IP Address Lookup Algorithms:** Impact of Addressing on Lookup, Longest Prefix Matching, Naïve Algorithms, Binary Tries, Multibit Tries, Compressing Multibit Tries, Search by Length Algorithms, Search

by Value Approaches, Hardware Algorithms, Comparing Different Approaches. **IP Packet Filtering and Classification:** Importance of Packet Classification,
Packet Classification Problem, Packet Classification Algorithms, Naïve Solutions, Two-Dimensional Solutions, Approaches ford Dimensions, Extending Two-Dimensional Solutions, Divide and Conquer Approaches, Tuple Space Approaches, Decision Tree Approaches, Hardware-Based Solutions.

8 Hours

UNIT – 4

ADVANCED ROUTING PROTOCOLS FOR WIRELESS NETWORKS: Wireless networking basic aspects, Basic routing concepts, AD hoc routing, Mesh routing, Vehicular routing, Sensor routing

6 Hours

UNIT – 5

Toward NEXT GENERATION ROUTING: Quality of Service Routing: QoS Attributes, Adapting Shortest Path and Widest Path Routing: A Basic Framework, Update Frequency, Information Inaccuracy, and Impact on Routing, Lessons from Dynamic Call Routing in the Telephone Network, Heterogeneous Service, Single-Link Case, A General Framework for Source-Based QoS Routing with Path Caching, Routing Protocols for QoS Routing **MPLS and GMPLS:** Traffic Engineering Extension to Routing Protocols, Multiprotocol Label Switching, Generalized MPLS, MPLS Virtual Private Networks. **Routing and Traffic Engineering with MPLS:** Traffic Engineering of IP/MPLS Networks, VPN Traffic Engineering, Routing/Traffic Engineering for Voice Over MPLS. **VoIP Routing: Interoperability through IP and PSTN :** PSTN Call Routing Using the Internet, PSTN Call Routing: Managed IP Approach, IP-PSTN Interworking for VoIP, IP Multimedia Subsystem, Multiple Heterogeneous Providers Environment and All-IP Environment of VoIP Services

8 Hours

TEXT BOOKS:

1. Deepankar Medhiand Karthikeyan Ramasamy, “Network Routing: Algorithms, Protocols, and Architectures”, (The Morgan Kaufmann Series in Networking), Elsevier Inc 2007

2. Miguel Elias M. Campista and Marcelo G. Rubinstein, “Advanced Routing Protocols for Wireless Networks”, John Wiley & Sons , Inc, © ISTE Ltd 2014

REFERENCE BOOKS:

1. William Stallings, “High speed networks and Internets Performance and Quality of Service”, 2nd Edition, Pearson Education Asia. Reprint India 2002.

2. M. Steen Strub, "Routing in Communication network," Prentice –Hall International, Network, 1995.

3. James D. McCabe, "Network Analysis, Architecture, and Design", 3 rd Edition, 2007 Elsevier Inc.

COURSE OUTCOMES (COs):

The students should be able to:

CO1	Comprehend Network Topology architecture, Routing, Management Architecture, Communication Technologies and compare various routing algorithms also compute shortest Path with Candidate Path Caching
CO2	Identify and Implement suitable routing algorithm for a given network with user requirements and the type of channel over which the network has to operate and analyze its performance
CO3	Design a new algorithm or modify an existing algorithm to satisfy the evolving demands in the network and by the user applications
CO4	Classify packet problems using two dimensional solution
CO5	Develop quality of service for next generation routing protocols

BMS COLLEGE OF ENGINEERING, BENGALURU-19

Autonomous College under VTU

Department of Information Science and Engineering

Course Title	MULTIMEDIA COMMUNICATIONS				
Course Code	16ISCNPEMC	Credits	3	L-T-P-S	3-0-0-0
CIE	50 Marks	SEE	100 Marks (50% Weightage)		
Contact Hours / Week	3	Total Lecture Hours	39		

UNIT – 1

Introduction, multimedia information representation, multimedia networks, multimedia applications, Application and networking terminology, network QoS and application QoS, Digitization principles,. text, images, audio and video

7 Hours

UNIT – 2

Text and image compression,, compression principles, text compression- Run length, Huffman, LZW, Document Image compression using T2 and T3 coding, image compression- GIF, TIFF and JPEG

8 Hours

UNIT – 3

Audio compression: DPCM, ADPCM, Adaptive and Linear predictive coding, MPEG and Dolby coders video compression, **8 Hours**

UNIT – 4

Video compression standards: H.261, H.263, MPEG 2, MPEG-4 and Reversible VLCs, MPEG 21 multimedia framework

8 Hours

UNIT – 5

Notion of synchronization, presentation requirements, reference model for synchronization, Introduction to SMIL, Multimedia operating systems, Resource & Process management techniques. **8 Hours**

TEXT BOOKS:

1. Fred Halsall, "**Multimedia Communications**", Pearson education, 2001.

2. Raif steinmetz, Klara Nahrstedt, "**Multimedia: Computing, Communications and Applications",** Pearson education, 2002.

REFERENCE BOOKS:

1. K. R. Rao, Zoran S. Bojkovic, Dragorad A. Milovanovic, "**Multimedia Communication Systems**",Pearson education, 2004.

2. John Billamil, Louis Molina, "**Multimedia : An Introduction**", PHI, 2002.

COURSE OUTCOMES (COs):

The students should be able to:

CO1	Apply depth knowledge of multimedia communications
CO2	Synthesize and analyse the frameworks of various multimedia standardization
CO3	Analyse various multimedia applications used in application layer
CO4	Synthesize existing knowledge of multimedia middleware layer
CO5	Use Modern Engineering tools to evaluate QoS in network multimedia systems

BMS COLLEGE OF ENGINEERING, BENGALURU-19

Autonomous College under VTU

Department of Information Science and Engineering

Course Title	SOFTWARE DEFINED NETWORK				
Course Code	16ISCNPESD	Credits	3	L-T-P-S	3-0-0-0
CIE	50 Marks	SEE	100 Marks (50% Weightage)		
Contact Hours / Week	3	Total Lecture Hours	39		

UNIT – 1

Introduction: Control plane, Data plane, Moving information between planes, Why can separation be important? Distributed control planes: IP and MPLS, Creating the IP underlay, Convergence time, Load balancing, High availability, Creating the MPLS overlay, Replication. Centralized control planes: Logical versus Literal, ATM/LANE, Route servers.

7 Hours

UNIT – 2

OpenFlow: Wire protocol, Replication, FAWG, Config and Extensibility, Architecture, Hybrid approaches: Ships in the night, Dual Function switches, SDN Controllers: General concepts- VMware, Nicira.

8 Hours

UNIT – 3

Network Programmability: Management interface, Application-Network divide: Command line interface, NETCONF & NETMOD, SNMP, Modern programmatic interfaces: Publish and Subscribe interfaces, XMPP, Google's Protocol buffers, Thrift, JSON, Modern orchestration: Openstack, Cloudstack.

8 Hours

UNIT – 4

Network Function Virtualization: Virtualization and data plane I/O, Services engineered path, Service locations and chaining: Metadata, an application level approach, Scale, NFV at ETSI, Non-ETSI NFV Work: Middlebox studies, Embrace/LineRate.

8 Hours

UNIT – 5

Data Center concepts and constructs: Multitenant Data center, Virtualized multitenant data center: Orchestration, Connecting a tenant to the internet/VPN, Virtual machine migration and elasticity, Data center Interconnect, Fallacies of Data center distributed computing, Data center distributed computing pitfalls to consider, SDN solutions for the data center network, Building an SDN Framework: Open Daylight Controller/Framework.

8 Hours

TEXT BOOK:

1. SDN: Software Defined Networks, An Authoritative Review of Network Programmability Technologies, By Thomas D. Nadeau, Ken Gray Publisher: O'Reilly Media, August 2013, ISBN: 978-1-4493-4230-2, ISBN 10: 1-4493-4230-2.

REFERENCES:

1. Software Defined Networks: A Comprehensive Approach, by Paul Goransson and Chuck Black, Morgan Kaufmann, June 2014, Print Book ISBN: 9780124166752, eBook ISBN : 9780124166844
2. SDN and OpenFlow for Beginners by Vivek Tiwari, 2013.
3. Network Innovation through OpenFlow and SDN: Principles and Design, Edited by Fei Hu, CRC Press, ISBN-10: 1466572094, 2014.
4. Open Networking Foundation (ONF) Documents, https://www.opennetworking.org, 2015.
5. OpenFlow standards, http://www.openflow.org, 2015.
6. Online Reading Lists, including: http://www.nec-labs.com/~lume/sdn-reading-list.html, 2015.

COURSE OUTCOMES (COs):

The students should be able to:

CO1	Comprehend the conceptions of data and control planes with the need for plane separation
CO2	Gain knowledge on Openflow and general concepts of SDN controllers
CO3	Apply network programmability to realize new paradigm of communication and interaction
CO4	Implement network function virtualization and services
CO5	Analyze SDN solutions for data center network and frameworks

BMS COLLEGE OF ENGINEERING, BENGALURU-19

Autonomous College under VTU

Department of Information Science and Engineering

Course Title	CLOUD COMPUTING				
Course Code	16ISCNPECC	Credits	4	L-T-P-S	3-0-1-0
CIE	50 Marks	SEE	100 Marks (50% Weightage)		
Contact Hours / Week	5	Total Lecture Hours	39		

UNIT – 1

Introduction, Cloud Infrastructure: Cloud computing, Cloud computing delivery models and services, Ethical issues, Cloud vulnerabilities, Cloud computing at Amazon, Cloud computing the Google perspective, Microsoft Windows Azure and online services, Open-source software platforms for private clouds, Cloud storage diversity and vendor lock-in, Energy use and ecological impact, Service level agreements, User experience and software licensing.

8 Hours

UNIT – 2

Cloud Computing: Application Paradigms: Challenges of cloud computing, Architectural styles of cloud computing, Workflows: Coordination of multiple activities, Coordination based on a state machine model: The Zookeeper, The Map Reduce programming model, A case study: The GrepTheWeb application , Cloud for science and engineering, High-performance computing on a cloud, Cloud computing for Biology research, Social computing, digital content and cloud computing.

8 Hours

UNIT – 3

Cloud Resource Virtualization: Virtualization, Layering and virtualization, Virtual machine monitors, Virtual Machines, Performance and Security Isolation, Full virtualization and paravirtualization, Hardware support for virtualization, Case Study: Xen a VMM based paravirtualization, Optimization of network virtualization, vBlades, Performance comparison of virtual machines, The dark side of virtualization.

8 Hours

UNIT - 4

Python for Cloud: Python for Amazon Web services, Python for Google Cloud platform, Python for Windows Azure, python for map Reduce

8 Hours

UNIT – 5

Cloud Security: Introduction, CSA - Cloud Security Architecture, authentication, authorization, Identity and Access Management, data security, Key Management, Auditing

7 Hours

TEXT BOOKS:

1. Dan C Marinescu: Cloud Computing Theory and Practice. Elsevier(MK) 2013.
2. Arshdeep Bahga, vijay Madisetti " Cloud Computing – A Hands-on approach", Universities Press, 2014

REFERENCE BOOKS:

1. Rajkumar Buyya , James Broberg, Andrzej Goscinski: Cloud Computing Principles and Paradigms, Willey 2014.
2. John W Rittinghouse, James F Ransome:Cloud Computing Implementation, Management and Security, CRC Press 2013

COURSE OUTCOMES (COs):

The students should be able to:

CO1	Understand and apply the knowledge of Cloud computing delivery models and services in developing applications on Cloud platform and in creating private cloud
CO2	Analyse various application paradigms, programming and coordination models of Cloud computing
CO3	Apply the knowledge of cloud resource virtualization, management and scheduling with Virtual machine monitors
CO4	Analyse the security issues with various cloud platforms while developing applications

BMS COLLEGE OF ENGINEERING, BENGALURU-19

Autonomous College under VTU

Department of Information Science and Engineering

Course Title	INTERNET OF THINGS				
Course Code	16ISCNPEIO	Credits	4	L-T-P-S	3-0-1-0
CIE	50 Marks	SEE	100 Marks (50% Weightage)		
Contact Hours / Week	5	Total Lecture Hours	39		

UNIT – 1

Introduction to Internet of Things: Introduction: Definition and Characteristics of IoT, Physical Design of IoT**:** Things in IoT, IoT Protocols, Logical Design of IoT: IoT Functional Blocks, IoT Communication Models, IoT Communication APIs, IoT Enabling Technologies: Wireless Sensor Networks, Cloud Computing, Big Data Analytics, Communication protocols, Communication Protocols, Embedded Systems, IoT Levels and Deployment Templates Internet of Things Applications: Introduction, Home Automation, Smart Metering/Advanced Metering Infrastructure-Health/Body Area Networks, City Automation, Smart Cards, Tracking, Surveillance system, Environment, Energy, Retail, Logistics, Agriculture, Industry and Health care and Lifestyle

9 Hours

UNIT – 2

IoT Systems Logical Design using Python: Introduction, Installing Python, Data types and Data structures, Control flow, Functions, Modules, Packages, File handling, Classes, Python packages for IoT. What is an IoT device, Exemplary Device: Raspberry Pi, about the board, Linux on Raspberry Pi, Raspberry Pi Interfaces, and Programming Raspberry Pi with Python

7 Hours

UNIT – 3

Layer ½ Connectivity: Wireless Technologies for the IoT-WPAN Technologies for IoT/M2M, Cellular and Mobile Network Technologies for IoT/M2M,Layer 3 Connectivity :IPv6 Technologies for the IoT: Overview and Motivations. Address Capabilities, IPv6 Tunneling, IPsec in IPv6,Header Compression Schemes, Quality of Service in IPv6, Migration Strategies to IPv6.

8 Hours

UNIT – 4

Case Studies illustrating IoT Design-Introduction, Home Automation, Cities, Environment, Agriculture, Productivity Applications using different IoT devices, platform and software.

8 Hours

BMS COLLEGE OF ENGINEERING, BENGALURU-19

Autonomous College under VTU

Department of Information Science and Engineering

UNIT – 5

Data Analytics for IoT – Introduction, Apache Hadoop, MapReduce Programming Model, Hadoop MapReduce Job Execution, MapReduce Job Execution workflow, Hadoop Cluster Setup, Starting and Stopping Hadoop Cluster Using Hadoop MapReduce for Batch Data Analysis.

7 Hours

TEXT BOOKS:

1. Daniel Minoli, "Building the Internet of Things with IPv6 and MIPv6:The Evolving world of M2M Communications", Wiley, 2013

2. Arshdeep Bahga, Vijay Madisetti, "Internet of Things : A Hands on Approach" Universities Press., 2015

REFERENCE BOOKS:

1. Michael Miller, The Internet of Things", First E dition, Pearson, 2015.

2. Claire Rowland,Elizabeth Goodman et.al.," Designing Connected Products", First Edition,O'Reilly, 2015

COURSE OUTCOMES (COs):

The students should be able to:

CO1	Apply the knowledge of Cloud, Sensor and Communication technologies in analyzing and developing IoT applications
CO2	Identify the appropriate APIs, models and Enabling Technologies required to develop schemes for the applications of IoT
CO3	Analyze the wireless and IPV6 technologies for IoT applications
CO4	Design IoT applications for real life problems
CO5	Develop and demonstrate IoT solutions for various real time problems
CO6	Perform IoT data Analysis using Apache Hadoop MapReduce

BMS COLLEGE OF ENGINEERING, BENGALURU-19

Autonomous College under VTU

Department of Information Science and Engineering

Course Title	WEB TECHNOLOGIES				
Course Code	16ISCNPEWT	Credits	4	L-T-P-S	3-0-1-0
CIE	50 Marks	SEE	100 Marks (50% Weightage)		
Contact Hours / Week	5	Total Lecture Hours	39		

UNIT – 1

Introduction to HTML: HTML5 Document structure, HTML forms, Working with Video and Audio, **Cascading Style Sheets**: Introduction, Levels of style sheets, Style specification formats, Selector forms, Property value forms, Font properties, List properties, Alignment of text, Colour, The Box model, Background images, transitions and animations. Case Study : Twitter Bootstrap

7 Hours

UNIT - 2

Java Script: program structure in JavaScript (Datatypes, functions, objects , events), Java script, JQuery, JSON, AJAX.

8 Hours

UNIT – 3

PHP/MYSQL: What is Scripting, Client Side Scripting Vs Server Side Scripting, Features of PHP (data types, strings, functions, arrays, form handling and validation, Date Time, PHP include, Error handling). Introduction to MYSQL, Database Operations, Connecting MYSQL and PHP

8 Hours

UNIT – 4

Introduction to MVC, Benefits of MVC over conventional ASP.NET, Microsoft Razor framework**.**

8 Hours

UNIT – 5

Java Web Technologies : Creating JSP Pages, Session Management, JSP and JDBC, Database Accessing, Web services.

8 Hours

TEXT BOOKS:

1. Achyut Godbole, Atul Khathe: Web Technologies 3/e, McGraw Hill Education, 2013.

2. Robert W. Sebesta, Programming the World Wide web, 7th Edition, Pearson Education, 2013.

REFERENCE BOOK:

1. Paul J. Deitel, Harvey M. Deitel, Abbey Deitel, , Internet & World Wide Web How to Program, 5/e , Prentice Hall, , 2013.

COURSE OUTCOMES (COs):

The students should be able to:

CO1	Apply the knowledge of modern web languages, scripting languages and latest Web frameworks to develop interactive web applications
CO2	Analyze front-end web coding languages to add dynamic content, animation and effects to websites
CO3	Differentiate client side and server side scripting technologies
CO4	Design an interactive website(s) with regard to issues of usability, accessibility and Standards
CO5	Conduct experiments as per the specific requirements and constraints, based on analysis, modeling using Integrated Development tools (Webstorm/CMS).
CO6	Ability to perform in a team to create web applications using modern web programming frameworks (Webstorm).

BMS COLLEGE OF ENGINEERING, BENGALURU-19

Autonomous College under VTU

Department of Information Science and Engineering

Course Title	MOBILE APPLICATION DEVELOPMENT				
Course Code	16ISCNPEMD	Credits	4	L-T-P-S	3-0-1-0
CIE	50 Marks	SEE	100 Marks (50% Weightage)		
Contact Hours / Week	5	Total Lecture Hours	39		

UNIT – 1

Introduction to mobile communication and computing, Introduction to mobile computing, Novel applications, limitations and GSM architecture, Mobile services, System architecture, Radio interface, protocols, Handover and security. Smart phone operating systems and smart phones applications

7 Hours

UNIT – 2

Fundamentals of Android Development: Introduction to Android., The Android 4.1 Jelly Bean SDK, Understanding the Android Software Stack, Installing the Android SDK, Creating Android Virtual Devices, Creating the First Android Project, Using the Text View Control, Using the Android Emulator, The Android Debug Bridge (ADB), Basic Widgets Understanding the Role of Android Application Components, Event Handling , Displaying Messages Through Toast, Creating and Starting an Activity, Using the Edit ext Control

8 Hours

UNIT – 3

The Android Debug Bridge (ADB), Basic Widgets Understanding the Role of Android Application Components, Event Handling , Displaying Messages Through Toast, Creating and Starting an Activity, Using the Edit ext Control Building Blocks for Android Application Design, Laying Out Controls in Containers, Utilizing Resources and Media, Using Selection Widgets and Debugging Displaying and Fetching Information Using Dialogs and Fragments

8 Hours

UNIT – 4

Widgets and Debugging Using Selection Widgets and Debugging Displaying and Fetching Information Using Dialogs and Fragments Advanced Android Programming: Internet, Entertainment, and Services, Implementing drawing and animations

8 Hours

BMS COLLEGE OF ENGINEERING, BENGALURU-19

Autonomous College under VTU

Department of Information Science and Engineering

UNIT – 5

Displaying web pages and maps: Displaying web pages and maps communicating with sms and emails,. creating and using content providers: Creating and consuming services, Publishing android applications

8 Hours

TEXT BOOK:

1. Mobile Computing: technologies and Applications- N. N. Jani S chand 2009.

REFERENCE BOOK:

1. B.M.Hirwani- Android programming Pearson publications-2013.

COURSE OUTCOMES (COs):

The students should be able to:

CO1	Understand mobile computing architecture
CO2	Develop design for mobile applications for specific requirements
CO3	Implement the design using Android SDK
CO4	Implement the design using Widgets
CO5	Deploy mobile applications in Android marketplace for distribution