M.E. Computer Engineering (Computer Networks)
Course 2013 (w.e.f. 2013)

Subject Code	Subject	Teaching Scheme Hrs/Week		Examination Scheme					Credits
		Lect.	Pract	Paper		Tw	Oral/ Presentation	Marks	
				In Semester Assessment	End Semester Assessment				
SEM — I									
510201	Advanced Network Algorithms	04	—	50	50	—	—	100	**4**
510202	Wireless Communication	04	—	50	50	—	—	100	**4**
510203	Advanced Databases	04	—	50	50	—	—	100	**4**
510204	Research Methodology	04	—	50	50	—	—	100	**4**
510205	Elective –I	05	—	50	50#	—	—	100	**5**
510206	Laboratory Practice-I	—	04	—		50	50	100	**4**
	Total	**21**	**04**	**250**	**250**	**50**	**50**	**600**	**25**

Subject Code	Subject	Teaching Scheme Hrs/Week		Examination Scheme					Credits
		Lect.	Pract	Paper		Tw	Oral/ Presentation	Marks	
				In Semester Assessment	End Semester Assessment				
SEM— II									
510207	Network Design, Modeling and Analysis	04	—	50	50	—	—	100	**4**
510208	Distributed Systems	04	—	50	50	—	—	100	**4**
510209	High Performance Networks	04	—	50	50	—	—	100	**4**
510210	Elective –II	05	—	50	50#	—	—	100	**5**

510211	Laboratory Practice-II	—	04	—		50	50	100	**4**
510212	Seminar-I	—	04	—		50	50	100	**4**
	Total	**17**	**08**	**200**	**200**	**100**	**100**	**600**	**25**

Subject Code	**Subject**	**Teaching Scheme Hrs/Week**		**Examination Scheme**					**Credits**
		Lect.	**Pract**	**Paper**		**Tw**	**Oral/ Presentation**	**Marks**	
				In Semester Assessment	**End Semester Assessment**				
SEM— III									
610201	Advanced TCP/IP	04	—	50	50	—	—	100	**4**
610202	System Operations and Maintenance	04	—	50	50	—	—	100	**4**
610203	Elective –III	05	—	50	50#	—	—	100	**5**
610204	Seminar –II	04	—			50	50	100	**4**
610205	Dissertation Stage – I	—	08	—		50	50	100	**8**
	Total	**17**	**08**	**150**	**150**	**100**	**100**	**500**	**25**

Subject Code	**Subject**	**Teaching Scheme Hrs/Week**		**Examination Scheme**					**Credits**
		Lect.	**Pract**	**Paper**		**Tw**	**Oral/ Presentation**	**Marks**	
				In Semester Assessment	**End Semester Assessment**				
SEM— IV									
610206	Seminar –III	—	05	—	—	50	50	100	**5**

610207	Dissertation Stage – II	—	20	—	—	150	50	200	**20**
	Total		**25**	—	—	**200**	**100**	**300**	**25**

#: Ref. Rule R-1.3 for Examination Rules of "*Rules and Regulations for M.E. Programs under faculty of Engineering effective from June 2013*".

Electives:

Elective I		**Elective II**	
510205A	**Applied Cryptography**	**510210A**	**Advanced Software Engineering and Formal Methods**
510205B	**Convergence Technology**	**510210B**	**Network Programming**
510205C	**Mobile Computing**	**510210C**	**Information Security Audit and Management**
510205D	**Open Elective/ Infrastructure Management**	**510210D**	**Open Elective/Pervasive Computing**

Elective III		**Non Credit Courses (Note 1)**	
610203A	**Internet Routing Design**	**Semester -I**	**Cyber Security**
610203B	**Cloud Computing**	**Semester-II**	**Information and Cyber Warfare**
610203C	**IR and WEB Mining**	**Semester-III**	**Bio-Metrics and Cyber Security**
610203D	**Open Elective/ Web Technology**	**Semester -IV**	**Cyber Forensics and Information Security**

The dissertation must result into the publication of at least two research papers (at Stage–I and Stage-II respectively) preferably in the Journal having Citation Index 2.0 and ISSN number; or paper can be published in reputed International Journal recommended by the guide of the Dissertation and the BoS supported cPGCON event for paper presentation and participation. The guides certificate covering originality of the work and plagiarism-testing result shall be included in the report along with the Published Journal Papers and. cPGCON paper presentation and participation certificates. The comments received by the journal paper reviewers be attached in the Dissertation report and shall be made available during dissertation presentation/viva to the examiners.

Note 1: Refer R-2.7 for Examination Rules of "*Rules and Regulations for M.E. Programs under faculty of Engineering effective from June 2013*". Non-credit courses are mandatory for the grant of the term and shall be completed by the students as a self study either by referring to the Hand books, Journal/Conference papers (atleast 25 in number), open source software, tools and in addition may be by organizing educational

visits to the technological/professional centers in the subject, *if any*. Each student is required to produce in own words, one 10 pages innovative, technical paper to be submitted as a part of the semester course work of non-credit courses.

Semester – I

510201 - Advanced Network Algorithms

Teaching Scheme	Examination Scheme
Lectures: 4Hrs/week	Theory In-semester Assessment: 50 Marks
	Theory End-semester Assessment: 50 Marks
	Total Credits : 04

Unit I.

The Problem: Network Bottlenecks, Techniques: Network Algorithmics, Network Implementation Models: Protocols, Hardware, Network Device Architectures, Operating Systems, Fifteen Implementation Principles

Unit II.

Principles in action: Buffer Validation of Application Device Channels, Scheduler for Asynchronous Transfer Mode Flow Control, Route Computation Using Dijkstra's Algorithm, Ethernet Monitor Using Bridge Hardware, Demultiplexing in the X-Kernel, Tries with Node Compression, Packet Filtering in Routers, Avoiding Fragmentation of Link State Packets, Policing Traffic Patterns etc.

Reducing Copying via Local Restructuring, Avoiding Copying Using Remote DMA, Broadening to File Systems, Broadening beyond Copies, Broadening beyond Data Manipulations, transferring control.

Unit III.

Maintaining timers, Demultiplexing, Protocol Processing, Buffer Management, Cyclic Redundancy Checks and Checksums, Generic Protocol Processing, Reassembly

Unit IV.

Exact-Match Lookups, Prefix-Match Lookups: Finessing Lookups, Nonalgorithmic Techniques for Prefix Matching, Unibit Tries, Multibit Tries, Level-Compressed (LC) Tries, Lulea-Compressed Tries, Tree Bitmap, Binary Search on Ranges, Binary Search on Prefix Lengths, Memory Allocation in Compressed Schemes, Lookup-Chip Model

Unit V.

Packet-Classification Problem, Simple Solutions, Two-Dimensional Schemes, Approaches to General Rule Sets, Using Divide-and-Conquer, Bit Vector Linear Search, Cross-Product, Equivalence Cross-Product, Decision Tree Approaches, Switching, Scheduling Packets

Unit VI.

Routers as Distributed Systems: Internal Flow Control, Internal Striping, Asynchronous Updates, Measuring Network Traffic : Reducing SRAM Width Using DRAM Backing Store, Reducing Counter Width Using Randomized Counting, Reducing Counters Using Threshold Aggregation ,Reducing Counters Using Flow Counting ,Reducing Processing Using Sampled NetFlow , Reducing Reporting Using Sampled Charging, Correlating Measurements Using Trajectory Sampling, A Concerted Approach to Accounting, Computing Traffic Matrices, Sting as an Example of Passive Measurement, Network Security : Searching for Multiple Strings in Packet Payloads, Approximate String Matching, IP Traceback via Probabilistic Marking, IP Traceback via Logging, Detecting Worms

References:

1. George Varghese, "Network Algorithmics,: An Interdisciplinary Approach to Designing Fast Networked Devices ", The Morgan Kaufmann Series in Networking, ISBN-10: 0120884771, **13:** 978-0120884773

510202- Wireless Communication

Teaching Scheme
Lectures: 4Hrs/week

Examination Scheme
Theory In-semester Assessment: 50 Marks
Theory End-semester Assessment: 50 Marks
Total Credits : 04

Unit I.

Evolution of Broadband Wireless, Fixed Broadband Wireless: Market Drivers and applications, Mobile Broadband Wireless: Market Drivers and Applications, WiMAX and other Broadband Wireless Technologies, Technical challenges for Broadband Wireless, Background on IEEE 802.16 and WiMAX, WiMAX Physical Layer, Advanced Features for Performance Enhancements, Reference Network Architecture, Performance Characterization.

Unit II.

Communication System Building Blocks, The Broadband Wireless Channel: Pathos and Shadowing, Fading, Modeling Broadband Fading Channels, Multiuser Diversity and Adaptive Modulation, Resource-Allocation Techniques for OFDMA, OFDMA in WiMAX: Protocols and Challenges.

Challenges in wireless networking, Wireless communications standards, Multipath propagation, Linear time-variant model, Channel correlation function, Path loss and shadowing ,Small-scale multipath fading,

Unit III. Quality of Service, Multimedia Session Management, Security, Mobility Management, Handover management, All-IP wireless networks, Traffic calculation, IP for Wireless: Issues and Potential Solutions.

Unit IV.

Channel Coding, Hybrid-ARQ, Interleaving, Symbol Mapping, OFDM Symbol Structure, Subchannel and Subcarrier Permutations, Slot and Frame Structure, Transmit Diversity and MIMO, Closed-Loop MIMO, Ranging, Convergence Sublayer, MAC PDU Construction and Transmission, Bandwidth Request and Allocation, Network Entry and Initialization, Power-Saving Operations.

Wireless ATM - HIPERLAN- HIPERLAN-2, WiMax, Migration path to UMTS, UMTS Basics, Air Interface, 3GPP Network Architecture, CDMA2000 overview- Radio and Network components, Network structure, Radio network, TD-CDMA, TD-SCDMA.

Unit V.

General Design Principles of the Architecture, Network Reference Model, Protocol Layering Across a WiMAX Network, Network Discovery and Selection, IP Adress Assignment, Authentication and Security Architecture, Quality-of-Service Architecture, Mobility Management, Radio Resource Management, Paging and Idle-Mode Operation.

Unit VI.

Methodology for Link-Level Simulation, A WGN Channel Performance of WiMAX, Fading Channel Performance of WiMAX, Benefits of Multiple-Antenna Techniques in WiMAX, Advanced Receiver Structures and Their Benefits, Wireless Channel Modeling, Methodology for System-Level Simulation, System Level Simulation Results
Interworking between WLANS AND 3G, 4G and Beyond WWANS Technologies

Interworking objectives and requirements, Schemes to connect WLANs and 3G Networks, Session Mobility, Interworking Architectures for WLAN and GPRS, System Descriptions, Local Multipoint Distribution Service, Multichannel Multipoint Distribution system, 4G features and challenges, Technology path, IMS Architecture, Convergent Devices, 4G, technologies, Advanced Broadband Wireless Access and Services, Multimedia, MVNO.

References:

1. Fundamentals of WiMAX understanding broadband wireless networking: Jeffrey G. Andrews. Arunabha Ghosh. Rias Muhamed. LPE, Perason.
2. Current Technology Developments of WiMAX Systems; Editor Dr. Maode Ma Nanyang Technological University; Springer.
3. Wireless Communications and Networking by J.W. Mark and W. Zhuang, Prentice-Hall, 2003
4. Kaveth Pahlavan,. K. Prashanth Krishnamuorthy, "Principles of Wireless networks", Prentice Hall of India, 2006.
5. Clint Smith. P.E., and Daniel Collins, “3G Wireless Networks”, 2nd Edition, Tata McGraw Hill, 2007.
6. Dharma Prakash Agrawal & Qing-An Zeng, “Introduction to Wireless and Mobile Systems”, Thomson India Edition, 2nd Ed., 2007.

510203- Advanced Databases

Teaching Scheme
Lectures: 4Hrs/week

Examination Scheme
Theory In-semester Assessment: 50 Marks
Theory End-semester Assessment: 50 Marks
Total Credits : 04

UNIT I Physical database design & Tuning

Database workloads, physical design and tuning decisions, Need for Tuning
Index selection: Guideline for index selection, Clustering & Indexing Tools for index selection
Database Tuning: Tuning indexes, Tuning Conceptual schema Tuning Queries &views, Impact of Concurrency, Benchmarking

UNIT II Distributed Databases

Introduction, Design Framework, Design of database fragmentation, The Allocation of Fragments, Translation of global queries to fragment queries, Optimization of access queries, Introduction to Distributed Transaction Management, Concurrency Control, Reliability.

UNIT III Advance Transaction Processing

Transaction Processing Monitors, Transactional Workflow, Real time transaction System, Long duration Transactions, Transaction Management in Multi-databases, Distributed Transaction Management, Main Memory Databases, and Advanced Transaction Models.

UNIT IV: Semi-Structured Data and XML

Semi-Structured Data, Introduction to XML, XML hierarchical Model, DTD & XML schema, XML Namespace, XML query & Transformation: Xpath, XSLT, XQuery, Storage of XML data, **XMLTechnologies :** DOM &SAX Interfaces X pointer, Xlink, XHTML, SOAP, WSDL, UDDI,XML database Application.

UNIT V: Emerging Trends in Databases

Introduction, Motivation, Temporal databases, Spatial & geographic databases, Multimedia Databases, Mobility & personal Databases, real-time databases

UNIT VI Advanced Application Development

Performance Tuning, Performance Benchmarks, Standardization, E-Commerce, Legacy Systems, Large-scale Data Management with HADOOP, Semi structured database COUCHDB: Introduction, Architecture and principles, features, Distributed computing with MAPREDUCE and PIG

References:

1. Database system Concept by Silberschatz And Korth 6th Edition
2. Distributed Databases principles & systems, Stefano Ceri, Giuseppe Pelagatti
3. Web data Management, Abiteboul, loana, philippe etal Cambridge publication
4. Database Systems, Thomas Connolly, Carolyn Begg, Pearson 4th Edition
5. Database Management Systems , Raghu Ramakrishnan and Johannes Gehrke
6. C.M. Krishna, Kang G. Shin, “Real-Time Systems”, Tata McGraw Hill

510204- Research Methodology

Teaching Scheme	Examination Scheme
Lectures: 4Hrs/week	Theory In-semester Assessment: 50 Marks
	Theory End-semester Assessment: 50 Marks
	Total Credits : 04

Objective: to introduce the student to research methodology, and to prepare them for conduct independent research

Unit I Understand the research process

Evolution of research methodology; Meaning, nature, scope, and significance of research; Research paradigm; Objectives of research, Motivation for research; Postulates underlying scientific investigations; Types of research; Research process and workflow; Principles of ethics, ethical considerations in research; Intellectual Property Rights (IPR)

Unit II. Problem identification and hypothesis formulation

Selecting an area for research; Problem identification; Literature search; "Understanding" reported research; Fitting the pieces; Ascertaining current state of knowledge; Sources of information; Recording literature search findings;

Defining the problem; Hypothesis formulation

Unit III. Research design

Type of research designs, pitfalls and advantages; Research approaches; Principles of experimental design; Design of experiments; Characteristics of good research design;

Universe, population, and sample; Sampling concepts, principles, and techniques; Sample design (random, pseudo random, cluster, stratified, multi-stage); Sampling considerations (size, design, selection, measurements);

Measures, Measurements, Metrics, and Indicators; Measurement scales and direct measurements

Unit IV. Methods, tools, and techniques

Data collection techniques (observation, interviewing, questionnaires, web-based, group techniques, experimentation, surveys); Sources of errors; Reliability and validity;

Probability theory and theoretical distributions; Parametric statistics, Simple linear models (ANOVA, correlation and Regression, ANACOVA), Multivariate analysis, Step-wise regression;

Non-parametric statistics, Sign test, Paired ranking test, Pearson Correlation, Man-Whitney U Test, Chi-square test,

Unit V. Data processing and Data analysis

Primary and secondary data; coding and summarization of data, quantification of qualitative data (content analysis); Computation of indirect metrics; Role of descriptive statistics; Measures of central tendency, dispersion, skewness, kurtosis; plots and correlations; Inferential statistics, hypothesis testing, Type I and Type II errors, Power of tests;

Role of computers in research; Use of statistical packages (e.g. SPSS)

Unit VI. Reporting research

Dissemination of research findings; Reporting and interpretation of results; cautions in interpretations, Type of reports, Typical report outlines, use of diagrams, tables, and charts;

Optimization and optimization methods, Introduction to game theory, Queuing theory

References:

1. Kothari C.R., Research Methodology (2nd Ed.), New Age International, (2004); ISBN(13): 978-81-224-1522-3
2. Kumar, Ranjit, Research Methodology (3rd Ed); Sage Publications, 2011; IBSN: 978-1-8492-0301-2
3. Berkman, Elliot T., A Conceptual Guide to Statistics Using SPSS, Sage Publications, 2011; ISBN: 978-1-4129-7406-6

510205A- Applied Cryptography

Teaching Scheme
Lectures: 5Hrs/week

Examination Scheme
Theory In-semester Assessment: 50 Marks
Theory End-semester Assessment: 50 Marks
Total Credits : 05

Unit I

Basic cryptosystem, Cryptographic algorithms – types and properties, Cryptographic protocols- building blocks, basic, intermediate and advanced protocols.

Unit II

Cryptographic Techniques, Key length, Key management, Algorithm Types and modes of operation, Cryptographically secure pseudo-random bit generation and statistical tests.

Unit III

Cryptographic Algorithms, Mathematical basics, DES, AES, Blowfish, MD5, Block ciphers and stream ciphers- design and analysis, discrete logarithm and diffie helman problem, Cryptanalysis, strength of an algorithm, Linear and Differential cryptanalysis, Brute force attacks,

Unit IV

Hash functions and data integrity, security of hashing function, various types of problems like collision etc., iterated hash function, SHA, MAC, unconditionally secure MAC.

Unit V

Signature scheme, security requirement for signature scheme, digital signature etc., provably secure signature schemes, undeniable signatures.

Unit VI

Key establishment protocols- key transport and establishment using symmetric and asymmetric techniques, key management techniques-techniques for distributing confidential and public keys, key control techniques.

Reference Books :

1. Bruce Schneier, “Applied Cryptography”, Second Edition John Wiley & Sons, 1996
2. A. Menezes, P. van Oorschot, and S. Vanstone , “Handbook of Applied Cryptography”, CRC Press, 1996.
3. Cryptography Theory and Practice by Douglas R. Stinson. A, CRC press, 3rd Edition, 2005.

510205B- Convergence Technology

Teaching Scheme	**Examination Scheme**
Lectures: 5Hrs/week	**Theory In-semester Assessment: 50 Marks**
	Theory End-semester Assessment: 50 Marks
	Total Credits : 05

Unit I. Introduction : Convergence Technologies

Overview of convergence, Benefits of Converged network, Challenges, Types of convergence , OSI layered perspective : Possible convergence at each layer and protocol modifications

Unit II. Switching Networks

ATM, Packet Switched Networks, Circuit Switched Networks, Frame Relays

Unit III. Convergence Standards and Protocols

Voice Compression, VOIP Convergence, H.323 protocol, SIP, Media Gateway Control, Protocol (MGCP), MEGACO

Unit IV. Multimedia Convergence

Coding Standards , Compression Techniques, Lossy and Lossless, MPEG-1 and -2 Compression, Voice and Video Coding and Speech Processing , Benefits by convergence of broadcasting and telecommunications, IPCablecom, Interoperability among broadcasting systems, Media Networking, Multi Services over MPLS, Multimedia Security , Multimedia Quality of Service , IP TV

Unit V. Wireless Technology and Network Convergence

Wireless Standards, IEEE 802.11, HYPERLAN, IEEE 802.15.4, Wireless ATM , Wireless Internet, Wireless Convergence, Broadband Wireless Access, Sensor Networks, Zigbee and Protocol stack,RFID

Unit VI: convergence Case Studies

Home Integration Technologies, IP Convergence, Convergence for NGN , Smart City, Smart e-Mall, Fixed mobile convergence, The Walt Disney Company, The Tribune Company, Viacom Inc., AOL Time Warner

(Students and Instructors are recommended to cover convergence case studies of these topics.)

References

1. Multimedia Communications Directions and Innovations By Jerry Gibson Academic Press
2. ATM Networks Concepts and Protocols by Sumeet Kasera and Pankaj Sethi Tata McGraw
3. Ad Hoc Wireless Network: Architectures and Protocols, by C. Siva Ram Murthy B.S. Manoj. Pearson

510205C- Mobile Computing

Teaching Scheme **Examination Scheme**

Lectures: 4Hrs/week **Theory In-semester Assessment: 50 Marks**

Theory End-semester Assessment: 50 Marks

Total Credits : 05

Unit I. Mobile Communications and Computing : An Overview

Mobile Communication, Mobile Computing, Mobile Computing Architecture, Mobile Devices, Mobile System Networks, Data Dissemination, Mobility Management, Security, Mobile Devices and Systems, Mobile Phones, Digital , Music Players, Handheld Pocket Computers, Handheld Devices: Operating Systems, Smart Systems, Limitations of Mobile Devices, Automotive Systems

Unit II. GSM and Similar Architectures , GSM-Services & System Architectures ,Radio Interfaces, Protocols

Localization, Calling, Handover, Security, New Data Services, General Packet Radio Services, High Speed Circuit Switched Data, DECT , Wireless Medium Access Control and CDMA - based Communication ,Medium Access Control, Introduction to CDMA - based Systems, Spread Spectrum in CDMA Systems, Coding Methods in CDMA,IS-95 CDMA One System,IMT-2000,i-mode, OFDM

Unit III. Mobile IP Network Layer , IP & Mobile IP Network Layer s, Packet Delivery & Handover Management, Location Management, Registration, Tunneling & Encapsulation, Route Optimization, Dynamic Host Configuration Protocol, Mobile Transport Layer , Conventional TCP/IP Transport Layer Protocol, Indirect TCP, Snooping TCP, Mobile TCP, Other Methods of TCP layer Transmission for Mobile Networks, TCP over 2.5G/3G Mobile ,Networks

Unit IV Data Synchronization in Mobile Computing Systems: Synchronization, Synchronization Software for Mobile Devices, Synchronization Protocols, SyncML-Synchronization Language for Mobile Computing, Sync4J (Funambol), Synchronized Multimedia Markup Language (SMIL), Mobile Devices: Servers and Management , Mobile Agent, Application Server, Gateway, Portals, Service Discovery, Device Management, Mobile File System, Security

Unit V. Mobile Ad-Hoc and Sensor Networks : Introduction to Mobile Ad-Hoc Networks, MANET, Wireless Sensor Networks, Applications, Wireless LAN, Mobile Internet Connectivity and Personal Area Network, Wireless LAN (WiFi) Architecture & Protocol Layers, WAP 1.1 & WAP 2.0 Architectures, XHTML-MP (Extensible Hypertext Markup Language Mobile Profile),Blue tooth-enabled Devices Networks, Layers in Bluetooth Protocol, Security in Bluetooth Protocol, IrDA, ZigBee, Mobile Application Languages-XML, Java, J2ME, and JavaCard.

Unit VI. Mobile Operating Systems, Characteristics, Basic functionalities of Operating Systems, Windows CE, Symbian OS, Android OS, Linux for Mobile Devices, SIM card File system

References

1. Raj Kamal, Mobile Computing, 2/e , Oxford University Press-New Delhi

2. Handbook of Algorithms for Wireless Networking and Mobile Computing, edited by Azzedine Boukerche, CHAPMAN & HALL/CRC COMPUTER and INFORMATION SCIENCE SERIES
3. Handbook of Wireless Networks and Mobile Computing, Edited by Ivan Stojmenovic, John Wiley & Sons.

510205D- Infrastructure Management

Teaching Scheme	Examination Scheme
Lectures: 5Hrs/week	Theory In-semester Assessment: 50 Marks
	Theory End-semester Assessment: 50 Marks
	Total Credits : 05

Course Objectives

Information Storage and Management (ISM) is the only course of its kind to fill the knowledge gap in understanding varied components of modern information storage infrastructure.

Upon successful completion of this course, participants should be able to:

1. Evaluate storage architecture; understand logical and physical components of a storage infrastructure including storage subsystems;
2. Describe storage networking technologies and data archival solution;
3. Understand and articulate business continuity solutions including, backup and recovery technologies, and local and remote replication solutions;
4. Identify parameters of infrastructure management and describe common infrastructure management activities and solutions;

Prerequisites

To understand the content and successfully complete this course, a participant must have a basic understanding of computer architecture, operating systems, networking, and databases.

Unit I: Infrastructure Management Overview

Definitions, Infrastructure management activities, Evolutions of Systems since 1960s (Mainframes-to-Midrange-to-PCs-to-Client-server computing-to-New age systems) and their management, growth of internet, current business demands and IT systems issues, complexity of today's computing environment, Total cost of complexity issues, Value of Systems management for business.

Unit II: Preparing for Infrastructure Management

Factors to consider in designing IT organizations and IT infrastructure, Determining customer's Requirements, Identifying System Components to manage, Exist Processes, Data, applications, Tools and their integration, Patterns for IT systems management, Introduction to the design process for information systems, Models, Information Technology Infrastructure Library (ITIL).

Unit III: Service Management

Service Delivery Processes- Service-level management, financial management and costing, IT services continuity management, Capacity management, Availability management.
Service Support Processes- Configuration Management, Service desk. Incident management. Problem management, Change management, Release management.

Unit IV: Introduction to Information need, storage technology / systems

Concept of information availability and its measurement, causes and consequences of downtime, backup/recovery purposes and considerations, architecture and different backup/recovery topologies;

Local replication technologies and their operation, remote replication technologies and their operation, emerging technologies like de duplication, offsite backup.

Challenges in Data Storage and Management, Data Storage Infrastructure.
Components of a Storage System Environment: Disk drive components, Disk Drive performance, Logical Components.

Data protection: concept of RAID and different RAID levels (RAID 0, 1, 3, 5, 0+1/1+0, and 6);
Intelligent Storage System (ISS) and its components, Implementation of ISS as high-end and midrange storage arrays.

Unit V: Different Storage Technologies and Virtualization

Introduction to Networked Storage: Evolution of networked storage, Architecture, Overview of FC-SAN, NAS, and IP-SAN. Network-Attached Storage (NAS): Benefits of NAS, Components, Implementations, File Sharing, I/O operations, Performance and Availability.
Content Addressed Storage (CAS): features and Benefits of a CAS. CAS Architecture, Storage and Retrieval, Examples.

Storage Virtualization: Forms, Taxonomy, Configuration, Challenges, Types of Storage Virtualizations.

Overview of emerging technologies such as Cloud storage, Virtual provisioning, Unified Storage, FCOE, FAST.

Unit VI: Implementing, Managing and maintaining a Network Infrastructure

Implementing, Managing and Maintaining IP Addressing; Configure TCP/IP addressing on a server computer using DHCP; Implementing, Managing and Maintaining Name Resolution using DNS Server; Implementing, Managing and Maintaining Routing and Remote Access; Configure remote access authentication protocols; Implement secure access between private networks; Manage Routing and Remote Access routing interfaces; Maintaining a Network Infrastructure.

Reference Books:

1. G. Somasundaram, Alok Shrivastava, EMC Educational Services, Information Storage and Management, Wiley India,.
2. Robert Spalding, “Storage Networks: The Complete Reference“, Tata McGraw Hill, Osborne, 2003.
3. Marc Farley, “Building Storage Networks”, Tata McGraw Hill ,Osborne, 2001.
4. Jan Van Bon, “Foundations of IT Service Management: based on ITIL”, Van Haren Publishing, 2nd edition 2005
5. Harris Kem, Stuart Gaiup, Guy Nemiro, “IT Organization: Building a Worldclass Infrastructure”, Prentice Hall, 2000
6. Richard Barker and Paul Massiglia, .Storage Area Network Essentials: A Complete Guide to Understanding and Implementing SANs., Wiley India.
7. Meet Gupta, .Storage Area Network Fundamentals., Pearson Education Limited, 2002.

510206- Laboratory Practice- I

Teaching Scheme
Lectures: 4Hrs/week

Examination Scheme
TW: 50 Marks
OR: 50 Marks
Total Credits : 04

1. Setup a private broadband wireless/WIFI network of 4 to 5 nodes each, separated by wireless routers. Design and implement IDS architecture for private networks.
2. Design an algorithm for assignment no 1 above for shortest distance to establish wireless start-to-end network.
3. Design and implement IDS based on packet classification on server. Design a class to store log files in distributed database.

Or assignments equivalent to the above assignments

4. Elective teacher shall design four suitable assignments based on Elective I maintaining above quality of the assignments.

5. Design and implement class/classes using latest 64-bit C++/JAVA/ Python/QT 5.1 and above, concurrent Cuda C++ or such latest 64-bit programming tools for the implementation of Two journal (IEEE Transactions/ACM/ Elsevier/Springer) papers published in the current year related to the respective elective subjects. Development Tools such as MATLAB/OPENCV/OPENMP/NS3 or equivalent may be used if required to interface the developed classes to the simulators.

Tools for the Laboratories: The laboratories must be equipped with adequate, well maintained working resources as per the software/equipment/tools list published by the Board of Studies time to time. For maintaining the quality and effective performance the Board of Studies may publish the quality guidelines for effective conduct of the laboratories, seminars and dissertation.

Semester-II

510207- Network Design, Modeling and Analysis

Teaching Scheme	Examination Scheme
Lectures: 4Hrs/week	Theory In-semester Assessment: 50 Marks
	Theory End-semester Assessment: 50 Marks
	Total Credits : 04

Unit I. Essentials of Probability

Probability on a Sample Space, Basic Operations on Events, Probability on Events, Conditional Probability, Independent events, Bayes' formula, Random Variables, Probability Mass Function for a Random Variable, Cumulative Distribution Function, Expectation of a Random Variable, Discrete random variables, Continuous Random Variables, Expectation of Random Variable, Exponential distribution & its properties.

Unit II. Delay Models in Data Networks

Multiplexing of Traffic on a Communication Link, Queuing Models- Little's Theorem, Probabilistic Form of Little's Theorem, Application of Little's Theorem, The M/M/1 Queuing System, Arrival Statistics, Service Statistics, Markov Chain Formulation, Deviation of the Stationary Distribution, Occupancy Distribution upon Arrival, Occupancy Distribution upon Departure, other queuing system: M/M/2, M/M/m, M/M/α, M/M/m/m, M/M/1/N, D/D/1 etc. The M/G/1 System, M/G/1 Queues with Vacations, Reservations and Polling, Priority Queuing

Unit III. Centralized Network Design

Modeling networks as graphs, Problem definition: Multipoint line layout heuristics, CMST algorithm, ESAU-William's algorithm, Sharma's algorithm, Unified algorithm, Bin packing, Terminal assignments algorithms, Concentrator location algorithms

Unit IV. Access Network Design

Importance, Simple access design problem, one-speed one center design, Line crossings in access designs, multispeed access designs, Multicenter local access design.

Unit V. Mesh network design

Good design, network routing and backbone design, MENTOR algorithm for MUX and router design, two connected backbones, Augmented MENTOR and MENTour designs.

Unit VI. Network design with Constraints and network redesign

Design with hop-limited, node-pair, equipment, degree, processing, link, performance, reliability constraints.

Rerouting algorithm, redesigning for new traffic, adding new sites to network, merging networks.

Reference Books

1.Kershenbaum A., "Telecommunication Network Design Algorithms", Tata McGraw Hill
2.Bertsekas D. and Gallager R., "Data Networks," 2nd Ed., Prentice-Hall, Englewood Cliffs, N.J., 1992.
3. Robert S Cahn, "Wide Area Network Design: Concepts and Tools for Optimization", Morgan Kaufmann series in Networking.
4. Sheldon M. Ross, "Introduction to Probability Models", Elsevier

510208- Distributed Systems

Teaching Scheme	Examination Scheme
Lectures: 4Hrs/week	Theory In-semester Assessment: 50 Marks
	Theory End-semester Assessment: 50 Marks
	Total Credits : 04

Objectives :

1. **To understand and correlate the distributed system concepts for designing of the distributed application.**
2. **To understand the Role of Distributed operating system in Distributed application design.**
3. **To expose the students to design the internet application as Distributed System application**

Unit-I

Introduction – Examples of Distributed Systems – Resource Sharing and the Web – Challenges- System Models - Physical Models – Architectural Models – Fundamental Models- Characterization of Distributed Systems – Client-Server Communication – Distributed Objects and Remote Invocation – Communication Between Distributed Objects – Remote Procedure Call – Events and Notifications

Unit-II

Naming and Name services , Time and Global State Management :Introduction – Issues – Communication Primitives – Inherent Limitations - Lamport's Logical Clock; Vector Clock; Causal Ordering; Global State; Cuts; Termination Detection.Transactions and Concurrency control, Distributed Transactions

Unit-III

Distributed Mutual Exclusion: Non-Token Based Algorithms, Lamport's Algorithm, Ricart-Agrawala algorithm, Singhal's dynamic information-structure algorithm, Lodha and Kshemkalyani's fair mutual exclusion algorithm, Quorum-based mutual exclusion algorithms, Maekawa's algorithm, Agarwal–El Abbadi quorum-based algorithm, Token-Based Algorithms, Suzuki-Kasami's Broadcast Algorithm, Raymond's tree-based algorithm – Distributed Deadlock Detection – Issues – Centralized Deadlock-Detection Algorithms - Distributed Deadlock-Detection Algorithms. Agreement Protocols – Classification - Solutions – Applications.

Unit-IV

Distributed File systems – Architecture – Mechanisms – Design Issues –
Distributed Shared Memory – Architecture – Algorithm – Protocols - Design Issues. Distributed Scheduling – Issues – Components – Algorithms.
Distributed Transactions

Unit-V

Failure recovery and Fault Tolerance, classification of failures. Backward and forward error recovery, Basic approaches of backward error recovery, recovery in concurrent systems,

consistent set of checkpoints, synchronous check pointing and recovery, asynchronous check pointing and recovery.
Atomic actions and committing, commit protocols, non-blocking commit protocols, Votic protocols,
Dynamic vote re-assignment protocols, failure resistant processor, Reliable communication.
Distributed Multimedia systems, Mobile and Ubiquitous computing

Unit-VI

Internet-enabled Distributed Computing Technologies

Application Server architectures: JEE Extensions of the Java Distributed Object model and the DCOM component-based architectures
Web Services: WSDL, UDDI, SOAP, XMLhttp-based RPC combined with standards for interface definition and naming.
Discussion and application of select API's from the API layer of the JEE architecture to illustrate distributed transactions, middleware access protocols (MQ Series API), and Messaging services (JMS).

REFERENCES :

1. George Coulouris, Jean Dellimore and Tim KIndberg, "Distributed Systems Concepts and Design", 5th Edition, Pearson Education
2. Ajay D. Kshemkalyani and MukeshSinghal, " Distributed Computing – Principles, Algorithms and Systems", Cambridge University Press, 2008.
3. Pradeep K. Sinha, Distributed Operating Systems, PHI, 2005.
4. Nancy A. Lynch, Distributed Algorithms, Morgan Kaufmann Publishers, 2000

510209- High Performance Networks

Teaching Scheme | **Examination Scheme**

Lectures: 4Hrs/week | **Theory In-semester Assessment: 50 Marks**

Theory End-semester Assessment: 50 Marks

Total Credits : 04

Prerequisites:

- Basics of Data Communication
- Basics of networking

Unit I Introduction

Basics of networking, protocol stack TCP/IP, ISO-OSI, Evolution of high speed networking, Basics of networking technologies such as Token Bus, Token Ring, FDDI, Ethernet, Fast Ethernet, Gigabit Ethernet, X.25, Frame relay, DSL, ATM, MPLS, wireless networks such as 802.11, 802.16, WiMax, 3G & 4G networks, Design considerations in high performance networking.

Unit II Gigabit Ethernet

Foundations of gigabit Ethernet: from shared to dedicated media, from shared to dedicated LAN, Full-duplex Ethernet, Ethernet frame format, flow control, automatic configuration, architecture of Gigabit Ethernet, Gigabit Ethernet physical layer, MAC layer and devices, applications of Gigabit Ethernet, performance considerations, research areas in Gigabit Ethernet

Unit III ATM

Introduction to ATM, basic principles, ATM protocol reference model, core aspects, Interworking with ATM,ATM layers: physical, ATM layer, AAL ATM service and traffic parameterization, ATM traffic management, IP over ATM, research areas in ATM

Unit IV MPLS

Introduction to MPLS, considerations in the choice of cells Vs frames, IP over MPLS architecture & terminology, MPLS forwarding operations, MPLS encapsulation standards, MPLs signalling and routing protocols, research areas in MPLS

Unit V High Performance Wireless Networks

Introduction to broadband wireless networks, evolution, fixed broadband wireless networks, mobile broadband wireless networks, overview of IEEE 802.16 and Wimax standards, Physical and MAC layer of WiMax, security, research areas in high performance wireless networks.

Unit VI 3G and 4G Wireless Standards

Overview of GSM, GPRS, WCDMA, Protocols like UMTS, HSPA family : HSDPA and HSUPA RPM architecture, HSPDA protocol Stack, LTE(Long Term Evolution) and Mobile WiMax.

References :

1. Rich Seifert, "Gigabit Ethernet: Technology and Applications for High-Speed LANs" Addison-Wesley ISBN:9780201185539
2. “ATM Networks Concepts and Protocols”, Sumit Kasera,Tata McGraw-Hill Professional, Networking series,ISBN-13:978-0-07-058353-5
3. David E. McDysan, Dave Paw, “ATM & MPLs Theory & Application: Foundations of Multi Service Networking”,DOI:10.1036/0072228377, McGraw-Hill publication.
4. Jeffrey G. Andrews, Anuradha Ghosh, Rias Muhamed ,“Fundamentals of WiMAX understanding Broadband Wireless Networking”, Prentice Hall, ISBN:0-13-222552-2
5. Kevin Roebuck, “4G Standards: High Impact Emerging Technology”, Tebbo, ISBN 1743042760

510210A - Advanced Software Engineering and Formal Methods

Teaching Scheme	Examination Scheme
Lectures: 5Hrs/week	Theory In-semester Assessment: 50 Marks
	Theory End-semester Assessment: 50 Marks
	Total Credits : 05

Objectives:

- Gain knowledge of Formal Methods to software development
- Use of mathematical objects and logical techniques to specify and analyze the properties and behavior of these objects.
- Introduce students to advanced techniques and methods in software engineering that reflect the current state of the art.

Outcomes:

Upon completion of this course the student should be able to:

- describe the characteristics and tradeoffs between different formal and informal methods of software development;
- specify software using a formal specification language;
- develop high quality software requirement specifications using informal or semi-formal notation;
- appreciate the use of formal and rigorous techniques in program refinement and verification.

Unit I: Introduction

What Are Formal Methods? Objectives of Formal Methods, Using Formal methods in Software Development, Why Use Formal Methods? Why Not? Myths of Formal Methods, Integrating Formal Methods into Development, Requirements of Formal System – Types – Prepositional Logic – Predicate Logic – Relationships and Functions. Specification Languages.

Unit II: Formal Specification style

Formal Specifications, Desirable Properties of Formal Specifications, Formal Specification in Software Development, Formal Specification Languages, Characteristics of Specification Languages, Tool Support for Specification Languages, Types of Formal Specifications, Basic Specification Language Types, Model-Oriented, Property Oriented, Concurrency-Based Specifications –Example.

Unit III: Steps towards abstraction and traditional program proof

Overview of Propositional logic, Predicate logic, Sets and relations, Lambda calculus, Assertions, declarations, specifications, code, Informal reasoning about programs, Formal reasoning about programs, Simple imperative language, Example.

Unit VI: Vienna Development Method (VDM)

Introduction to VDM, Basic Types – Quote Types – Compound Types – Optional Types, VDM Features Structuring**,** Modeling Functionality – Functions – Operations – Additional Constructs – Modules, Examples.

Unit V: The Z notation

Zermelo–Fraenkel set theory, The Interchange Language – User-Defined Identifiers, Data Types, Basic Types, Compound Types – Schemas – Additional Constructs. Z declarations, Example specification, Code generation, Tool support, ZTC, ZANS.

Unit VI: Formal semantic and tools

Operational Semantics – De-notational Semantics – Axiomatic Semantics Proof Editors, Proof Analyzer, Symbolic Simulators, Translators, Test Generation Tools, Examples.

References:

1. Andrew Harry, " Formal Methods: Fact File VDM and Z", John Wiley and Sons,1996..
2. Jim Woodcock, Jim Davies, "Using Z Specification, Refinement and Proof", Prentice Hall International, 1996.
3. The Way of Z: Practical Programming with Formal Methods, By Jonathan Jacky
4. Published 1997,Cambridge University, ISBN 0521559766
5. E.M. Clarke, Orna Grumberg and Doron Peled *Model Checking*, MIT Press,2002

510210B - Network Programming

Teaching Scheme	Examination Scheme
Lectures: 5Hrs/week	Theory In-semester Assessment: 50 Marks
	Theory End-semester Assessment: 50 Marks
	Total Credits : 05

Unit I. The Transport Layer: TCP and UDP with policy control

TCP Connection Establishment and Termination, TIME_WAIT State, Port Numbers, Concurrent Servers, Buffer Sizes and Limitations.

Unit II. Sockets and Socket Programming

Introduction, Socket Address Structures, Value-Result Arguments, Byte Ordering Functions, Byte Manipulation Functions, socket Function. TCP Client-Server: TCP Echo Server, TCP Echo Client, Crashing of Server Host, Crashing and Rebooting of Server Host, Shutdown of Server Host. UDP Sockets: UDP Echo server, UDP Echo Client.

Unit III. Routing Sockets

Datalink Socket Address Structure, Reading and Writing, Interface Name and Index Functions

Unit IV. Name and Address Conversions

Domain Name System, Functions. Advanced Name and Address Conversions: Functions and Implementation

Unit V. IPv4 and IPv6 Interoperability

IPv4 Client, IPv6 Server, IPv6 Client, IPv4 Server, IPv6 Address Testing Macros, IPV6_ADDRFORM Socket for interoperability between IPv4 & IPv6

Unit VI. Multicasting and Broadcasting

Broadcast Addresses, Unicast versus Broadcast, Multicasting: Multicast Addresses, Multicasting versus Broadcasting on A LAN, Multicasting on a WAN, Multicast Socket Options, Simple Network Time Protocol, SNTP (RFC 2030)

Unit VII. Threads

Thread Functions: Creation and Termination, TCP Echo Server, Thread-Specific Data, Web Client and Simultaneous Connections

Unit VIII. Client-Server Design Alternatives

TCP Client Alternatives, TCP Test Client, Iterative Server, Concurrent Server, Thread Locking around accept, TCP Preforked Server, Descriptor Passing, TCP Concurrent Server, One Thread per Client, TCP Prethreaded Server.

References:

1. Richard Stevens, Bill Fenner, “UNIX network programming Volume-1 -The Sockets Networking API”, 3 rd edition.
2. UNIX Internals – “A new Frontier” , PH

510210C - Information Security Audit and Management

Teaching Scheme	Examination Scheme
Lectures: 5Hrs/week	Theory In-semester Assessment: 50 Marks
	Theory End-semester Assessment: 50 Marks
	Total Credits : 05

Unit I **Introduction to management of information security:**

Basics of information security, OSI security architecture, information security audit, Principles of information security management, information security life-cycle, security policy, legal issues.

Unit II **Planning for security:** Precursors to planning, strategic planning, information security Governance, Planning for information security implementation, Common threats, Preparing for contingencies and disasters.

Unit III **Security Management Models and Practices:** Information security policy, developing the security program, security management models, security management practices, risk management, assessing and controlling risk.

Unit IV **Protection Mechanism:** access control and authentication, cryptography, firewalls, intrusion detection and prevention system, audit trails, remote access protection, wireless networking protection, scanning and analysis tools.

Unit V **Personnel and Security:** Staffing the security function, information security professional credentials, employment policies and practices, information security and the law, ethics in information security, professional organizations and their codes of ethics, law and ethics.

Unit VI **Information Security Project Management:** Applying project management to security, project management tools. Case Study: ASSESSING AND MITIGATING THE RISKS TO A HYPOTHETICAL COMPUTER SYSTEM**.**

References:

1. Whitman & Mattord. Management of Information Security. Thomson Course Technology (2004). ISBN: 0-619-21515-1.
2. An Introduction to Computer Security: The NIST Handbook.
3. Cryptography and Network security principles and practices, Pearson education, Fourth Edition.
4. Risk Management Guide for Information Technology Systems.
5. Contingency Planning Guide for Information Technology Systems.

510210D - Pervasive Computing

Teaching Scheme	Examination Scheme
Lectures: 5Hrs/week	Theory In-semester Assessment: 50 Marks
	Theory End-semester Assessment: 50 Marks
	Total Credits : 05

Unit I Introduction

Introduction to Pervasive Computing, Concept of Distributed ,Mobile , Pervasive computing , Wearable Computing .Characteristics of Pervasive computing , Adaptive Computing , Mobility Management and caching

Unit II. Pervasive Computing Devices

Device Technology, Device Characteristics , Hardware and Software for Pervasive computing , HMI and HCI ,Device connectivity (Relevant Protocol)

Unit III. Middleware for Pervasive

Adaptive Middleware , Context aware middleware , Mobile middleware , Service Discovery , Mobile Agents

Unit IV. Ad Hoc and Sensor Networks

Properties ,Features ,Challenges ,Sensor Network Architecture ,Types of WSN, Protocols, Applications

Unit V. Security

Approaches to Security ,Security for Wireless LAN, Security for Wireless MAN , Security for Wireless WAN , Security for WSN

Unit VI. Emerging trends

IoT (Internet of Things), Wearable computing , On -chip –networks, Sensor clouds

References :

1. Burkhardt, Henn,Hepper,Rintdroff,Schaeck, " Pervasive Computing ", Addision Wesely,2002.
2. Frank Adelstein,Sandeep K.S. Gupta,Golden G. Richard III, Loren Schwiebert, Fundamentals of Mobile and Pervasive Computing", TATA McGRAW-HiLL,,2005.
3. Jochen Schiller, Mobile Communication, Pearson Education Asia

510211- Laboratory Practice- II

Teaching Scheme
Lectures: 4Hrs/week

Examination Scheme
TW: 50 Marks
OR: 50 Marks
Total Credits : 04

1. Design an algorithm for assignment no 3 stated below.
2. Design and implement distributed architecture for name node, tracker node and adequate data nodes(separated by ASDL router).
3. Design and implement an application for student data analysis (attendance and result etc) under Hadoop or equivalent using distributed database storage. Design a class for front-end for searching students records.

Or assignments equivalent to the above assignments

4. Elective teacher shall design four suitable assignments based on Elective II maintaining above quality of the assignments.

5. Design and implement class/classes using latest 64-bit C++/JAVA/ Python/QT 5.1 and above, concurrent Cuda C++ or such latest 64-bit programming tools for the implementation of Two journal (IEEE Transactions/ACM Elsevier/Springer) papers published in the current year related to the respective elective subjects. Development Tools such as MATLAB/OPENCV/OPENMP/NS3 or equivalent may be used if required to interface the developed classes to the simulators.

Tools for the Laboratories: The laboratories must be equipped with adequate, well maintained working resources as per the software/equipment/tools list published by the Board of Studies time to time. For maintaining the quality and effective performance the Board of Studies may publish the quality guidelines for effective conduct of the laboratories, seminars and dissertation.

510212- Seminar- I

Teaching Scheme	Examination Scheme
Lectures: 4Hrs/week	Theory In-semester Assessment: 50 Marks
	Theory End-semester Assessment: 50 Marks
	Total Credits : 04

State-of-the-art topic. The presentation should cover motivation, mathematical modeling, data-table discussion and conclusion approved by the guide. To maintain the quality of the seminar work it is mandatory on the seminar guides to maintain a progressive record of the seminar contact Hrs of 1 Hrs per month per seminar which shall include the discussion agenda, weekly outcomes achieved during practical sessions, corrective actions and comments on the progress report as per the plan submitted by the students including dates and timing, along with the signature of the student as per the class and teacher time table (as additional teaching load); such record of progressive work shall be referred by the examiners during evaluation.

Semester-III

610201- Advanced TCP/IP

Teaching Scheme **Examination Scheme**

Lectures: 4Hrs/week **Theory In-semester Assessment: 50 Marks**

Theory End-semester Assessment: 50 Marks

Total Credits : 04

Unit I Introduction: TCP/IP protocol suite, TCP connection management, TCP state transition diagram, Introduction to Client-Server environment, Client-Server architecture, Client-Server models, Server complexity and scalability, UNIX I/O paradigm and Network I/O, Socket programming primitives, IP address manipulation routines, SCTP, SCTP connection management.

Unit II Application layer protocols based on TCP/IP: FTP, TFTP, TELNET and Rlogin, DNS, Voice over IP (RTP).

Unit III Application layer protocols for web: HTTP/HTTPS, SMTP, MIME, S/MIME, IMAP, POP3,

Unit IV Flow control and Congestion control schemes and protocols: ECN/CI bit, Open loop-closed loop flow control mechanisms, TCP Tahoe, TCP Reno, new Reno, TCP Vegas, comparison of all of these protocols.

Unit V TCP/IP in Wireless environment: AODV protocol, DSDV protocol, TCP Westwood, TCP Jersey, TTCP -Transactional TCP, TCP performance in mixed wired and wireless environment.

Unit VI Security Issues at network and transport layers: IPSec protocol suite: Authentication Header, ESP, IKE: Key management, VPN, Firewall- types and configurations, SSL/TLS protocols.

References :

1. Douglus Comer, “Internetworking with TCP/IP: Principles, Protocols and Architecture, Volume 1”, Pearson Education Asia
2. Kurose , Rose, “Computer Networking: a Top-Down Approach”, Addison-Wesley, ISBN : 0132856204
3. Behrouz Forouzan, “TCP/IP Protocol suite”, Tata McGraw-Hill Edition
4. Kumkum Garg, “Mobile Computing: Theory and Practice”, Pearson Education India, ISBN – 81-3173-166-9.

610202- Systems Operations and Maintenance

Teaching Scheme **Examination Scheme**

Lectures: 4Hrs/week **Theory In-semester Assessment: 50 Marks**

Theory End-semester Assessment: 50 Marks

Total Credits : 04

Unit I. Introducing IOS

Evolution of Networking, Requirements for Carrier-Grade NOS, Operating System Concepts, High-Level Overview of Cisco IOS XR

IOS Infrastructure

IOS Kernel, System Manager, Interprocess Communication: Characteristics , Light Weight Messaging, Group Service Protocol, Atomic Descriptor Ring, Qnet

Distributed Services, Process Placement, System Database High Availability Architecture, Forwarding Path

Unit II. Installation & Configuration Management

Understanding Distributed Configuration Management, Understanding Configuration Planes Components of Configuration Management, Understanding the Two-Stage Commit Model, Configuration Features in Cisco IOS XR, Configuration Management During different events, Configuration Rollback

Unit III. Monitoring, Operations and security

Using SNMP, Embedded Event Manager, Monitoring Processes, Secure Operating System Securing Access to the Router, Securing the Forwarding Plane

Unit IV. Routing IGP

Routing Information Protocol, Enhanced Interior Gateway Routing Protocol, Open Shortest Path First, Intermediate System to Intermediate System, Implementing BGP IOS

Unit V. IOS MPLS Architecture

Architecture Fundamentals, Label Distribution Protocol, MPLS Traffic Engineering, L2VPN, IOS Multicast: -Understanding Multicast Routing Fundamentals , Understanding IOS XR Multicast, Configuring Multicast, Monitoring and Troubleshooting Multicast

Unit VI. Secure Domain Router

Owner and Non-Owner SDR , Understanding SDR Privileges, Creating a Secure Domain Router, DRP, Configuring a Secure Domain Router, Process Placement, Understanding CRS-1 Multishelf, Multishelf Fabric Interconnect, Multishelf Control Ethernet, Multishelf Configuration,

References:

1. Mobeen Tahir , Mark Ghattas, Dawit Birhanu , Syed Natif Nawaz," CISCO IOS XR Fundamentals", Cisco Press, ISBN-10: 1-58705-271-7, 13: 978-1-58705-271-2

610203A - Internet Routing Design

Teaching Scheme	Examination Scheme
Lectures: 5Hrs/week	Theory In-semester Assessment: 50 Marks
	Theory End-semester Assessment: 50 Marks
	Total Credits : 05

Unit I Internet

Evolution of the Internet, ISP Services and Characteristics, IP Addressing and Allocation Techniques

Unit II Routing Protocol Basics

Interdomain Routing Basics : Overview of Routers and Routing, Routing Protocol Concepts, Segregating the World into Autonomous Systems, Border Gateway Protocol

Unit III Effective Internet Routing Designs

Tuning BGP Capabilities: Building Peer Sessions, Sources of Routing Updates, The Routing Process Simplified, Controlling BGP Routes, Route Filtering and Attribute Manipulation, BGP-4 Aggregation

Unit IV. Redundancy, Symmetry, and Load Balancing

Redundancy, Symmetry, Load Balancing, Specific Scenarios: Designing Redundancy, Symmetry, and Load Balancing
Single-Homing, Multihoming to a Single Provider, Multihoming to Different Providers, Customers of the Same Provider with a Backup Link, Customers of Different Providers with a Backup Link

Unit V. Controlling Routing Inside the Autonomous System

Interaction of Non-BGP Routers with BGP Routers, BGP Policies Conflicting with Internal Defaults, Policy Routing, Controlling Large-Scale Autonomous Systems: - Route Reflectors, Confederations, Controlling IGP Expansion,

Unit VI. Designing Stable Internets

Route Instabilities on the Internet, BGP Stability Features, **Internet Routing Device Configuration,** Configuring Basic BGP Functions and Attributes:- Building Peering Sessions, Route Filtering and Attribute Manipulation, Peer Groups, Sources of Routing Updates, Overlapping Protocols, Configuring Effective Internet Routing Policies

References:

1. Sam Halabi with Danny McPherson, “Internet Routing Architectures”, Second Edition

610203B - Cloud Computing

Teaching Scheme **Examination Scheme**
Lectures: 5Hrs/week **Theory In-semester Assessment: 50 Marks**
Theory End-semester Assessment: 50 Marks
Total Credits : 05

Unit I. Introduction

Cloud computing fundamentals, the role of networks in Cloud computing, Essential characteristics of Cloud computing, Cloud deployment model, Cloud service models, Multitenancy, Cloud cube model, Cloud economics and benefits, Cloud types and service scalability over the cloud, challenges in cloud NIST guidelines

Unit II. Virtualization, Server, Storage and Networking

Virtualization concepts , types, Server virtualization, Storage virtualization, Storage services, Network virtualization, Service virtualization, Virtualization management, Virtualization technologies and architectures, Internals of virtual machine, Measurement and profiling of virtualized applications. Hypervisors: KVM, Xen, HyperV Different hypervisors and features

Unit III. Data in cloud

Storage system architecture, Big data, Virtualized Data Centre (VDC) architecture, VDC environments, concepts, planning and design, Managing VDC and cloud infrastructures,
hybrid storage networking technologies (iSCSI, FCIP,FCoE), host system design consideration

Unit IV. Cloud security

Cloud Security risks, Security, Privacy, Trust, Operating system security, Security of virtualization, Security risks posed by shared images, Security risk posed by a management OS, Xoar, Trusted virtual machine monitor

Unit V. QoS [Quality of Service] of Cloud

Taxonomy and survey of QoS management and service , Selection methodologies for cloud computing, Auto scaling, Load balancing and monitoring in open source cloud, Resource scheduling for Cloud Computing

Unit VI. Cloud patterns and application

Cloud Platforms: Amazon EC2 and S3, Cloudstack, Intercloud, Mobile Cloud Designing an image: Pre-packaged image, singleton instances prototype images Designing an architecture : Adapters, Facades, Proxies and balancers Clustering : The n-Tier Web pattern, Semaphores and Locking Map Reduce Peer-to-Peer framework

References:

1. Dr. Kumar Saurabh,"Cloud Computing", Wiley Publication
2. Borko Furht, "Handbook of Cloud Computing", Springer
3. Venkata Josyula,"Cloud computing – Automated virtualized data center", CISCO Press
4. Greg Schulr,"Cloud and virtual data storage networking",CRC Press
5. Mark Carlson,"Cloud data management and storage", Mc Graw hill
6. Lizhe Wang, " Cloud Computing:Methodology, System and Applications", CRC Press
7. Cloud computing: Data Intensive Computing and Scheduling by Chapman Hall/CRC
8. Christopher M. Moyer, Building Applications in the Cloud: Concepts, Patterns, and Projects
9. Dan C. Marinescu," Cloud computing: Theory and Practice".

Additional References:

1. Antonopoulus, Nikos, ”Cloud computing: Principles, Systems and Applications”,1st edition
2. Ronald Krutz,”Cloud Security: Comprehensive guide to Secure Cloud Computing”, Wiley Publishing
3. Barrie Sosinsky,”Cloud Computing Bible”, Wiley
4. Rajkumar Buyya,”CLOUD COMPUTING Principles and Paradigms”,Wiley and Sons, Inc
5. Anthony T. Velte, “Cloud Computing: Practical Approach”, Mc Graw Hill
6. Tim Mather,”Cloud Security and Privacy”, O’REILLY
7. Gautham Shroff, “Enterprise Cloud Computing”, Cambridge

610203C - IR and Web Mining

Teaching Scheme	Examination Scheme
Lectures: 5Hrs/week	Theory In-semester Assessment: 50 Marks
	Theory End-semester Assessment: 50 Marks
	Total Credits : 05

Unit I. Information Retrieval Basics

Goals and history of IR. The impact of the web on IR. Components of an IR system, Boolean and vector-space retrieval models; ranked retrieval; text-similarity metrics; TF-IDF (term frequency/inverse document frequency) weighting; cosine similarity. Simple tokenizing, stop-word removal, and stemming; inverted indices, Index Construction and compression.

Unit II. Information Retrieval Models

Probabilistic Information Retrieval, Language Modeling for Information Retrieval, Adhoc Retrieval, Latent Semantic Indexing, Relevance feedback, Pseudo relevance feedback, Query expansion, Query languages, POS tagging,

Unit III. Web Mining

Web Structure, content and usage mining, Web Crawling, Indexes, Search engines; spidering; metacrawlers; directed spidering; link analysis (e.g. hubs and authorities, Google PageRank), Information Extraction, spam filtering, XML retrieval.

Unit IV. Performance metrics

Recall, precision, and F-measure; Evaluations on benchmark text collections, TREC Tracks. **Social Networks:** Social Web, Blogs, Wikis, Forums, Social Network analysis, Recommender systems, Information Filtering, Collaborative filtering and content-based recommendation of documents and products.

Unit V. Semantic web

Web 3.0, Ontology, OWL, RDF Schema, ontology learning, Knowledge representation, management and extraction, Multimedia Retrieval, Content based Image retrieval, Pattern Matching and classification for IR.

Unit VI. Specific topics in IR and Web Mining

Focused Retrieval, Transfer Learning, Learning to Rank, Personalisation, Behavioral Targeting, Cross Language IR, Digital Libraries, Bibliographic systems, Patent Search, E-learning, Security Issues, Political and ethical issues.

References:

1. Yates & Neto, "Modern Information Retrieval", Pearson Education, ISBN 81-297-0274-6 (2011).
2. Christopher D. Manning, Prabhakar Raghavan, Hinrich Schütze , “Introduction to Information Retrieval” (available online at http://nlp.stanford.edu/IR-book/)
3. Chakrabarti, S., Mining the Web, Morgan Kaufmann (An Imprint of Elsevier) 2005.

Additional References :

1. C.J. Rijsbergen, "Information Retrieval", (http://www.dcs.gla.ac.uk/Keith/Preface.html)
2. Grossman, D. A. and Frieder, O., Information Retrieval: Algorithms and Heuristics. Kluwer 1998.
3. Search Engines: Information Retrieval in Practice by Bruce Croft, Donald Metzler, and Trevor Strohman, Addison-Wesley, 2009.
4. Information Retrieval: Implementing and Evaluating Search Engines by S. Buttcher, C. Clarke and G. Cormack, MIT Press, 2010.
5. Web Data Mining: Exploring Hyperlinks, Contents, and Usage Data by B. Liu, Springer, Second Edition, 2011.

610203D- Web Technology

Teaching Scheme **Examination Scheme**

Lectures: 5Hrs/week **Theory In-semester Assessment: 50 Marks**

Theory End-semester Assessment: 50 Marks

Total Credits : 05

Unit I Introduction to Web

WWW, HTTP, HTML, Web Client, Web Server, Web application, Web architectures – 2-tier, 3-tier, n-tier, XML – DTD, Schemas, Style sheet and transformation language – XSL, XSLT, XML parsers – DOM, SAX.

Unit II Client-side Technologies

DHTML – HTML, DOM, CSS, JavaScript ; Java applets, Rich UI – HTML5, AJAX, jQuery, WebGL.

Unit III Server-side Technologies

CGI, Fast CGI, Java Servlets, JSP, Java Beans, JDBC, Session tracking, JSTL, JSP custom tag library.

Unit IV

Middleware, Application server, J2EE architecture, J2EE technologies – RMI, EJB, JMS, JNDI, JTA, JCA, JAAS, JAXP, JAXB, Java Mail.

Unit V

MVC architecture, Frameworks – Struts – view helper, front controller, JSF, Spring.

Unit VI Web Services and SOA

Web service concepts - WSDL, SOAP, UDDI, REST, Business Process Execution Language for Web Services,

SOA definition, evolution, overview and characteristics of SOA, Enterprise Service Bus (ESB), Advantages of SOA.

References:

1. James L. Weaver, Kevin Mukhar, “Beginning J2EE 1.4: From Novice to Professional (Apress Beginner Series) (Paperback) “, James P. Crume (Publisher)
2. William Crawford, Jim Farley, “Java Enterprise in a Nutshell”, 3rd Edition, O'Reilly, ISBN: 0-596-10142-2.
3. John Hunt, **“**Guide to J2EE – Enterprise Java**”,** Springer.
4. Java 6 and J2EE 1.5 – Black Book – Dream tech press, Kogent learning solutions inc.

610204 - Seminar- II

Teaching Scheme
Practical: 4 Hrs/week

Examination Scheme
TW: 50 Marks
Presentation Oral: 50 Marks
Total Credits: 04

Seminar based on state-of-the art in the selected electives and approved by guide. The presentation and the report should cover motivation, mathematical modeling, data-table discussion and conclusion. The reports to be prepared using LATEX derivative. To maintain the quality of the seminar work it is mandatory on the seminar guides to maintain a progressive record of the seminar contact Hrs of 1 Hrs per month per seminar which shall include the discussion agenda, weekly outcomes achieved during practical sessions, corrective actions and comments on the progress report as per the plan submitted by the students including dates and timing, along with the signature of the student as per the class and teacher time table (as additional teaching load); such record of progressive work shall be referred by the examiners during evaluation.

610205 – Dissertation Stage-I

Teaching Scheme
Practical: 8 Hrs/week/student

Examination Scheme
TW: 50 Marks
OR: 50 Marks
Total Credits: 08

Motivation, Problem statement, survey of journal papers related to the problem statement, problem modeling and design using set theory, NP-Hard analysis, SRS, UML, Classes, Signals, Test scenarios and other necessary, problem specific UML, software engineering documents. Student should publish one International Journal Paper (having ISSN Number and preferably with Citation Index II); or paper can be published in reputed International Journal recommended by the guide of the Dissertation and in addition to above the term work shall include the paper published, reviewers comments and certificate of presenting the paper in the conference organized/sponsored by the Board of Studies in Computer Engineering. To maintain the quality of the dissertation work it is mandatory on the dissertation guides to maintain a progressive record of the dissertation contact Hrs of 1 Hrs per week which shall include the dissertation discussion agenda, weekly outcomes achieved during practical sessions, corrective actions and comments on the progress report as per the plan submitted by the students including dates and timing, along with the signature of the student as per the class and teacher time table; such record of progressive work shall be referred by the dissertation examiners during evaluation. At the most 8 dissertations can be assigned to a guide.

Tools for the Laboratories: The laboratories must be equipped with adequate, well maintained working resources as per the software/equipment/tools list published by the Board of Studies time to time.

Semester - IV

610206 - Seminar- III

Teaching Scheme
Practical: 5 Hrs/week

Examination Scheme
TW: 50 Marks
Presentation Oral: 50 Marks
Total Credits: 05

Seminar based on selected research methodology preferably algorithmic design advances as an extension to seminar-II, approved by the guide. The presentation should cover motivation, mathematical modeling, data-table discussion and conclusion. The reports shall be prepared using LATEX derivative. To maintain the quality of the seminar work it is mandatory on the seminar guides to maintain a progressive record of the seminar contact Hrs of 1 Hrs per month per seminar which shall include the discussion agenda, weekly outcomes achieved during practical sessions, corrective actions and comments on the progress report as per the plan submitted by the students including dates and timing, along with the signature of the student as per the class and teacher time table (as additional teaching load); such record of progressive work shall be referred by the examiners during evaluation.

610206 – Dissertation Stage-II

Teaching Scheme
Practical: 20 Hrs/week/student

Examination Scheme
TW: 150 Marks
OR: 50
Total Credits: 20

Selection of Technology, Installations, UML implementations, testing, Results, performance discussions using data tables per parameter considered for the improvement with existing known algorithms and comparative graphs to support the conclusions drawn. Student should publish one International Journal Paper (having ISSN Number and preferably with Citation Index II); or paper can be published in reputed International Journal recommended by the guide of the Dissertation and in addition to above the term work shall include the paper published, reviewers comments and certificate of presenting the paper in the conference organized/sponsored by the Board of Studies in Computer Engineering. To maintain the quality of the dissertation work it is mandatory on the dissertation guides to maintain a progressive record of the dissertation contact Hrs of 1 Hrs per week which shall include the dissertation discussion agenda, weekly outcomes achieved during practical sessions, corrective actions and comments on the progress report as per the plan submitted by the students including dates and timing, along with the signature of the student as per the class and teacher time table; such record of progressive work shall be referred by the dissertation examiners during evaluation. At the most 8 dissertations can be assigned to a guide.

Important Note regarding all Open Electives

Open Elective proposal shall be (current state-of the art in Computer Engineering or Inter-disciplinary or intra-disciplinary) focusing algorithms, technologies developed using computing or systems programming (Kernel level/ Embedded) or virtualization or useful for the

professional growth, if any, to be forwarded to the BoS, Computer Engineering for necessary approvals on or before the month of December every year. The teaching shall be done through Industry-Institute Interaction/invited talks/webminars etc.

Tools for the Laboratories: The laboratories must be equipped with adequate, well maintained working resources as per the software/equipment/tools list published by the Board of Studies time to time. For maintaining the quality and effective performance the Board of Studies may publish the quality guidelines for effective conduct of the laboratories, seminars and dissertation.