

SNS COLLEGE OF TECHNOLOGY, COIMBATORE – 641035**(AN AUTONOMOUS INSTITUTION)****REGULATION – 2016****CHOICE BASED CREDIT SYSTEM****SUGGESTED CURRICULA AND SYLLABI****M. E. COMPUTER SCIENCE & ENGINEERING****SEMESTER I**

S.NO.	COURSE CODE	COURSE TITLE	CAT	CONTACT PERIODS	L	T	P	C	PRE-REQUISITES
THEORY									
1.	16MA601	Operations Research	FC	4	4	0	0	4	-
2.	16CS601	Data Structures and Algorithms	PC	3	3	0	0	3	-
3.	16CS602	Object Oriented Software Engineering	PC	3	3	0	0	3	-
4.	16CS603	Computer Networks and Management	PC	3	3	0	0	3	-
5.	16CS604	Computer Architecture	PC	3	3	0	0	3	-
6.		Elective – I	PE	3	3	0	0	3	-
PRACTICAL									
7.	16CS605	Data Structures Laboratory	PC	4	0	0	4	2	-
8.	16CS606	Networking Laboratory	PC	4	0	0	4	2	-
TOTAL				27	19	0	8	23	

SEMESTER II

S.NO.	COURSE CODE	COURSE TITLE	CAT	CONTACT PERIODS	L	T	P	C	PRE-REQUISITES
THEORY									
1.	16CS607	Advanced Operating Systems	PC	3	3	0	0	3	-
2.	16CS608	Web Technology	PC	4	3	1	0	4	16CS603
3.	16CS609	Internet of Things	PC	3	3	0	0	3	16CS603
4.		Elective – II	PE	3	3	0	0	3	-
5.		Elective – III	PE	3	3	0	0	3	-
6.		Elective – IV	PE	3	3	0	0	3	-
PRACTICAL									
7.	16CS610	Operating System Laboratory	PC	4	0	0	4	2	-
8.	16CS611	Web Technology Laboratory	PC	4	0	0	4	2	-
TOTAL				24	18	1	8	23	

SEMESTER III

S.NO.	COURSE CODE	COURSE TITLE	CAT	CONTACT PERIODS	L	T	P	C	PRE-REQUISITES
THEORY									
1.		Elective – V	PE	3	3	0	0	3	-
2.		Open Elective **	OE	3	3	0	0	3	-
PRACTICAL									
3.	16GE702	Technical Seminar	EEC	3	0	0	3	1	-
4.	16CS701	Project Work (Phase I)	EEC	12	0	0	12	6	-
TOTAL				21	6	0	15	13	

SEMESTER IV

S.NO.	COURSE CODE	COURSE TITLE	CAT	CONTACT PERIODS	L	T	P	C	PRE-REQUISITES
PRACTICAL									
1.	16CS702	Project Work (Phase-II)	EEC	24	0	0	24	12	16CS701
TOTAL				24	0	0	24	12	

TOTAL CREDITS: 72

**Courses from the curriculum of other PG programmes

FOUNDATION COURSE (FC)

S.NO.	COURSE CODE	COURSE TITLE	CONTACT PERIODS	L	T	P	C	PRE-REQUISITES
1.	16MA601	Operations Research	4	4	0	0	4	-

PROFESSIONAL CORE (PC)

S.NO.	COURSE CODE	COURSE TITLE	CONTACT PERIODS	L	T	P	C	PRE-REQUISITES
1.	16CS601	Data Structures and Algorithms	3	3	0	0	3	-
2.	16CS602	Object Oriented Software Engineering	3	3	0	0	3	-
3.	16CS603	Computer Networks and Management	3	3	0	0	3	-
4.	16CS604	Computer Architecture	3	3	0	0	3	-
5.	16CS607	Advanced Operating Systems	3	3	0	0	3	-
6.	16CS608	Web Technology	4	3	1	0	4	-
7.	16CS609	Internet of Things	3	3	0	0	3	-
8.	16CS605	Data Structures Laboratory	4	0	0	4	2	-

9.	16CS606	Networking Laboratory	4	0	0	4	2	-
10.	16CS610	Operating System Laboratory	4	0	0	4	2	-
11.	16CS611	Web Technology Laboratory	4	0	0	4	2	-

PROFESSIONAL ELECTIVES– (PE)

S.NO.	COURSE CODE	COURSE TITLE	CONTACT PERIODS	L	T	P	C	PRE-REQUISITES
1.	16CS612	Grid Computing	3	3	0	0	3	-
2.	16CS613	XML and Web Services	3	3	0	0	3	-
3.	16CS614	Bioinformatics	3	3	0	0	3	-
4.	16CS615	Digital Imaging	3	3	0	0	3	-
5.	16CS616	Adhoc Networks	3	3	0	0	3	-
6.	16CS617	Agent Based Intelligent Systems	3	3	0	0	3	-
7.	16CS618	Software Quality Assurance	3	3	0	0	3	-
8.	16CS619	Data Warehousing and Data Mining	3	3	0	0	3	-
9.	16CS620	Cyber Forensics and Information Security	3	3	0	0	3	-
10.	16CS703	Mobile Computing	3	3	0	0	3	-
11.	16CS704	Multimedia Systems	3	3	0	0	3	-
12.	16CS705	Network Security	3	3	0	0	3	-
13.	16CS706	Visualization Techniques	3	3	0	0	3	-
14.	16CS707	Soft Computing	3	3	0	0	3	-
15.	16CS708	Performance Evaluation of Computer Systems and Networks	3	3	0	0	3	-
16.	16CS709	Information and Cyber Warfare	3	3	0	0	3	-
17.	16CS710	Cyber Security	3	3	0	0	3	-
18.	16CS712	Distributed Computing	3	3	0	0	3	-
19.	16CS713	Information Security	3	3	0	0	3	-
20.	16SW605	Software Project Management	3	3	0	0	3	-
21.	16IT621	Component Based Technology	3	3	0	0	3	-
22.	16IT611	Cloud Computing	3	3	0	0	3	-
23.	16CS720	Big Data Analytics	3	3	0	0	3	-

EMPLOYABILITY ENHANCEMENT COURSES (EEC)

S.NO.	COURSE CODE	COURSE TITLE	CONTACT PERIODS	L	T	P	C	PRE-REQUISITES
1.	16CS701	Project Work (Phase-I)	12	0	0	12	6	-
2.	16GE702	Technical Seminar	3	0	0	3	1	-
3.	16CS702	Project Work (Phase-II)	24	0	0	24	12	16CS701

OPEN ELECTIVE OFFERED TO OTHER PG PROGRAMMES

S.NO.	COURSE CODE	COURSE TITLE	CONTACT PERIODS	L	T	P	C	PRE-REQUISITES
1.	16CS901	Satellite Communication	3	3	0	0	3	-
2.	16CS902	Knowledge Management	3	3	0	0	3	-
3.	16CS903	Managing Innovation and Entrepreneurship	3	3	0	0	3	-
4.	16CS904	Fuzzy Systems	3	3	0	0	3	-
6.	16CS906	Enterprise Resource Planning & Management	3	3	0	0	3	-
7.	16GE701	Engineering Educational Management	3	3	0	0	3	-

S.No.	SUBJECT AREA	Credits Per Semester				Total Credits
		I	II	III	IV	
1	FC	4	-	-	-	4
2	PC	16	14	-	-	30
3	PE	3	9	3	-	15
4	OE	-	-	3	-	3
5	EEC	-	-	7	12	19
	TOTAL	23	23	13	12	71

16MA601	OPERATIONS RESEARCH	L	T	P	C
		4	0	0	4

UNIT-I	QUEUEING MODELS	12
Poisson Process – Markovian Queues – Single and Multi-server Models – Little’s formula – Machine Interference Model – Steady State analysis – Self Service Queue.		

UNIT-II	ADVANCED QUEUEING MODEL	12
Non- Markovian Queues – Pollaczek Khintchine Formula – Queues in Series – Open Queueing Networks – Closed Queueing networks.		

UNIT-III	NETWORK MODELS	12
Network Construction- computation of earliest start time, latest start time, Total, free and independent float time- Computation of optimistic, most likely Pessimistic and expected time.		

UNIT-IV	LINEAR PROGRAMMING	12
Formulation – Graphical solution – Simplex method – Two phase method - Transportation and Assignment Problems.		

UNIT-V	NON-LINEAR PROGRAMMING	12
Lagrange multipliers – Equality constraints – Inequality constraints – Kuhn - Tucker conditions – Quadratic Programming.		

L:45	T:15	T: 60 PERIODS
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REFERENCES					
<ol style="list-style-type: none"> 1. Nita H.Shah., Ravi M. Gor and Hardik Soni, Operations Research, Prentice Hall India, 2008 - [Unit - I ,III,IV,V]. 2. Ross.S.M.,Introduction to Probability Models, 10th Edition,Academic Press,2010-[Unit I & II]. 3. Donald Gross and Carl M. Harris, Fundamentals of Queueing theory, 3rd edition, John Wiley and Sons, New York (2011 Reprint)-[Unit I & II]. 4. Sankara Iyer P, Operations Research, Tata Mcgraw Hill, 2008-[Unit-I ,III, IV]. 5. Taha,H.A.Operations Research:An Introduction,Ninth Edition,Pearson Education Edition,Asia,New Delhi, 2011-[Unit I,II,III,IV,V]. 					
16CS601	DATA STRUCTURES AND ALGORITHMS	L	T	P	C
		3	0	0	3

UNIT-I	COMPLEXITY ANALYSIS & ELEMENTARY DATA STRUCTURES	9
Asymptotic notations – Properties of Big-O notation – Asymptotic notation with several parameters – Conditional Asymptotic notation – Amortized analysis –Recurrence equations – solving recurrence equations – Arrays – Linked lists.		

UNIT-II	HEAP STRUCTURES	9
Min-max heaps – Deaps – Lefist Trees - Binomial heaps – Fibonacci heaps – Skew heaps – Lazy_Binomial heaps.		

UNIT-III	TREE STRUCTURES	9
Trees-Binary search trees – AVL trees – 2-3 trees & 2-3-4 trees – B-trees and B+ trees – Red-Black trees- Splay trees – Forest.		

UNIT-IV	GREEDY & DIVIDE AND CONQUER	9
Quicksort – Strassen’s matrix multiplication – Convex hull - Tree-vertex splitting – Job sequencing with deadlines – Optimal storage on tapes		

UNIT-V	DYNAMIC PROGRAMMING AND BACKTRACKING	9
Multistage graphs – 0/1 knapsacks using dynamic programming – Flow shop scheduling – N-queens problem (4 & 8) – graph coloring – knapsack using backtracking- NP-completeness – NP hard Problems.		

L:45	T:0	T: 15 PERIODS
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REFERENCES
<ol style="list-style-type: none"> 1. E. Horowitz, S.Sahni and Dinesh Mehta, Fundamentals of Data structures in C++, Galgotia, 2007. (UNIT I – Chapter 2, 4) (UNIT II – Chapter 9) (UNIT III – Chapter 5) 2. Adam Drozdex, Data Structures and algorithms in C++, Second Edition, Thomson learning vikas publishing House, 2001. (UNIT I – Chapter 2, Chapter 3). 3. M. A. Weiss, “Data Structures and Algorithm Analysis in C”, Second Edition, Pearson Education, 2005. (UNIT IV, UNIT V- Chapter10) 4. E. Horowitz, S.Sahni and S. Rajasekaran, Computer Algorithms / C++, Galgotia, 2007.G. Brassard and P. Bratley, Algorithmics: Theory and Practice, Prentice –Hall, 1988. (UNIT I) 5. Thomas H.Corman, Charles E.Leiserson, Ronald L. Rivest, ”Introduction to Algorithms”, Second Edition, PHI 2003. (UNIT IV) 6. Anany Levitin, “Design and Analysis of Algorithms”, Pearson Education, 2010. (UNIT V)

16CS603	COMPUTER NETWORKS AND MANAGEMENT	L	T	P	C
		3	0	0	3

UNIT-I	HIGH SPEED NETWORKS	9
Introduction: Need for speed & quality of service, TCP & IP- Frame Relay Networks – Asynchronous transfer mode – ATM Protocol Architecture, ATM logical Connection, ATM Cell – ATM Service Categories – AAL. High Speed LAN’s: Fast Ethernet, Gigabit Ethernet, Fiber Channel -Wireless		

LAN's: applications, requirements – Architecture of 802.11.		
UNIT-II	CONGESTION AND TRAFFIC MANAGEMENT	9
Queuing Analysis- Queuing Models – Single Server Queues – Effects of Congestion –Congestion Control – Traffic Management – Congestion Control in Packet Switching Networks –Frame Relay Congestion Control- Link level Flow & error control.		

UNIT-III	TCP AND ATM CONGESTION CONTROL	9
TCP Flow control – TCP Congestion Control – Retransmission – Timer Management –Exponential RTO backoff – KARN's Algorithm – Window management Traffic and Congestion control in ATM – Requirements – Attributes – Traffic Management Frame work, Traffic Control – ABR traffic Management – ABR rate control, RM Cell formats, ABR Capacity allocations.		

UNIT-IV	INTEGRATED AND DIFFERENTIATED SERVICES	9
Integrated Services Architecture – Approach, Components, Services- Queuing Discipline, FQ, PS, BRFQ, GPS, WFQ – Random Early Detection, Differentiated Services.		

UNIT-V	PROTOCOLS FOR QoS SUPPORT	9
Interior Routing Protocols, Exterior Routing Protocols , RSVP – Goals & Characteristics, Data Flow, RSVP operations, Protocol Mechanisms –Multiprotocol Label Switching – Operations, Label Stacking, Protocol details – RTP – Protocol Architecture, Data Transfer Protocol, RTCP Challenges and research issues in high performance networks.		

L:45	T:0	T: 45 PERIODS
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REFERENCES	
<ol style="list-style-type: none"> 1. William Stallings, “High Speed Networks And Internet”, Pearson Education, Second Edition, 2002.(Unit-I,II,III,IV,V) 2. Warland & Pravin Varaiya, “High Performance Communication Networks”, Jean Harcourt Asia Pvt. Ltd., II Edition, 2001. (UNIT I , II) 3. Irvan Pepelnjk, Jim Guichard and Jeff Aparcar, “MPLS and VPN architecture”, Cisco Press, Volume 1 and 2, 2003. (UNIT IV) 4. High-speed networks: TCP/IP and ATM design principles by William Stallings, Ist Edition, Prentice hall, 1998. (UNIT III) 5. High Performance TCP/IP Networking: Concepts, issues and solutions: By Mahoob Hassan Raj and Jain PHI Publisher, 1998. (UNIT V) 	

16CS602	OBJECT ORIENTED SOFTWARE ENGINEERING	L	T	P	C
		3	0	0	3

UNIT-I	INTRODUCTION	9
Software Engineering Concepts – software development life cycle - Development Activities –Managing Software Development – Unified Modeling Language – Architectural Modeling.		
UNIT-II	ANALYSIS	9
Requirements Elicitation – Concepts – Activities – Management – Techniques – Documentation – Analysis Object Model – Analysis Static Models – Analysis Dynamic Models.		

UNIT-III	SYSTEM DESIGN	9
System Design Concepts – Overview of System Design – Decomposing the system - System Design Activities – Data flow oriented design - Architectural Styles – Design Patterns – Addressing Design Goals – Managing System Design.		

UNIT-IV	OBJECT DESIGN AND IMPLEMENTATION ISSUES	9
Implementation Workflow – Reusing Pattern Solutions – Specifying Interfaces – Mapping Models to Code – Mapping Object Model to Database Schema - Testing.		

UNIT-V	MANAGING CHANGE	9
Rationale Management – Configuration Management – Project Management – Quality Management – Metrics - Maintenance.		

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REFERENCES
<ol style="list-style-type: none"> 1. Bernd Bruegge, Alan H Dutoit, Object-Oriented Software Engineering, 2nd, Pearson Education, 2004. (UNIT I, II and V) 2. Stephen Schach, Software Engineering 7th edition, McGraw-Hill, 2007. (UNIT III and IV) 3. Grandy Booch, James Rumbough, Ivar Jacobson. The Unified Modeling Language User Guide, Pearson Education 2002. 4. Roger Pressman, “Software Engineering”, Sixth edition, Tata McGraw Hill. 5. Timothy C. Lethbridge, Robert Laganier “Object-Oriented Software Engineering – A practical software development using UML and Java”, Tata McGraw-Hill, New Delhi. 6. Simon Bennett, Steve McRobb and Ray Farmer. Object-Oriented System Analysis and Design Using UML, 2nd Edition, McGraw-Hill, 2002. 7. Ali Bahrami, “Object Oriented System Development”, McGraw Hill International Edition, Singapore, 1999.

16CS604	COMPUTER ARCHITECTURE	L	T	P	C
		3	0	0	3

UNIT-I	FUNDAMENTALS OF COMPUTER DESIGN AND PIPELINING	9
Fundamentals of Computer Design – Measuring and reporting performance –Quantitative principles of computer design. Instruction set principles – Classifying ISA –Design issues. Pipelining – Basic concepts – Hazards – Implementation – Multicycle operations.		

UNIT-II	INSTRUCTION LEVEL PARALLELISM WITH DYNAMIC APPROACHES	9
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Concepts – Dynamic Scheduling – Dynamic hardware prediction – Multiple issue – Hardware based speculation – Limitations of ILP – Case studies.

UNIT-III	INSTRUCTION LEVEL PARALLELISM WITH SOFTWARE APPROACHES	9
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Compiler techniques for exposing ILP – Static branch prediction – VLIW – Advanced compiler support – Hardware support for exposing more parallelism – Hardware versus software speculation mechanisms – Case studies.

UNIT-IV	MULTIPROCESSORS AND MULTICORE ARCHITECTURES	9
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Symmetric and distributed shared memory architectures – Performance issues – Synchronization issues – Models of memory consistency – Software and hardware multithreading – SMT and CMP architectures – Design issues – Vector processor architecture – Case studies.

UNIT-V	MEMORY AND I/O	9
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Cache performance – Reducing cache miss penalty and miss rate – Reducing hit time – Main memory and performance – Memory technology. Types of storage devices – Buses – RAID – Reliability, availability and dependability – I/O performance measures – Designing an I/O system – Case studies.

L:45	T:0	T: 45 PERIODS
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REFERENCES

1. John L.Hennessey and David A.Patterson, “Computer Architecture – A quantitative approach”, Morgan Kaufmann / Elsevier, 5th. Edition, 2012.(Unit I,II, III,IV).
2. David E.Culler, Jaswinder Pal Singh, “Parallel Computing Architecture: A hardware/ software approach”, Morgan Kaufmann / Elsevier, 1998.(Unit II,III).
3. William Stallings, “Computer Organization and Architecture – Designing for Performance”, Pearson Education, 9th Edition, 2012. (Unit V)
4. Kai Hwang, “Advanced Computer Architecture ”, McGraw Hill International,2001.(Unit II, III, IV,V)
5. Behrooz Parhami, “Computer Architecture”,Oxford University Press,2011.

16CS605	DATA STRUCTURES LABORATORY	L	T	P	C
		0	0	4	2

LIST OF EXPERIMENTS

1. Min Heap & Max Heap.
2. Heaps.
3. Leftist Heap.
4. AVL Tree.
5. B-Tree.
6. Tries.
7. Quick Sort.
8. Job Sequencing with Deadlines.
9. 0/1 Knapsack using Dynamic Programming.
10. Graph coloring using backtracking.

L:0	T:0	P:60	T: 60 PERIODS
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16CS606	NETWORKING LABORATORY	L	T	P	C
		0	0	4	2

LIST OF EXPERIMENTS
<ol style="list-style-type: none"> 1. Implementation of Socket Programming <ol style="list-style-type: none"> a. TCP Sockets. b. UDP Sockets. c. Applications using Sockets. 2. Implementation of FTP. 3. Simulation of Sliding Window Protocol. 4. Simulation of Interior Routing Protocols. 5. Simulation of Exterior Routing Protocols. 6. Development of applications such as DNS/ HTTP/ E – mail/ Multi - user Chat. 7. Simulation of Network Management Protocols. 8. Study of Network Simulator Packages – such as opnet, ns2, etc.

P:60	T:0	T: 60 PERIODS
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16CS607	ADVANCED OPERATING SYSTEMS	L	T	P	C
		3	0	0	3

UNIT-I	INTRODUCTION	9
<p>Overview - Functions of an Operating System – Design Approaches – Types of Advanced Operating System - Synchronization Mechanisms – Concept of a Process, Concurrent Processes – The Critical Section Problem, Other Synchronization Problems – Language Mechanisms for Synchronization – Axiomatic Verification of Parallel Programs – Process Deadlocks - Preliminaries – Models of Deadlocks, Resources, System State – Necessary and Sufficient conditions for a Deadlock – Systems with Single-Unit Requests, Consumable Resources, Reusable Resources.</p>		

UNIT-II	DISTRIBUTED OPERATING SYSTEMS	9
<p>Introduction – Issues – Communication Primitives – Inherent Limitations - Lamport’s Logical Clock; Vector Clock; Causal Ordering; Global State; Cuts; Termination Detection. Distributed Mutual Exclusion – Non-Token Based Algorithms – Lamport’s Algorithm – the Ricart-agrawala algorithm-meakawa’s 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.</p>		
UNIT-III	DISTRIBUTED RESOURCE MANAGEMENT	9
<p>Distributed File systems – Architecture – Mechanisms – Design Issues – Distributed Shared Memory –</p>		

Architecture – Algorithm – Protocols - Design Issues. case study: The Sun NFS. Distributed Scheduling – Issues– Components – Algorithms.		
UNIT-IV	FAILURE RECOVERY AND FAULT TOLERANCE	9
Basic Concepts-Classification of Failures – Basic Approaches to Recovery; Recovery in Concurrent System; Synchronous and Asynchronous Check pointing and Recovery; Check pointing in Distributed Database Systems; Fault Tolerance; Issues - Two-phase and Nonblocking Commit Protocols; Voting Protocols; Dynamic Voting Protocols;		
UNIT-V	MULTIPROCESSOR AND DATABASE OPERATING SYSTEMS	9
Multiprocessor system architecture – motivations-architectures Multiprocessor Operating System-Structures – Design Issues – Threads – Process Synchronization – Processor Scheduling –Memory Management – Reliability / Fault Tolerance; Database Operating Systems –Introduction – Concurrency Control – Distributed Database Systems – Concurrency Control-lock based -time stamped algorithms.		

L:45	T:0	T: 45 PERIODS
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REFERENCES
<ol style="list-style-type: none"> 1. Mukesh Singhal and N. G. Shivaratri, “Advanced Concepts in Operating Systems”, McGraw-Hill, 2000. (UNIT I to V) 2. Abraham Silberschatz, Peter B. Galvin, G. Gagne, “Operating System Concepts”,Sixth Edition, Addison Wesley Publishing Co., 2003. (UNIT I , II) 3. Andrew S. Tanenbaum, “Modern Operating Systems”, Second Edition, Addison Wesley, 2001. (UNIT I , II)

16CS608	WEB TECHNOLOGY	L	T	P	C
		3	1	0	4

UNIT-I	INTRODUCTION	9 + 3
Web essentials – clients – servers - communication – markup languages – XHTML – simple XHTML pages style sheets – CSS.		
UNIT-II	CLIENT SIDE PROGRAMMING	9 + 3
Client side programming – Introduction to Java Scripts, Objects in Java Script, and Dynamic HTML with Java Script– Java beans-Java beans API -host objects: Browsers and the DOM.		
UNIT-III	SERVER SIDE PROGRAMMING	9 + 3
Server side programming – web server basics- java servlets – basics – simple program – separating programming and presentation – ASP/JSP - JSP basics ASP/JSP objects – simple ASP/JSP pages.		
UNIT-IV	DATA CONNECTIVITY	9 + 3
Representing Web data – data base connectivity – JDBC – Dynamic Web pages – XML – DTD – XML schema – DOM -XSLT– SAX – Xquery.		
UNIT-V	WEB APPLICATIONS	9 + 3
Building Web applications –WSDL-RDF- cookies – sessions – open source environment – PHP –		

MYSQL – case studies.

L:60 T:0 T: 60 PERIODS

REFERENCES

1. Jeffrey C Jackson, “Web Technology – A computer Science perspective”, Pearson Education, 2007. (Unit I to IV)
2. Rasmus Lerdorf and Levin Tatroe,”Programming PHP”, O’Reilly 2002. (Unit V)
3. Chris Bates, “Web Programming – Building Internet Applications, “Wiley India, 2006.(UNIT I,II IV)
4. Deitel & Deitel, Internet & World Wide Web. PHI Publications, 2012. (UNIT I)
5. Eric Ladd, Jim O’Donnell et al.,”Using HTML 4, XML and JAVA1.2”, Prentice Hall of India 2003. (Unit I and IV)
6. Margaret Levine Young,” Internet the Complete Reference”, Second edition Tata McGraw Hill Education Private Limited, 2002. (Unit V)
7. Wendy Willard,” Web design- A Beginner’s Guide”, TATA McGraw Hill, 2012. (UNIT I , II)
8. Vikram Vaswani,”MySQL the Complete Reference”, Tata McGraw Hill Education Private Limited 2004. (Unit V)
9. Pankaj Sharma, “Introduction to Web Technology” , 2009. (Unit III, IV, V)

16CS609	INTERNET OF THINGS	L	T	P	C
		3	0	0	3

UNIT-I	INTRODUCTION	9
Definitions and Functional Requirements –Motivation – Architecture - Web 3.0 View of IoT– Ubiquitous IoT Applications – Four Pillars of IoT – DNA of IoT - The Toolkit Approach for End-user Participation in the Internet of Things. Middleware for IoT: Overview – Communication middleware for IoT –IoT Information Security.		
UNIT-II	IOT PROTOCOLS	9
Protocol Standardization for IoT – Efforts – M2M and WSN Protocols – SCADA and RFID Protocols – Issues with IoT Standardization – Unified Data Standards – Protocols – IEEE 802.15.4 – BACNet Protocol – Modbus – KNX – Zigbee Architecture – Network layer – APS layer – Security.		
UNIT-III	WEB OF THINGS	9
Web of Things versus Internet of Things – Two Pillars of the Web – Architecture Standardization for WoT– Platform Middleware for WoT – Unified Multitier WoT Architecture – WoT Portals and Business Intelligence. Cloud of Things: Grid/SOA and Cloud Computing – Cloud Middleware – Cloud Standards – Cloud Providers and Systems – Mobile Cloud Computing – The Cloud of Things Architecture.		
UNIT-IV	INTEGRATED	9
Integrated Billing Solutions in the Internet of Things Business Models for the Internet of Things - Network Dynamics: Population Models – Information Cascades - Network Effects – Network Dynamics: Structural Models - Cascading Behavior in Networks - The Small-World Phenomenon.		

UNIT-V	APPLICATIONS	9
The Role of the Internet of Things for Increased Autonomy and Agility in Collaborative Production Environments - Resource Management in the Internet of Things: Clustering, Synchronisation and Software Agents. Applications - Smart Grid – Electrical Vehicle Charging.		

L:45	T:0	T: 45 PERIODS
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REFERENCES
<ol style="list-style-type: none"> 1. The Internet of Things in the Cloud: A Middleware Perspective - Honbo Zhou – CRC Press – 2012. (Unit I-V) 2. Architecting the Internet of Things - Dieter Uckelmann; Mark Harrison; Florian Michahelles - (Eds.) – Springer – 2011. (Unit I-V) 3. Networks, Crowds, and Markets: Reasoning About a Highly Connected World - David Easley and Jon Kleinberg, Cambridge University Press – 2010.(Unit IV) 4. The Internet of Things: Applications to the Smart Grid and Building Automation by – Olivier Hersent, Omar Elloumi and David Boswarthick - Wiley -2012. (Unit V) 5. Olivier Hersent, David Boswarthick, Omar Elloumi , “The Internet of Things – Key applications and Protocols”, Wiley, 2012.(Unit I-V)

16CS610	OPERATING SYSTEM LABORATORY	L	T	P	C
		0	0	4	2

LIST OF EXPERIMENTS

MULTIPROCESSOR OPERATING SYSTEMS

PROGRAM 1 – Semaphores - Multiprocessor operating systems

Assume there are three processes: Pa, Pb, and Pc. Only Pa can output the letter A, Pb B, and Pc C. Utilizing only semaphores (and no other variables) the processes are synchronized so that the output satisfies the following conditions:

- a) A B must be output before any C's can be output.
- b) B's and C's must alternate in the output string, that is, after the first B is output, another B cannot be output until a C is output. Similarly, once a C is output, another C cannot be output until a B is output.
- c) The total number of B's and C's which have been output at any given point in the output string cannot exceed the number of A's which have been output up to that point.

Examples

- AACB -- invalid, violates a)
- ABACAC -- invalid, violates b)
- AABCABC -- invalid, violates c)
- AABCAAABC -- valid
- AAAABCBC -- valid
- AB -- valid

PROGRAM 2 – Multithreading - Multiprocessor operating systems

The Cigarette Smokers Problem

Consider a simulation with three smoker threads and one agent thread. Each smoker continuously makes a cigarette and smokes it. But to make a cigarette, a smoker needs three ingredients: tobacco, paper, and matches. One of the smoker threads has only paper, another has only tobacco and the third have only matches. The agent thread has an infinite supply of all three materials. The three smoker threads are initially blocked. The agent places two randomly chosen (different) ingredients on the table and unblocks the one smoker who has the remaining ingredient. The agent then blocks. The unblocked smoker removes the two ingredients from the table, makes a cigarette, and smokes it for a random amount of time, unblocking the agent on completion of smoking the cigarette. The agent then puts out another random two of the three ingredients, and the cycle repeats.

Write a multi-class multithreaded Java program that uses a monitor to synchronize the agent thread and

the three smoker threads. **Do not mechanically translate semaphore code into monitor code!** The agent thread executes in an agent object created from an agent class. Each smoker thread executes in a smoker object. All smoker objects are created from one smoker class whose constructor is used to specify the ingredient possessed by the smoker object. A driver class with a main method constructs the objects and starts the threads. Use a single monitor object instantiated from a class Control for synchronization. Each of the four threads invokes a synchronized monitor method for its synchronization. No semaphores are allowed. No synchronized blocks are allowed, only synchronized methods. No busy waiting is allowed. No calls to nap inside a synchronized method are allowed (do not nap while holding the monitor object's lock, that is, while inside a synchronized method or while inside a method called by a synchronized method).

PROGRAM 3 – Multiple sleeping barbers - Multiprocessor operating systems

Write a multi-class multithreaded Java program that simulates multiple sleeping barbers, all in one barbershop that has a finite number of chairs in the waiting room. Each customer is instantiated from a single Customer class, each barber is instantiated from a single Barber class.

Network operating systems

PROGRAM 4 – Network operating systems

Establish a Lab setup for the following network operating systems based programs based on the skills in networking on your own. E.g. for identifying networking hardware, identifying different kinds of network cabling and network interface cards can be done.

Exercises

1. Identifying Local Area Network Hardware
2. Exploring Local Area Network Configuration Options
3. Verifying TCP/IP Settings
4. Sharing Resources
5. Testing LAN Connections

Real time operating systems

PROGRAM 5 – Real time operating systems

A real-time program implementing an alarm clock shall be developed.

[Alarm clock, using C and Simple_OS]

The program shall fulfill the following requirements:

Clock with alarm functionality shall be implemented, It shall be possible to set the time, It shall be possible to set the alarm time, the alarm shall be *enabled* when the alarm time is set, the alarm shall be *activated* when the alarm is enabled, and when the current time is equal to the alarm time, an activated alarm must be acknowledged. Acknowledgement of an alarm shall lead to the alarm being *disabled*, the alarm is enabled again when a new alarm time is set, an alarm which is not acknowledged shall be repeated every 10 seconds. The program shall communicate with a graphical user interface, where the current time shall be displayed, and where the alarm time shall be displayed when the alarm is enabled. It shall be possible to terminate the program, using a command which is sent from the graphical user interface.

Database operating systems

PROGRAM 6 – Transactions and Concurrency -Database operating systems

Exercises

Assume any application (e.g. banking) on your own and do the following exercises.

1. Investigate and implement the ObjectStore's concurrency options.
2. Implement the concurrency conflict that occurs between multiple client applications.
3. Observe and implement the implication of nested transactions.

Distributed operating systems

PROGRAM 7 – Distributed operating systems

1. Design a RMI Lottery application. Each time you run the client program -- “**java LotteryClient n**”, the server program “**LotteryServer**” will generate **n** set of Lottery numbers. Here **n** is a positive integer, representing the money you will spend on Lottery in sterling pounds. Write this program in a proper engineering manner, i.e. there should be specifications, design (flow chart, FD, or pseudo code), coding, test/debug, and documentation.

2. Consider a distributed system that consists of two processes which communicate with each other. Let **P** be a state predicate on the local state of one process and **Q** be a state predicate on the local state of the other process. Assume that neither **P** nor **Q** are stable (i.e. closed).

Design a superimposed computation which detects that there exists an interleaving of underlying events in this system where at some state $P \wedge Q$ holds. (A superposed computation is one that does not affect the underlying system; it may \read" but not \write" the state of the underlying system. Events in a superposed computation may occur in at the same instant as the underlying events and/or at different instants.) State

any assumptions you make.

[Hint: Use vector clocks.]

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16CS611	WEB TECHNOLOGY LABORATORY	L	T	P	C
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LIST OF EXPERIMENTS

1. Creation of HTML pages with frames, links, tables and other tags.
2. Usage of internal and external CSS along with HTML pages.
3. Client side Programming
 - # Java script for displaying date and comparing two dates.
 - # Form Validation including text field, radio buttons, check boxes, list box and other controls.
4. Usage of ASP/JSP objects response, Request, Application, Session, Server, ADO etc
 - # Writing online applications such as shopping, railway/air/bus ticket reservation system with Set of ASP/JSP pages.
 - # Using sessions and cookies as part of the web application.
5. Create a Java bean program for file handling.
6. Writing Servlet Program using HTTP Servlet.
7. Any online application with database access.
8. Writing DTD or XML schema for the domain specific XML document.
9. Parsing an XML document using DOM and SAX Parsers.
10. Sample web application development in the open source environment.

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16GE702	TECHNICAL SEMINAR	L	T	P	C
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UNIT-I	DEFINING THE RESEARCH PROBLEM	9
Formulation of research problem; Identification and selection of problem. Meaning purpose and principles of research design. Design criteria-different types of research and Experimental design. Purpose of the study: Exploratory, Descriptive, Hypothesis Testing.		
UNIT-II	METHODS OF DATA COLLECTION	9
Sources of data- methods of data collection- observation, questionnaire, interview, schedules and interviews.Sampling Techniques – Probabilistic and non-probabilistic samples. Issues of Precision and Confidence in determining Sample Size. Hypothesis testing, Parametric and Non-Parametric (Chi-square, Kolmogorov - Simronov, Mann-Whitney (U test), Kriskal Wallis(H Test).		
UNIT-III	MEASUREMENT AND SCALING TECHNIQUES	9
Measurement in research- measurement in scales- scaling techniques, Thurstone V scale Model, Osgoods semantic, Likert type, Q sort and Multi-Dimensional , scale constitution techniques- content analysis. Processing and analysis of data-processing operation- problem in processing, types of analysis.		
UNIT-IV	MULTI VARIATE ANALYSIS TECHNIQUES	9
Mobile Databases: Location and Handoff Management - Effect of Mobility on Data Management - Location Dependent Data Distribution - Mobile Transaction Models - Concurrency Control - Transaction Commit Protocols- Mobile Database Recovery Schemes		
UNIT-V	INTERPRETATION AND REPORT WRITING	9
Meaning and techniques of interpretation, significance of report writing, different types of steps in report writing, case studies.		

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REFERENCES
<ol style="list-style-type: none"> 1. Kothari C.R., “Research Methodology Methods and Techniques”, New Age International Publishers, 2006.(Unit I,III,IV,V) 2. Pannerselvam R., ”Research Methodology”, PHI Learning Ltd,2004.(Unit I,II,III,IV,V) 3. Kidder L.H., “Research Methods in Social Relations”, Hall Saunders International, 2002.(Unit I,III,IV,V) 4. Sedhu A.M., & Singh A., “Research Methodology in Social Science”, Himalaya Publishing House, Mumbai, 2003.(Unit I,III,IV,V)

DEPARTMENT ELECTIVE

16CS612	GRID COMPUTING	L	T	P	C
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UNIT-I	INTRODUCTION TO GRID COMPUTING	7
Introduction – The Grid – Past, Present and Future – Applications of grid computing Organizations and their roles.		

UNIT-II	GRID COMPUTING ARCHITURE	8
Grid computing anatomy – Next generation of Grid computing initiatives–Merging the Grid Services		

architecture with Web services architecture.

UNIT-III	GRID COMPUTING TECHNOLOGIES	11
OGSA – Sample use cases that drive the OGSA platform components – OGSI– OGSA Basic Services – Security standards for grid computing.		

UNIT-IV	GRID COMPUTING TOOL KIT	10
Globus Toolkit –Versions – Architecture –GT Programming model –A sample grid service Implementation.		

UNIT-V	HIGH LEVEL GRID SERVICES	9
High level grid services – OGSI .NET middleware Solution Mobile OGSI.NET for Grid computing on Mobile devices. Case study: GridSIM: A Tool kit for Modeling and Simulating Grid Computing.		

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REFERENCES

1. Joshy Joseph & Craig Fellenstein, “Grid Computing”, Pearson/PHI PTR-2004. (Unit I to V)
2. Fran Berman, Geoffrey Fox, Anthony J.G. Hey, “Grid Computing: Making the Global Infrastructure a reality “, John Wiley and sons, 2003. (Unit I to V)
3. Daniel Minoli, “A networking approach to Grid Computing”, Wiley Interscience, 2004. . (Unit I to V)
4. Ian Foster & Carl Kesselman – “The Grid2 Blueprint for a New Computing Infrastructure”- Morgan Kaufmann, 2003. (Unit I to V)
5. Ahmar Abbas,”Grid Computing: A practical guide to Technology and Applications,” firewall Publisher, 2004. . (Unit I to IV)

16CS613	XML AND WEB SERVICES	L	T	P	C
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UNIT-I	XML TECHNOLOGY FAMILY	9
XML – benefits – Advantages of XML over HTML – EDI –Databases – XML based standards – DTD – XML Schemas – XML processing – DOM –SAX- presentation technologies – XSL – XFORMS – XHTML – voice XML – Transformation – XSLT – XLINK – XPOINTERS – XPATH –XQuery .		

UNIT-II	ARCHITECTING WEB SERVICES	9
Business motivations for web services – B2B – B2C- Technical motivations – limitations of CORBA and DCOM – Service oriented Architecture (SOA) – Architecting web services – Implementation view		

– web services technology stack – logical view – composition of web services – deployment view – from application server to peer to peer – process view – life in the runtime.

UNIT-III	WEB SERVICES BUILDING BLOCK	11
<p>Transport protocols for web services – messaging with web services – protocols – SOAP – describing web services – WSDL – Anatomy of WSDL – manipulating WSDL – web service policy – Discovering web services – UDDI – Anatomy of UDDI- Web service inspection – AdHoc Discovery – Securing web services.</p>		

UNIT-IV	IMPLEMENTING XML IN E-BUSINESS	10
<p>B2B - B2C Applications – Different types of B2B interaction – Components of e-business XML systems – ebXML – Rosetta Net Applied XML in vertical industry – Web services for mobile devices.</p>		

UNIT-V	XML AND CONTENT MANAGEMENT	9
<p>Semantic Web – Role of Meta data in web content – Resource Description Framework – RDF schema – Architecture of semantic web – content management workflow – XLANG – WSFL.</p>		

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REFERENCES
<ol style="list-style-type: none"> 1. Ron schmelzer et al, “XML and Web Services”, Pearson Education, 2002. (UNIT I, II, IV, V) 2. SandeepChatterjee and James Webber, “Developing Enterprise Web Services: An Architect’s Guide”, Prentice Hall, 2004.16 (Unit – III) 3. Frank P. Coyle, “XML, Web Services and the Data Revolution”, Pearson Education, 2002. (UNIT I) 4. Keith Ballinger, “.NET Web Services Architecture and Implementation”, Pearson Education, 2003. (UNIT II) 5. Henry Bequet and MeerajKunnumpurath, “Beginning Java Web Services”, Apress, 2004. (UNIT I) 6. Russ Basiura and Mike Batongbacal, “Professional ASP.NET Web Services”, Apress. 2001. (UNIT III)

16CS614	BIOINFORMATICS	L	T	P	C
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UNIT-I	INTRODUCTORY OF DATABASE AND NETWORK CONCEPTS	9
<p>The Central Dogma – The Killer Application – Parallel Universes – Watson’s Definition – Top Down Versus Bottom up – Information Flow – Convergence – – Data Management – Data Life Cycle – Database Technology – Interfaces – Implementation – Networks – Geographical Scope – Communication Models – Transmissions Technology – Protocols – Bandwidth – Topology – Hardware</p>		

UNIT-II	SEARCH ENGINES AND DATA VISUALIZATION	9
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The search process – Search Engine Technology – Searching and Information Theory –Computational methods – Search Engines and Knowledge Management – Data Visualization –Sequence visualization – structure visualization – user Interface – Animation Versus simulation– General Purpose Technologies.

UNIT-III	STATISTICS AND DATA MINING	9
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Statistical concepts – Microarrays – Imperfect Data – Basics - Randomness – Variability – Approximation – Interface Noise – Assumptions – Sampling and Distributions – Hypothesis Testing – Quantifying Randomness – Data Analysis – Tool selection statistics of Alignment – Clustering and Classification – Data Mining – Methods – Selection and Sampling – Preprocessing and Cleaning – Transformation and Reduction – Data Mining Methods – Evaluation – Visualization – Designing new queries – Infrastructure Pattern Recognition and Discovery – Machine Learning – Text Mining – Tools– Dot Matrix Analysis – Substitution Matrix – Dynamic Programming – Word Method – Bayesian Method – Multiple Sequence Alignment Tools.

UNIT-IV	PATTERN MATCHING	9
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Pattern Matching Fundamentals - Pair wise sequence alignment – Local versus global alignment – Multiple sequence alignment – Computational methods – Dot Matrix analysis – Substitution matrices – Dynamic Programming – Word methods – Bayesian methods – Multiple sequence alignment – Dynamic Programming - Progressive strategies – Iterative strategies – Tools – Nucleotide Pattern Matching – Polypeptide pattern matching – Utilities – Sequence Databases.

UNIT-V	MODELING AND SIMULATION	9
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Drug Discovery Fundamentals – components – process – Perspectives – Numeric considerations – Algorithms - – Hardware – Issues – Protein structure – AbInitio Methods – Heuristic methods – Systems - Biology – Tools – Collaboration and Communications – standards - Issues – Security – Intellectual property- Case Study.

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REFERENCES

1. Bryan Bergeron, “Bio Informatics Computing”, Second Edition, Pearson Education, 2003 (Unit I, II, III, IV and Unit IV).
2. Westhead.D.R, Parish.J.H,Twyman.R.M, Instant Notes in Bio Informatics, BIOS Scientific Publishers 2000(Unit II and Unit V).
3. C.Gibas & P.Jambeck, Developing Bioinformatics Skills, O’Reilly,1999.
4. T.K.Attwood and D.J. Perry Smith, “Introduction to Bio Informatics, Longman Essen, 1999.
5. Pierre Baldi, SorenBrunak, “Bio Informatics – The Machine Learning Approach”, 2nd

Edition, First East West Press, 2003.

6. Zoe Lacroix and Terence Critchlow, “Bioinformatics: Managing Scientific Data”, The Morgan Kaufmann Series in Multimedia Information and Systems, 1st Edition 2003.

16CS615	DIGITAL IMAGING	L	T	P	C
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UNIT-I	INTRODUCTION	9
<p>Origins of Digital Image Processing, examples, Fundamental Steps in Digital Image Processing, Components of an Image Processing System, Image analysis and computer vision, spatial feature extraction, transform features, Edge detection, gradient operators, compass operators, stochastic gradients, line and spot detection.</p>		

UNIT-II	DIGITAL IMAGE FUNDAMENTALS	9
<p>Elements of Visual Perception, Image Formation, Representing Digital Images, Zooming and Shrinking Digital Images, Image transforms-Fourier transforms,Walsh,Hadamard,Discrete cosine, Hotelling transforms. Some Basic Relationships between Pixels, Linear and Nonlinear Operations.</p>		

UNIT-III	IMAGE ENHANCEMENT IN THE FREQUENCY DOMAIN	11
<p>Background, Image Enhancement in the Frequency Domain, Introduction to the Fourier Transform and the Frequency, Domain, Smoothing Frequency-Domain Filters, Sharpening Frequency Domain Filters, Homomorphic Filtering.</p>		

UNIT-IV	IMAGE RESTORATION	10
<p>A Model of the Image degradation/Restoration process, Noise Models, Restoration in the Presence of Noise Only–Spatial Filtering, Periodic Noise Reduction by Frequency Domain Filtering, Linear, Position- Invariant Degradations , Estimating the Degradation Function, Inverse Filtering ,Minimum Mean Square Error (Wiener) Filtering.</p>		

UNIT-V	OBJECT RECOGNITION AND INTERPRETATION	9
<p>Patterns and pattern classes –Decision – Theoretic methods-Structural methods.</p>		

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REFERENCES

1. Rafael C Gonzalez and Richard E Woods "Digital Image Processing", Third Edition, PHI, 2009. (Unit I to V)
2. Sid Ahmed, "Image Processing", 5th Edition, McGraw Hill, New York, 2001.
3. Anil Jain, K, "Fundamentals of Digital Image Processing", Second Edition, Prentice Hall of India, New Delhi, 2002.
4. Scott E Umbaugh, "Computer Vision and Image Processing", Second Edition, PHI, 2005.

16CS616	ADHOC NETWORKS	L	T	P	C
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UNIT-I	AD-HOC MAC	9
<p>Introduction – Issues in Ad-Hoc Wireless Networks. MAC Protocols – Issues, Classifications of MAC protocols- Contention based Protocols, Contention based Protocols with Reservation Mechanisms , Multi channel MAC & Power control MAC protocol.</p>		

UNIT-II	AD-HOC NETWORK ROUTING	9
<p>Issues – Classifications of routing protocols – Table Driven Routing Protocols, on-demand Routing Protocols, Hybrid Routing Protocols, Hierarchical Routing Protocols and Power aware Routing Protocols.</p>		

UNIT-III	MULTICAST ROUTING AND TRANSPORT LAYER	9
<p>Multicast routing – Classifications, Tree based, Mesh based. Transport Layer Issues, Design Goals, TCP over Ad Hoc – Feedback based TCP with explicit link, TCP-BuS, Ad Hoc TCP, and Split TCP.</p>		

UNIT-IV	WSN –MAC	9
<p>Introduction – Sensor Network Architecture – Layered Architecture, Clustered Architecture, Data dissemination – Flooding, Gossiping, Rumor Routing, Sequential Assignment Routing, Directed Diffusion, Geographical hash table, Gathering. MAC Protocols – self-organizing, Hybrid TDMA/FDMA and CSMA based MAC.</p>		

UNIT-V	WSN ROUTING, LOCALIZATION & QOS	9
<p>Issues in WSN routing – OLSR, AODV. Localization – Indoor and Sensor Network Localization. QoS in WSN – coverage and Exposure.</p>		

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REFERENCES	
1.	C.Siva Ram Murthy and B.S.Manoj, “Ad Hoc Wireless Networks – Architectures and Protocols”, Pearson Education, 2004. (UNIT I to V)
2.	Feng Zhao and Leonidas Guibas, “Wireless Sensor Networks”, Morgan Kaufman Publishers,2004. (UNIT IV , V)
3.	C.K.Toh, “Ad Hoc Mobile Wireless Networks”, Pearson Education, 2002. (UNIT I,II,III)
4.	Thomas Krag and Sebastin Buettrich, “Wireless Mesh Networking”, O’Reilly Publishers, 2007. (UNIT III)

16CS617	AGENT BASED INTELLIGENT SYSTEMS	L	T	P	C
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UNIT-I	INTRODUCTION	9
Definitions - Foundations - History - Intelligent Agents-Problem Solving-Searching -Heuristics - Constraint Satisfaction Problems - Game playing.		

UNIT-II	KNOWLEDGE REPRESENTATION AND REASONING	9
Logical Agents-First order logic-First Order Inference-Unification-Chaining- Resolution Strategies-Knowledge Representation-Objects-Actions-Events-Logical Recovery.		

UNIT-III	PLANNING AGENTS	9
Planning Problem-State Space Search-Partial Order Planning-Graphs-Nondeterministic - Domains-Conditional Planning-Continuous Planning-Multi Agent Planning.		

UNIT-IV	AGENTS AND UNCERTAINTY	9
Acting under uncertainty – Probability Notation-Bayes Rule and use – Bayesian- Networks-Other Approaches-Time and Uncertainty-Temporal Models- Utility Theory -Decision Network – Complex Decisions.		

UNIT-V	HIGHER LEVEL AGENTS	9
Knowledge in Learning-Relevance Information-Statistical Learning Methods-Reinforcement Learning-Communication-Formal Grammar-Augmented Grammars-Future of AI.		

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REFERENCES	
1.	Stuart Russell and Peter Norvig, “Artificial Intelligence - A Modern Approach”, 2nd Edition,Prentice Hall, 2002 (Unit I to Unit V).

2. Nils.J.Nilsson, Principles of Artificial Intelligence, Narosa Publishing House (Unit II & Unit V).
3. J.Ferber, Multi-agent Systems-An Introduction to Distributed Artificial Intelligence, Addison Wesley, 1999(Unit I to Unit V).
4. Michael Wooldridge, “An Introduction to Multi Agent System”, John Wiley, 2002(Unit I to Unit II).
5. Patrick Henry Winston, Artificial Intelligence, III Edition, AW, 1999(Unit III to Unit V).

16CS618	SOFTWARE QUALITY ASSURANCE	L	T	P	C
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UNIT-I		9
Introduction to software quality - challenges – OBJECTIVESs – quality factors – components of SQA– Contract review – development and quality plans – SQA components in project life cycle – SQA defect removal policies – Reviews.		

UNIT-II		9
Basics of software testing – test generation from requirements –combinatorial designs - test selection, minimization and prioritization for regression testing – test adequacy, assessment and enhancement.		

UNIT-III		9
Testing strategies – white box and black box approach – integration tests – system and acceptance test – performance tests – regression tests - internationalization testing – adhoc testing.		

UNIT-IV	9
<p>Hierarchical models of software quality – software quality metrics –function points – Software product quality – software maintenance quality – effect of case tools – software quality infrastructure – procedures – Staff training and certifications – corrective and preventive actions.</p>	

UNIT-V	9
<p>Project progress control – costs – quality management standards – project process standards – Management and its role in SQA – SQA unit-Issues and Challenges in SQA.</p>	

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REFERENCES
<ol style="list-style-type: none"> 1. Daniel Galin, Software quality assurance – from theory to implementation , Pearson education, 2009.(Unit I , III, IV,V) 2. AdityaMathur, Foundations of software testing, Pearson Education, 2008. (Unit II) 3. Srinivasan Desikan and Gopaldaswamy Ramesh, Software testing – principles and practices, Pearson education, 2006. (UNIT II) 4. Alan C Gillies, “Software Quality Theory and Management”, Cengage Learning, Second edition, 2003. (UNIT I-V)

16CS619	DATA WAREHOUSING AND DATA MINING	L	T	P	C
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UNIT-I	9
<p>Data Warehousing and Business Analysis: - Data warehousing Components –Building a Data warehouse – Mapping the Data Warehouse to a Multiprocessor Architecture – DBMS Schemas for Decision Support – Data Extraction, Cleanup, and Transformation Tools –Metadata, Query reporting tools and Applications – Online Analytical Processing (OLAP) – OLAP and Multidimensional Data Analysis.</p>	

UNIT-II	9
<p>Data Mining: - Data Mining Functionalities – Data Preprocessing – Data Cleaning – Data Integration and Transformation – Data Reduction – Data Discretization and Concept Hierarchy Generation. Association Rule Mining: - Efficient and Scalable Frequent Item set Mining Methods – Mining Various Kinds of Association Rules – Association Mining to Correlation Analysis – Constraint-Based Association Mining.</p>	

UNIT-III	9
<p>Classification and Prediction: - Issues Regarding Classification and Prediction – Classification by Decision Tree Introduction – Bayesian Classification – Rule Based Classification – Classification by Back propagation – Support Vector Machines – Associative Classification – Lazy Learners – Other</p>	

Classification Methods – Prediction – Accuracy and Error Measures – Evaluating the Accuracy of a Classifier or Predictor – Ensemble Methods – Model Section.		
UNIT-IV		9
Cluster Analysis: - Types of Data in Cluster Analysis – A Categorization of Major Clustering Methods – Partitioning Methods – Hierarchical methods – Density-Based Methods – Grid-Based Methods – Model-Based Clustering Methods – Clustering High Dimensional Data – Clustering with constraints – Outlier Analysis and detection methods.		
UNIT-V		9
Mining Object, Spatial, Multimedia, Text and Web Data: Multidimensional Analysis and Descriptive Mining of Complex Data Objects – Spatial Data Mining – Multimedia Data Mining – Text Mining - Applications and trends in data mining- Data Mining tools: WEKA and Rapid Miner , Big Data.		

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REFERENCES
<ol style="list-style-type: none"> 1. Alex Berson and Stephen J. Smith “Data Warehousing, Data Mining & OLAP”, Tata McGraw – Hill Edition, Thirteenth Reprint 2008. (Unit I:Chapters 6 to 13) 2. Jiawei Han and Micheline Kamber “Data Mining Concepts and Techniques” Elsevier, Third Edition, print 2011. (Unit II: Chapters 1 to 7;Unit III: Chapters 8 & 9;Unit IV:Chapters 10 to 12; Unit V: Chapters 13) 3. Ian H. Witten, Eibe Frank, Mark A. Hall “Data Mining: Practical Machine Learning Tools and Techniques” Elsevier 2011. (Unit V: Chapters 10 to 17) 4. Pete Warden, “Big Data Glossary”,O’Reilly , 2011. (UNIT V) 5. M.Golfarelli, S.Rizzi,” Data warehouse Design: Modern Principles and Methodologies”, McGraw-Hill, 2009. (UNIT I) 6. Margaret H.Dunham,”Data Mining: Introductotry and Advanced Topics”, Prentice Hall, 2003. (UNIT II, III,V) 7. Pang-Ning Tna, Michael Stunbach and Vipin Kumar,” Introduction to Data mining” Pearson Addison Wesley, 2005. (UNIT II) 8. Viktor Mayer-Schonberger, Kenneth Cukier, “Big Data: A Revolution That Will Transform How We Live, Work, and Think”, 2013. (UNIT V)

16CS620	CYBER FORENSICS AND INFORMATION SECURITY	L	T	P	C
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UNIT-I	INTRODUCTION	9
Cyber Forensics- Cyber Forensic Investigation Process- Driving Force behind Implementing Corporate Cyber-Rounding out of the Field- Auditing vs Cyber Forensic Investigation- Cyber Forensics Tools and utilities- Concealment Techniques: Spoliation- Cryptography- Steganography- Cloaking Techniques- Data hiding on NTFS		

UNIT-II	STANDARD OPERATION PROCEDURES	9

Digital Forensic Laboratory Accreditation Standards- Laboratory Manager checklist- Digital Forensic Examiner Checklist- Technician or Assistant Checklist- Budget Checklist- Training and Testing Checklist- Evidence Control Checklist- Quality Assurance Checklist- Equipment checklist- Cyber Forensics Investigation and Internal Auditing- Internal Control Questionnaire- Cyber Crime.

UNIT-III	INFORMATION SECURITY	9
<p>History, what is Information Security, Critical Characteristics of Information, NSTISSC Security Model, Components of an Information System, Securing the Components, Balancing Security and Access, The SDLC, The Security SDLC.</p>		

UNIT-IV	SECURITY INVESTIGATION & SECURITY ANALYSIS	9
<p>Need for Security, Business Needs, Threats, Attacks, Legal, Ethical and Professional issues. Risk Management: Identifying and Assessing Risk, Assessing and Controlling Risk.</p>		

UNIT-V	PHYSICAL DESIGN & LOGICAL DESIGN	9
<p>Security Technology, IDS, Scanning and Analysis Tools, Cryptography, Access Control Devices, Physical Security, Security and Personnel. Blueprint for Security, Information Security Policy, Standards and Practices, ISO 17799/BS 7799, NIST Models, VISA International Security Model.</p>		

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REFERENCES
<ol style="list-style-type: none"> 1. Cyber Forensics-A Field Manual for Collecting, Examining, and Preserving Evidence of Computer Crimes by Albert J Marcella, Robert s. Greenfield -Auerbach Publications, 2nd Edition,2007. (Unit- I, II) 2. Michael E Whitman and Herbert J Mattord, “Principles of Information Security”, Cengage Learning, 4th edition, 2011. (Unit III, IV, V) 3. Albert Marcella Jr., Doug Menendez “Cyber Forensics: A Field Manual for Collecting, Examining, and Preserving” Auerbach Publications, 2nd edition, 2008. (Unit- I, II) 4. Albert J Marcella Jr., Frederic Guillossou “Cyber Forensics: From Data to Digital Evidence”, Wiley Corporate F & A, 2012. (Unit III) 5. Micki Krause, Harold F. Tipton, “Handbook of Information Security Management”, Vol 1-3 CRC Press LLC, 2004. (Unit III,IV,V) 6. Stuart McClure, Joel Scrambray, George Kurtz, “Hacking Exposed”, Tata McGraw-Hill, 2003. (UNIT V) 7. Matt Bishop, “Computer Security Art and Science”, Pearson/PHI, 2002. (UNIT I)

16CS703	MOBILE COMPUTING	L	T	P	C
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UNIT-I	WIRELESS COMMUNICATION FUNDAMENTALS	9
Introduction – Wireless transmission – Frequencies for radio transmission – Signals – Antennas – Signal Propagation – Multiplexing – Modulations – Spread spectrum – MAC – SDMA – FDMA – TDMA – CDMA – Cellular Wireless Networks.		

UNIT-II	TELECOMMUNICATION SYSTEMS	11
GSM – System Architecture – Protocols – Connection Establishment – Frequency Allocation – Routing – Handover – Security – GPRS.		

UNIT-III	WIRELESS NETWORKS AND NETWORK LAYER	9
Wireless LAN – IEEE 802.11 Standards – Architecture – Services – HIPERLAN – Ad Hoc Network – Blue Tooth. Mobile IP – Dynamic Host Configuration Protocol – Routing – DSDV – DSR – AODV – ZRP – DMR.		

UNIT-IV	TRANSPORT LAYER	9
TCP over Wireless Networks – Indirect TCP – Snooping TCP – Mobile TCP – Fast Retransmit / Fast Recovery – Transmission/Timeout Freezing – Selective Retransmission – Transaction Oriented TCP.		

UNIT-V	APPLICATION LAYER	7
WAP – WAP Architecture – WDP – WTLS – WTP – WSP – WML – WML Script – WAE – WTA – Traditional TCP – Classical TCP improvements – WAP, WAP 2.0. Mobile Operating Systems: Palm OS – Windows CE – Symbian OS – Linux for Mobile Devices – Case Study of M-MAIL.		

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REFERENCES
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16CS704	MULTIMEDIA SYSTEMS	L	T	P	C
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UNIT-I	INTRODUCTION AND QoS	9
Introduction – Multimedia Skills and Training – Basic Concepts and tools in multimedia – QOS Requirements and Constraints – Concepts – Resources – Establishment Phase – Run Time Phase – Management Architectures.		

UNIT-II	OPERATING SYSTEMS	9
Real-Time Processing – Scheduling – Inter process Communication – Memory and Management – Server Architecture – Disk Management.		

UNIT-III	FILE SYSTEMS AND NETWORKS	9
Traditional and Multimedia File Systems Sound – Images – Animation – Video – Caching Policy – Batching – Piggy backing – Ethernet – Gigabit Ethernet – Token Ring – 100VG LAN – Fiber Distributed Data Interface – ATM Networks – MAN – WAN.		

UNIT-IV	COMMUNICATION AND COMPRESSION	9
Transport Subsystem – Protocol Support for QOS – Transport of Multimedia – Computer Supported Cooperative Work – Architecture – Session Management – Mbone Applications. Evaluating a compression system – Redundancy and visibility – Video compression techniques – Standardization of an algorithm – The JPEG image compression standard – ITU-T Standards – MPEG motion video compression standard – EPEG Motion Video Compression Standard – DVI Technology.		

UNIT-V	SYNCHRONIZATION	9
Synchronization in Multimedia Systems – Presentation – Synchronization Types – Multimedia Synchronization Methods – Case Studies – MHEG – MODE – ACME. Advanced forms of interaction in Multimedia: Elements of immersive/non-immersive – Virtual Reality – Augmented Reality – Telepresence – Applications – Mobile technologies. Case study: Just-in-Time.		

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16CS705	NETWORK SECURITY	L	T	P	C
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UNIT-I	INTRODUCTION	9
Attacks – Services – Mechanisms – Conventional Encryption – Classical and Modern Techniques – Encryption Algorithms – Confidentiality.		

UNIT-II	PUBLIC KEY ENCRYPTION	9
Number Theory Concepts – RSA – MD5 – SHA Algorithms – Elliptic Curve Cryptography.		

UNIT-III	MESSAGE AUTHENTICATION	9
Message Authentication and Hash Functions and Algorithms – Digest Functions – Digital Signatures – Authentication Protocols.		

UNIT-IV	NETWORK SECURITY APPLICATIONS	9
Authentication Applications – Electronic Mail Security – IP Security – Web Security.		

UNIT-V	SYSTEM SECURITY	9
Intruders – Viruses – Worms – Firewalls Design Principles – Trusted Systems. Case Study: Network Security in Disaster recovery.		

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REFERENCES
<ol style="list-style-type: none"> 1. William Stallings, Cryptography & Network Security - Principles & Practice, Prentice Hall, Fifth Edition, 2006. (UNIT I, II, IV & V) 2. Kaufman, Perlman, Speciner, “Network Security, Private Communication in a Public World”, Pearson Education, Second Edition, 2006. (UNIT II, III & IV) 3. Bruce Schneier, “Applied Cryptography”, Second Edition, John Wiley & Sons, 2009.(UNIT I, II, IV & V) 4. Man Young Rhee, “Internet Security”, First Edition , John Wiley & Sons, 2003. (UNIT I - V) 5. 6. Charles Pfleeger & Shari Lawrence Pfleeger, “Security in Computing”, Pearson Education,

Fourth Edition, 2006.(UNIT II, III & IV)

7. Bragg, Rhodes-Ousley, Strassberg, “The Complete Reference, Network Security”, Sixth Edition , Tata McGraw Hill Publications, 2004. (UNIT I, II)
8. Kahate, “Cryptography and Network Security”, Eighth Edition, Tata McGraw Hill Publications, 2006. (UNIT II, III & IV)
9. Wenbo Mao, “Modern Cryptography, Theory & Practice”, First Edition, Pearson Education, 2008.(UNIT I - V)

16CS706	VISUALIZATION TECHNIQUES	L	T	P	C
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UNIT-I	VISUALIZATION	9
Introduction – Issues – Data Representation – Data Presentation – Interaction-Visualization Design.		

UNIT-II	FOUNDATIONS FOR DATA VISUALIZATION	9
Visualization stages – Experimental Semiotics based on Perception Gibson’s Affordance theory – A Model of Perceptual Processing – Types of Data.		

UNIT-III	COMPUTER VISUALIZATION	9
Non-Computer Visualization – Computer Visualization: Exploring Complex Information Spaces – Fisheye Views – Applications – Comprehensible Fisheye views – Fisheye views for 3D data – Non Linear Magnification – Comparing Visualization of Information Spaces – Abstraction in computer Graphics – Abstraction in user interfaces.		

UNIT-IV	MULTIDIMENSIONAL VISUALIZATION	9
One Dimension – Two Dimensions – Three Dimensions – Multiple Dimensions – Trees – Web Works – Data Mapping: Document Visualization – Workspaces – Applications and Implications.		

UNIT-V	CASE STUDIES	9
Small interactive calendars – Selecting one from many – Web browsing through a key hole – Communication analysis – Archival analysis.		

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REFERENCES
<ol style="list-style-type: none"> 1. Colin Ware, “Information Visualization Perception for Design” Morgan Kaufmann Publishers, Third Edition , 2013. (UNIT I,II,V) 2. Robert Spence “Information visualization – Design for interaction”, Pearson Education, Second Edition, 2007. (UNIT IV,V) 3. Thomas strothotte, “Computer Visualization – Graphics Abstraction & interactivity”, First Edition, Morgan Kaufmann Publishers, 2007. (UNIT III,V)

4. Stuart.K.Card, Jock.D.Mackinlay and Ben Shneiderman, “Readings in Information Visualization Using Vision to think”, First Edition , Morgan Kaufmann Publishers, 2008.

16CS707	SOFT COMPUTING	L	T	P	C
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UNIT-I	INTRODUCTION	9
Evolution of Computing – Introduction – Soft Computing Constituents – From Conventional AI to Computational Intelligence – Neuro-fuzzy and soft computing characteristics – Fuzzy Set Theory – Fuzzy sets – Fuzzy rules and Fuzzy Reasoning.		

UNIT-II	FUZZY LOGIC	9
Crisp set and Fuzzy set – Basic concepts of Fuzzy Sets – Operations on Fuzzy Sets – Fuzzy Relations – Membership Functions – Fuzzy Inference Systems – Fuzzy Expert Systems – Fuzzy Decision Making.		

UNIT-III	GENETIC ALGORITHMS	9
Introduction to Genetic Algorithms (GA) – Applications of GA in Machine Learning – Machine Learning Approach to Knowledge Acquisition.		

UNIT-IV	NEURAL NETWORKS	9
Basic Concepts of neural networks – Neural network architectures – Adaptive Networks – Feed forward Networks – Supervised Learning Neural Networks – Radial Basis Function Networks – Reinforcement Learning – Unsupervised Learning Neural Networks – Advances in Neural networks.		

UNIT-V	NEURO-FUZZY MODELING	9
Adaptive Neuro – Fuzzy Inference Systems – Coactive Neuro-Fuzzy Modeling – Classification and Regression Trees – Data Clustering Algorithms – Rule base Structure Identification – Neuro-Fuzzy Control – Case study : Accident Compensation.		

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REFERENCES
<ol style="list-style-type: none"> 1. Jyh-Shing Roger Jang, Chuen-Tsai Sun, Eiji Mizutani, “Neuro-Fuzzy and Soft Computing”, First Edition , Prentice-Hall of India, 2003. (UNIT I, III, IV & V) 2. S.Rajasekaran and G.A.Vijaylakshmi Pai , “Neural Networks Fuzzy Logic and Genetic Algorithms”, First edition , Prentice Hall of India,2003. (UNIT IV) 3. David E. Goldberg, “Genetic Algorithms in Search, Optimization and Machine Learning”, First Edition , Addison Wesley, 1997. (UNIT II) 4. Mitchell Melanie, “An Introduction to Genetic Algorithm”, First Edition , Prentice Hall, 1998. 5. S.N. Sivanandam, S. Sumathi and S. N. Deepa, “Introduction to Fuzzy Logic using MATLAB”, Springer, 2007. 6. James A. Freeman and David M. Skapura, “Neural Networks Algorithms, Applications, and Programming Techniques”, Pearson Education, 2003.

16CS708	PERFORMANCE EVALUATION OF COMPUTER SYSTEMS AND NETWORKS	L	T	P	C
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UNIT-I	REQUIREMENT ANALYSIS	9
Performance Characteristics – Requirement Analysis Concepts – Model for Network Analysis, Architecture and design – User, Device, Network Requirements – Process –Developing RMA – Delay – Capacity Requirements – Flow Analysis – Identifying and Developing Flows – Flow Models – Flow Prioritization – Specification.		

UNIT-II	STOCHASTIC MODEL	9
Random variables – Stochastic process – Link Delay components – Queuing Models – Little’s Theorem – Birth & Death process – Queuing Disciplines.		

UNIT-III	QUEUING SYSTEM	9
Markovian FIFO Queuing Systems – M/M/1 – M/M/a – M/M/∞ - M/G/1 – M/M/m/m and other Markov – Non-Markovian and self-similar models – Network of Queues – Burke’s Theorem – Jackson’s Theorem.		

UNIT-IV	SCHEDULING	9
Multi-User Uplinks/Downlinks – Capacity Regions – Opportunistic Scheduling for Stability and Max Throughput – Multi-Hop Routing – Mobile Networks – Throughput Optimality and Backpressure.		

UNIT-V	OPTIMALITY	9
Performance of Optimal Lyapunov Networking – Energy Optimality – Energy-Delay Tradeoffs – Virtual Cost Queues – Average Power Constraints – Flow Control with Infinite Demand – Auxiliary Variables – Flow Control with Finite Demand – General Utility Optimization – Case Study: Peer-to-peer architecture.		

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<p>REFERENCES</p> <ol style="list-style-type: none"> 1. James D.McCabe, Network Analysis, Architecture and Design, Second Edition, Elsevier, 2003. (UNIT I-V) 2. Bertsekas & Gallager, Data Networks, Second Edition, Pearson Education, 2003. 3. Sheldon Ross, “Introduction to Probability Models”, Eighth edition, Academic Press, New York, 2003. 4. D. Bertsekas, A. Medic and A. Ozdaglar, “Convex Analysis and Optimization”, Athena Scientific, Cambridge, Massachusetts, 2003. 5. Nader F.Mir Computer and Communication Networks, Second Edition , Pearson Education.2007. 6. Paul J.Fortier, Howard E.Michel, Computer Systems Performance Evaluation and Prediction, Elsevier, 2003.

16CS709	INFORMATION AND CYBER WARFARE	L	T	P	C
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UNIT-I	INTRODUCTION	9
Cyber Warfare – Tactical and operational reasons for cyber war – War fighting domains – Importance of cyber warfare – Threat scape – Cyber Doctrine – sample doctrine strategy around the world – Translating Traditional Military Doctrine – Guideline and Directives – Operations and Exercises.		

UNIT-II	CYBER WARRIORS	9
Characteristics of Cyber Warriors – Education and Training – Differences from Traditional Forces – Present Cyber Warfare Forces – Staffing for Cyber Warfare.		

UNIT-III	LOGICAL WEAPONS	9
Reconnaissance Tools – Scanning Tools – Access and Escalation Tools – Exhilaration Tools – Sustainment Tools – Assault Tools – Obfuscation Tools – Logical and physical realms-Infrastructure – supply chain.		

UNIT-IV	COMPUTER NETWORK EXPLOITATION AND ATTACK	9
Intelligence and Counter – Intelligence – Reconnaissance – Surveillance – Waging war in the Cyber Era – the Attack Process.		

UNIT-V	COMPUTER NETWORK DEFENSE	9
Protection Methods – Security awareness and training – Defending against Cyber Attacks – Individual actors – Cyber Terrorism – Cyber Crime – Ethics in Cyber Warfare – Future of cyber war – Case Study: Denial of Service		

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REFERENCES				
<ol style="list-style-type: none"> 1. Jeffrey Carr, “Inside Cyber Warfare: Mapping the Cyber Underworld”, Second Edition, O’Reilly Media Inc., 2012. (UNIT I-V) 2. Steve Winterfeld, Jason Andress, “The Basics of Cyber Warfare: Understanding the Fundamentals of Cyber Warfare”, First Edition, Elsevier Inc., 2013. 3. Albert Marcella, Jr., Doug Menendez, “Cyber Forensics: A Field Manual for Collecting, Examining, and Preserving” Auerbach Publications, second edition, 2008. 4. Micki Krause, Harold F. Tipton, CRC Press LLC, 2004. 5. Stuart McClure, Joel Scrambray, George Kurtz, “Hacking Exposed”, Seventh Edition, Tata McGraw-Hill, 2003. 6. Matt Bishop, “Computer Security Art and Science”, First Edition, Pearson/PHI, 2002. 				

16CS710	CYBER SECURITY	L	T	P	C
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UNIT-I	INTRODUCTION TO CYBER SECURITY	9
Threats to security – Internet Fraud – Infrastructure attacks – Malicious hackers – Foundations of Information Assurance – Defence-in-depth strategy – Overview of RFC 2196- Common Criteria Model – Password Management – Incident Handling – Information warfare and operations.		

UNIT-II	SECURITY FOUNDATIONS	9
Access control: Purpose – Entities – Concepts – Criteria – Models – Users – Administration models – Mechanisms. Physical and environmental security controls – Applications development security – Techniques to enforce application security – Security Architecture – Operations Security – Host based intrusion detection – Network based detection efforts.		

UNIT-III	FIREWALL & VPNs	9
Firewall environment – Perimeter concepts – Intruders – Static packet filtering – Edge, Routers and Packet filters – Stateful filtering and inspection – Circuit gateways. VPNs security essentials – Tunneling and protocols – Business benefits.		

UNIT-IV	TOOLS AND METHODS USED IN CYBERCRIME	9
Introduction – Proxy Servers and Anonymizers – Keyloggers and Spywares – Steganography – DoS and DDoS Attacks – SQL Injection – Buffer Overflow – Attacks on Wireless Networks – Introduction Phishing: Methods of Phishing – Phishing Techniques – Identity Theft – Countermeasures – Special Issues in Cyber security.		

UNIT-V	CYBERCRIMES AND CYBERSECURITY: LEGAL PERSPECTIVES	9
Introduction – Intellectual property rights – computer software copyrights – copyright in databases and electronic publishing – Law of confidence – patent laws – trademarks – product designs – International law. Cyber law – Cyber laws in India – IT Act 2000 – data subject rights – ethical issues in computer security – Case study: Biometrics and forensics for new security solutions.		

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REFERENCES
<ol style="list-style-type: none"> 1. John W.Rittinghouse, William M.Hancock “Cyber security Operations Handbook”, Elsevier, 2005 (UNIT I-III) 2. Chuck Easttom “Computer Security fundamentals”, Second Edition, Pearson Education, 2012. (UNIT IV & V) 3. Nina Godbole, Sunit Belapur, “Cyber Security Understanding Cyber Crimes, Computer Forensics and Legal Perspectives”, First Edition, Wiley India Publications, April, 2011. 4. Albert J Marcella, Robert s. Greenfield, “Cyber Forensics - A Field Manual for Collecting, Examining, and Preserving Evidence of Computer Crimes”, Second Edition, CRC Press , 2007. 5. Pavan Duggal, “Cyber law: The Indian Perspective”, Third Edition, Saakshar Law Publications, Delhi, 2009. 6. S.R. Sharma, “Indian Legislation on Cyber Crime”, Second Edition, Anmol Publications, 2008.

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16CS712	DISTRIBUTED COMPUTING	L	T	P	C
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UNIT-I	COMMUNICATION IN DISTRIBUTED SYSTEMS	9
Introduction – Goals – Various Paradigms in Distributed Applications – Remote Procedure Call – Remote Object Invocation – Message-Oriented Communication – Stream Oriented Communication – Group Communication.		

UNIT-II	DISTRIBUTED OPERATING SYSTEMS	9
Message-Oriented middleware, Issues in Distributed Operating System – System Models-Processor Allocation – Threads in Distributed Systems – Clock Synchronization – Election Algorithms – Distributed Mutual Exclusion – Distributed Transactions – Distributed Deadlock – Agreement Protocols.		

UNIT-III	DISTRIBUTED RESOURCE MANAGEMENT	9
Introduction to traditional web services: XML – SOAP and the WS standards – Distributed Shared Memory – Data Centric Consistency Models – Client Centric Consistency Models –Distribution Protocols – Distributed File Systems – Sun NFS-CODA File System.		

UNIT-IV	FAULT TOLERANCE	9
Introduction to Fault Tolerance – Distributed Commit Protocols – Byzantine Fault Tolerance – Distributed Commit – Recovery – Synchronous Network Algorithms.		

UNIT-V	CASE STUDY IN DISTRIBUTED SYSTEMS	9
Introduction to CHORUS – CORBA – Distributed COM – GLOBE – JINI– Comparison of AMOEBA – MACH and CHORUS – Distributed Snapshot Global State Collection – Case study of Ethernet anomalies in a Distributed Computing Environment.		

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REFERENCES
<ol style="list-style-type: none"> 1. Andrew.S.Tanenbaum, Maarten Van Steen, “Distributed Systems Principles and Paradigms”, Second Edition, Pearson Education, 2007. (UNIT I, III, IV & V) 2. George Coulouris, Jean Dollimore, Tim Kindberg, “Distributed Systems Concepts and Design”, Fifth Edition, Addition Wesley, 2011. (UNIT II) 3. Hagit Attiya and Jennifer Welch, “Distributed Computing: Fundamentals, Simulations and Advanced Topics”, Second Edition, Wiley Publications, 2004. 4. Mukesh Singhal, “Advanced Concepts in Operating Systems”, First Edition , McGraw Hill Series in Computer Science, 1994. 5. M.L.Liu, “Distributed Computing Principles and Applications”, Second Edition, Addison

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7. Nancy A.Lynch, “Distributed Algorithms”, First Edition, Morgan Kaufmann Publishers, 2007.

16CS713	INFORMATION SECURITY	L	T	P	C
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UNIT-I	INTRODUCTION	9
An Overview of Computer Security – Access Control Matrix – Policy – Security policies – Confidentiality policies – Integrity policies and Hybrid policies – Standards and Practices.		

UNIT-II	KEY MANAGEMENT	9
Cryptography – Key management: Session and Interchange keys – Key exchange and Generation – Cryptographic Key Infrastructure – Storing and Revoking Keys – Digital Signatures – Cipher Technique – Authentication.		

UNIT-III	SYSTEM DESIGN	9
Systems: Design Principles – Representing Identity – Access Control Mechanisms – Information Flow.		

UNIT-IV	ATTACKS AND DETECTION	9
Types of Attacks – Malicious Logic – Vulnerability Analysis and Intrusion Detection – Firewall Technologies.		

UNIT-V	NETWORK SECURITY	9
Introduction – Network Organization – Availability – Network Flooding and Anticipating Attacks – System Security: Policy – Networks – Users – Authentication – Processes – Files – Retrospective – User Security – Program Security – Research Issues –Case Study : Information Security Culture.		

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REFERENCES
<ol style="list-style-type: none"> 1. Matt Bishop, “Computer Security art and science”, Second Edition, Pearson Education, 2010. (UNIT I-V) 2. Mark Merkow, James Breithaupt, “Information Security: Principles and Practices” First Edition, Pearson Education, 2009. 3. Whitman, “Principles of Information Security”, Second Edition, Pearson Education, 2007. 4. William Stallings, “Cryptography and Network Security: Principles and Practices”, Third Edition, Pearson Education, 2005. 5. Charles P.Pfleeger and Shari Lawrence Pfleeger, “Security in Computing”, Third Edition, 2006.

16SW605	SOFTWARE PROJECT MANAGEMENT	L	T	P	C
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UNIT-I		9
<p>Introduction to Software Project Management, An Overview of Project Planning: Select Project, Identifying Project scope and Objectives, infrastructure, project products a characteristics. Estimate efforts, Identify activity risks, and Allocate resources.</p>		

UNIT-II		9
<p>Project Evaluation: Strategic Assessment, Technical Assessment, cost-benefit analysis, cash flow forecasting, cost-benefit evaluation techniques, Risk Evaluation. Selection of Appropriate Project approach: Choosing technologies, choice of process models, structured methods.</p>		

UNIT-III		9
<p>Software Effort Estimation: Problems with over and under estimations, Basis of software estimation, Software estimation techniques, expert Judgment, Estimating by analogy. Activity Planning: Project schedules, projects and activities, sequencing and scheduling activities, networks planning models, formulating a network model.</p>		

UNIT-IV		9
<p>Risk Management: Nature of Risk, Managing Risk, Risk Identification and Analysis, Reducing the Risk. Resource Allocation: Scheduling resources, Critical Paths, Cost scheduling, Monitoring and Control: Creating Framework, cost monitoring, prioritizing monitoring.</p>		

UNIT-V		9
<p>Introduction – Understanding Behavior – Organizational Behavior: A Background – Selecting The Right Person For The Job – Instruction In The Best Methods – Motivation – The Oldman – Hackman Job Characteristics Model – Working In Groups – Becoming A Team –Decision Making – Leadership – Organizational Structures – Stress –Health And Safety.</p>		

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<p>REFERENCES</p> <ol style="list-style-type: none"> 1. Bob Hughes and Mike Cotterell,"Software Project Management", Fourth Edition, 2006.(Unit I- V). 2. Pressman, Roger,"Software Engineering", A Practitioner's approach.McGrawHill, 2009. (UNIT I,II,III IV) 3. Ramesh, Gopaldaswamy, "Managing Global Projects", Tata McGraw Hill, 2005. (UNIT V) 4. Humphrey, Watts,"Managing the Software Process ", Addison Wesley, 2006. (UNIT I, II) 5. Wheelwright and Clark,"Revolutionising product development", The Free Press, 2000.
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(UNIT V)

16IT621	COMPONENT BASED TECHNOLOGY	L	T	P	C
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UNIT-I	INTRODUCTION	9
Software Components – objects – fundamental properties of Component technology –modules – interfaces – callbacks – directory services – component architecture –components and middleware.		

UNIT-II	JAVA COMPONENT TECHNOLOGIES	9
Threads – Java Beans – Events and connections – properties – introspection – JAR files– reflection – object serialization – Enterprise Java Beans – Distributed Object models –RMI and RMI-IIOP – Case Study: Distributed Coordination-Based System – JINI.		

UNIT-III	CORBA TECHNOLOGIES	9
Java and CORBA – Interface Definition language – Object Request Broker – system object model – portable object adapter – CORBA services – CORBA component model – containers – application server – model driven architecture.		

UNIT-IV	COM AND .NET TECHNOLOGIES	9
COM – Distributed COM – object reuse – interfaces and versioning – dispatch interfaces – connectable objects – OLE containers and servers – Active X controls – .NET components - assemblies – appdomains – contexts – reflection – remoting.		

UNIT-V	COMPONENT FRAMEWORKS AND DEVELOPMENT	9
Connectors – contexts – EJB containers – CLR contexts and channels – Black Box component framework – directory objects – cross-development environment – component-oriented programming – Component design and implementation tools – testing tools - assembly tools.		

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REFERENCES
<ol style="list-style-type: none">1. Clemens Szyperski, “Component Software: Beyond Object-Oriented Programming”, Pearson Education publishers, 2003. (Unit I,II,IV & V)2. Ed Roman, “Enterprise Java Beans3.1”, Sixth Edition , Wiley , 2010. (Unit III)3. Mowbray, “Inside CORBA”, Pearson Education, New Delhi, 2003. (Unit III)4. Freeze, “Visual Basic Development Guide for COM & COM+”, BPB Publication,New Delhi, 2001. (Unit IV)5. Hortsamann, Cornell, “CORE JAVA Vol-II” Sun Press, New Delhi, 2002 (Unit II).

16IT611	CLOUD COMPUTING	L	T	P	C
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UNIT-I	UNDERSTANDING CLOUD COMPUTING	9
<p>Cloud Computing – History of Cloud Computing – Cloud Architecture – Cloud Storage – Advantages of Cloud Computing – Disadvantages of Cloud Computing – Companies in the Cloud Today – Cloud Services.</p>		

UNIT-II	DEVELOPING CLOUD SERVICES	9
<p>Web-Based Application – Pros and Cons of Cloud Service Development – Types of Cloud Service Development – Software as a Service – Platform as a Service – Web Services – OnDemand Computing – Discovering Cloud Services Development Services and Tools – Amazon Ec2 – Google App Engine – IBM Clouds.</p>		

UNIT-III	CLOUD COMPUTING FOR EVERYONE	9
<p>Centralizing Email Communications – Collaborating on Schedules – Collaborating on To-Do Lists – Collaborating Contact Lists – Cloud Computing for the Community – Collaborating on Group Projects and Events – Cloud Computing for the Corporation- SAS Security.</p>		

UNIT-IV	USING CLOUD SERVICES	9
<p>Collaborating on Calendars, Schedules and Task Management – Exploring Online Scheduling Applications – Exploring Online Planning and Task Management – Collaborating on Event Management – Collaborating on Contact Management – Collaborating on Project Management – Collaborating on Word Processing - Collaborating on Databases – Storing and Sharing Files.</p>		

UNIT-V	OTHER WAYS TO COLLABORATE ONLINE	9
<p>Collaborating via Web-Based Communication Tools – Evaluating Web Mail Services – Evaluating Web Conference Tools – Collaborating via Social Networks and Groupware – Collaborating via Blogs and Wikis.</p>		

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<p>REFERENCES</p> <ol style="list-style-type: none"> 1. Michael Miller, Cloud Computing: Web-Based Applications, Collaborate Online, Que Publishing, August 2008 (Unit I, II,III,IV,V) 2. John W.Rittinghouse, James F.Ransome,” Cloud Computing Implementation, Management and Security” CRC Press Taylor & Francis group, 2012. (Unit III, IV) 3. Borko Furht, Armando Escalante,“Hand book of cloud computing(Hard Cover)”, Springer New York, 2010 (Unit II,III,IV) 4. Haley Beard, “Cloud Computing Best Practices”, Emereo Pty Limited,2 Edition, August 2009.
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16CS720	BIG DATA ANALYTICS	L	T	P	C
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UNIT-I	INTRODUCTION TO BIG DATA	9
<p>Analytics – Nuances of big data – Value – Issues – Case for Big data – Big data options Team challenge – Big data sources – Acquisition – Nuts and Bolts of Big data. Features of Big Data - Security, Compliance, auditing and protection - Evolution of Big data – Best Practices for Big data Analytics - Big data characteristics - Volume, Veracity, Velocity, Variety – Data Appliance and Integration tools – Greenplum – Informatica.</p>		
UNIT-II	DATA ANALYSIS	9
<p>Evolution of analytic scalability – Convergence – parallel processing systems – Cloud computing – grid computing – map reduce – enterprise analytic sand box – analytic data sets – Analytic methods – analytic tools – Cognos – Microstrategy - Pentaho. Analysis approaches – Statistical significance – business approaches – Analytic innovation – Traditional approaches – Iterative</p>		
UNIT-III	STREAM COMPUTING	9
<p>Introduction to Streams Concepts – Stream data model and architecture - Stream Computing, Sampling data in a stream – Filtering streams – Counting distinct elements in a stream – Estimating moments – Counting oneness in a window – Decaying window - Realtime Analytics Platform(RTAP) applications IBM Infosphere – Big data at rest – Infosphere streams – Data stage – Statistical analysis – Intelligent scheduler – Infosphere Streams.</p>		
UNIT-IV	PREDICTIVE ANALYTICS AND VISUALIZATION	9
<p>Predictive Analytics – Supervised – Unsupervised learning – Neural networks – Kohonen models – Normal – Deviations from normal patterns – Normal behaviours – Expert options – Variable entry - Mining Frequent itemsets - Market based model – Apriori Algorithm – Handling large data sets in Main memory – Limited Pass algorithm – Counting frequent itemsets in a stream – Clustering Techniques – Hierarchical – K- Means – Clustering high dimensional data Visualizations - Visual data analysis techniques, interaction techniques; Systems and applications:</p>		
UNIT-V	FRAMEWORKS AND APPLICATIONS	9
<p>IBM for Big Data – Map Reduce Framework - Hadoop – Hive – Sharding – NoSQL Databases - S3 - Hadoop Distributed file systems – Hbase – Impala – Analyzing big data with twitter – Big data for ECommerce – Big data for blogs.</p>		

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<ol style="list-style-type: none"> 1. Frank J Ohlhorst, “Big Data Analytics: Turning Big Data into Big Money”, Wiley and SAS Business Series, 2012. 2. Colleen Mccue, “Data Mining and Predictive Analysis: Intelligence Gathering and Crime Analysis”, Elsevier, 2007. 3. Michael Berthold, David J. Hand, Intelligent Data Analysis, Springer, 2007. 4. Anand Rajaraman and Jeffrey David Ullman, Mining of Massive Datasets, Cambridge University Press, 2012. 5. Bill Franks, “Taming the Big Data Tidal Wave: Finding Opportunities in Huge Data Streams

with Advanced Analytics”, Wiley and SAS Business Series, 2012.

6. Paul Zikopoulos, Chris Eaton, Paul Zikopoulos, “Understanding Big Data: Analytics for Enterprise Class Hadoop and Streaming Data”, McGraw Hill, 2011.
7. Paul Zikopoulos, Dirk deRoos, Krishnan Parasuraman, Thomas Deutsch , James Giles, David
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11. Jiawei Han, Micheline Kamber “Data Mining Concepts and Techniques”, Second Edition, Elsevier, Reprinted 2008.

OPEN ELECTIVE

16CS901	SATELLITE COMMUNICATION	L	T	P	C
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UNIT-I	COMMUNICATION SATELLITE: ORBIT AND DESCRIPTIONS	9
Orbital Period and velocity, effects of orbital inclination, coverage angle and slant range, Placement of satellite in a geo-stationary orbit. Satellite description - Communication subsystem, telemetry, command and ranging subsystem, attitude control and electrical power.		

UNIT-II	EARTH STATION	9
Earth Station Antenna types, gain and radiated power, Pointing loss, noise temperature, G/T ratio, High power amplifiers, redundancy configurations, carrier and power combining. Low noise amplifiers - redundancy configuration and non-linearity Up converter and down converter - conversion process, Hopping and redundancy configurations.		

UNIT-III	SATELLITE LINK ANALYSIS AND DESIGN	9
Basic link analysis - Interference analysis, carrier to noise plus interference ratio, Terrestrial interface, cross polarization interference, adjustment channel and inter symbol interference. Rain induced attenuation, path diversity, up link power control, rain induced cross polarization interference. Satellite link design - link without frequency reuse, link design with frequency reuse.		

UNIT-IV	MULTIPLE ACCESS TECHNIQUES	9
Frequency Division Multiple Access (FDMA), Time Division Multiple Access (TDMA) and Code Division Multiple Access (CDMA). Demand assignment multiple access (DADMA) - SC PC & SPADE. Performance comparison of various multiple access schemes.		

UNIT-V	APPLICATION AND SERVICES	9
Satellite packet communications - ALOHA, slotted ALOHA and packet reservation. very small aperture terminal (VSAT) networks - technologies and configurations. Mobile satellite (MSAT) networks - operating environment, low orbital satellites. Iridium.		

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REFERENCES
1. RODY.D, Satellite Communication, PHI, 1989. 2. Bhargava et al, Digital Communication by Satellite. PHI, 1992. 3. T.Ha, Satellite Communication, McGraw Hill, 1996.

16CS902	KNOWLEDGE MANAGEMENT	L	T	P	C
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UNIT-I		9
Introduction: Definition, evolution, need, drivers, scope, approaches in Organizations, strategies in organizations, components and functions, understanding knowledge; Learning organization: five components of learning organization, knowledge sources, and documentation.		

UNIT-II		9
Essentials of Knowledge Management; knowledge creation process, knowledge management techniques, systems and tools.		

UNIT-III		9
Organizational knowledge management; architecture and implementation strategies, building the knowledge corporation and implementing knowledge management in organization.		

UNIT-IV		9
Knowledge management system life cycle, managing knowledge workers, knowledge audit, and knowledge management practices in organizations, few case studies.		

UNIT-V		9
Futuristic KM: Knowledge Engineering, Theory of Computation, Data Structure.		

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REFERENCES
1. Knowledge Management – a resource book – A Thothathri Raman, Excel, 2004. 2. Knowledge Management- Elias M. Awad Hasan M. Ghazri, Pearson Education 3. The KM Toolkit – Orchestrating IT, Strategy & Knowledge Platforms, Amrit Tiwana, Pearson, PHI, II Edn. 4. The Fifth Discipline Field Book – Strategies & Tools For Building A learning Organization – PeterSenge etal. Nicholas Brealey 1994 5. Knowledge Management – Sudhir Warier, Vikas publications. 6. Leading with Knowledge, Madanmohan Rao, Tata Mc-Graw Hill.

16CS903	MANAGING INNOVATION AND ENTREPRENEURSHIP	L	T	P	C
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UNIT-I		9
Introduction to Entrepreneurship: Evolution of entrepreneurship from economic theory Managerial and entrepreneurial competencies. Entrepreneurial growth and development.		

UNIT-II		9
Creativity and Innovation: Creativity and Innovation: Concepts Shifting Composition of the Economy Purposeful Innovation & the 7 Sources of Innovative Opportunity The Innovation Process. Innovative Strategies : Strategies that aim at introducing an innovation. Innovation & entrepreneurship: Can they work together? Planning - incompatible with Innovation & entrepreneurship.		

UNIT-III		9
Entrepreneurial Motivation: Need for continuous learning & relearning Acquiring Technological Innovation Entrepreneurial motivation (nAch story) Achievement Motivation in Real life.. Case Study.		

UNIT-IV		9
International Entrepreneurship: Concepts and Nature of International Entrepreneurship. The changing International environment. Ethics and International Entrepreneurship. Strategic Issues in International Entrepreneurship.		

UNIT-V		9
Problem Identification and Problem Solving: Problem Identification. Problem solving. Innovation and Diversification.		

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REFERENCES
<ol style="list-style-type: none"> 1. Martin, M.J., 1994, "Managing Innovation and Entrepreneurship in Technology based Firm", John Wiley. 2. Ettl, J.E., 2000, "Managing Technology Innovation", John Wiley & Sons. 3. Drucker, P. F. (2000), "The Discipline of Innovation," Harvard Business Review, May, (originally published 4. 1985, May-June, 63(3), 67-72.1 5. Christensen, C. M. and Raynor, M. E. (2003), The Innovator's Solution: Creating and Sustaining Successful Growth, Boston, MA: Harvard Business School Press. 6. Drucker, P. F. (1985), Innovation and Entrepreneurship, New York: Harper. 7. Harvard Business Review on Innovation (Collection of articles), Harvard Business School Press (2001).

16CS904	FUZZY SYSTEMS	L	T	P	C
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UNIT-I	INTRODUCTION	9
<p>Uncertainty and imprecision-statistics and random processes-uncertainty in information- fuzzy sets and membership-classical sets-operations on classical sets –properties of classical sets-fuzzy set operations-properties of fuzzy sets.</p>		

UNIT-II	FUZZY RELATIONS AND MEMBERSHIP FUNCTIONS	9
<p>Brief about Crisp relations- fuzzy relations –fuzzy tolerance and equivalence relations-value assignments-membership functions-features-standard forms and boundaries-fuzzification – membership value assignments –inference-rank ordering-neural networks-genetic algorithms –inductive reasoning.</p>		

UNIT-III	FUZZIFICATION AND FUZZY ARITHMETIC	9
<p>Lambda-cuts for fuzzy sets-lambda cutsfor fuzzy relations- defuzzification methods-Extension principle-functions of fuzzy sets- fuzzy transform-fuzzy numbers-approximate methods of extension-vertex method-DSW algorithm.</p>		

UNIT-IV	FUZZY LOGIC AND FUZZY RULE BASED SYSTEMS	9
<p>Fuzzy logic –approximate reasoning-fuzzy tautologies-contradictions-equivalence-and logical proofs-other forms of implication operation and composition operation-linguistic hedges-rule based systems-fuzzy associative memories-multiobjective decision making –fuzzy bayesian decision method.</p>		

UNIT-V	APPLICATIONS	9
<p>Single sample identification-multifeature pattern recognition-image processing-simple fuzzy logic controllers-General fuzzy logic controllers-Industrial applications-Fuzzy tool box in Matlab.</p>		

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REFERENCES
<ol style="list-style-type: none"> 1. Timothy J.Ross, "Fuzzy Logic with Engineering applications", McGraw Hill Inc. 2. George j.Klir & Tina A.Folger, "Fuzzy sets Uncertainty & Information", PHI,2001. 3. J.S.R.Jang C.T.Sun,E.Mizutani,"Neuro fuzzy and Soft Computing", PHI,2003.

16CS906	ENTERPRISE RESOURCE PLANNING & MANAGEMENT	L	T	P	C
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UNIT-I	INTRODUCTION	9
<p>Introduction to ERP, Its Evolution, Its Growth, Its Advantages, Its need, Integrated Management</p>		

Information, Business Modelling, Integrated Data Model. ERP and Related Technologies: BPR, MIS, DSS,EIS, Data Warehousing, Data Mining, OLTP, Supply Chain Management.

UNIT-II	MANUFACTURING PERSPECTIVE AND VARIOUS MODULES	9
MRP, BOM, Closed loop MRP, MRP-11, DRP,JIT and Kanban, CAD/CAM, PDM, Data Management, Benefits of PDM, MTO and MTS , ATO , ERP Modules – Finance, Plant Maintenance, Quality Management, Materials Management.		

UNIT-III	BENEFITS AND MARKET	9
Reduction of load-time-On-time shipment, Reduction in Cycle Time, Improved Resource Utilization, Better Customer Satisfaction, Improved Supplier Performance, Increased Flexibility, Reduced Quality Costs, Market, SAP AG, Baan, Oracle, Peoplesoft, JD Edwards, SSA, QAD.		

UNIT-IV	IMPLEMENTATION	9
ERP Implementation Lifecycle – Pro-evaluation Screening, Package Evaluation, Project Planning Phase, Gap-Analysis, Re-engineering, Configuration, Implementation Team Training, Testing, Going, Live, End-User Training. Faster Implementation Methodologies, Business Models and BAPIs. Convergence on Windows NT, Application Platforms, New Business Segment and Features.		

UNIT-V	INTEGRATION & DYNAMICS OF OPERATION MANAGEMENT	9
Integration: ERP Integration - Component based ERP - Extended ERP - ERP and Return on Investments. Dynamics of Operation Management: An information system for operation management – Establishing Performance measures Developing policies and actions - Teaching & - Integrated production and order management - Case Studies.		

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REFERENCES
<ol style="list-style-type: none"> Alexin Leon, “Enterprise Resource Planning”, Tata McGraw Hill, 1999. Erin Callaway, “ERP - Integrating applications and Business processes across the Enterprise”, 1999. Avraham Shtub, “ERP - The Dynamics of operations Management”, Kluwer Academic publishers, 2003.

16GE701	ENGINEERING EDUCATIONAL MANAGEMENT	L	T	P	C
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UNIT-I	EDUCATIONAL MANAGEMENT	9
Meaning, Definitions, Principles of good management, Functions of Management - POSDCORB (Planning, Organization, Staffing, Direction, Co ordination, Reporting, Budgeting Theories of		

Management, General principles of Educational management- Leadership in Educational Organizations: meaning and nature, nature of Leadership, - Styles of Leadership and development of Leadership, Types of Educational Management - Centralized and decentralized.

UNIT-II	INSTITUTIONAL PLANNING	9
<p>Institutional Planning – meaning, nature and characteristics, Types of Institutional Planning, Steps in Institutional Planning, Importance of Institutional Planning, Educational planning – School Time table and co-curricular activities, Planning,-Six elements- Objectives, Policies ,Procedures, Programmes, Budgets and Strategies, Long term and Short term Perspectives, Academic : curricular and co curricular activities – Time table –assignment of work to teachers.</p>		

UNIT-III	MODERN TECHNIQUES IN EDUCATIONAL MANAGEMENT AND THEIR APPLICATIONS IN EDUCATIONAL ORGANIZATION & STRUCTURE	9
<p>Programme Evaluation and Review Technique (PERT), Planning Programming Budgeting System (PPBS), - Management by Objectives (MBO) - Total Quality Management (TQM) Quality in Education- Input –Process –Output Analysis – Concept of Total Quality Management, Supervision and Inspection – functions - Accreditation and certification, Educational structure of education in the Central Government- role of MHRD, Central –State relation in Education in India Statutory/Autonomous Organization.</p>		

UNIT-IV	MANAGING CHANGE IN EDUCATION	9
<p>Need for change- Population growth, technological & scientific development educational growth & diffusion of knowledge, Planning for change: concept and objectives of planned change process, Approaches to change: Need oriented, people oriented, and task oriented, The stages of Change Process: awareness, interest, conviction, evaluation, trial, acceptance and adoption (Rogers, Ryan and Gross.)</p>		

UNIT-V	MANAGEMENT OF EDUCATIONAL SKILLS	9
<p>Meeting skills -f Why of meetings, Delegating responsibility,f Prepare for and organize meetings,f Chairing and minting,f Following-up,f interaction, Time Management -Planning,f Dealing with stress,f Systems for time Management, Presentation Skills -Planning,f Delivery use of media ,f External representation of organization, Team Building -fWorking under pressure ,f Working with people,f Negotiating ,f Team processes (storm, norm, etc.), Taking responsibility -f Handling conflict, Transactional Mode. (The course would be transacted through participatory approach including group discussion; self study, seminar/presentations by students etc)., Controlling- Management skills: Conceptual skills, Human skills, Technical skills, : Duties and responsibilities- Leadership-Meaning – styles -Management Grid – Morale – Organizational commitments, Academic freedom –Professional development, Classroom management –Management of school building – equipments –library –records and registers – hostel.</p>		

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REFERENCES
1. Aggarwal, J. C. (2008). Development and planning of modern education. UP: Vikas Publishing

House Pvt Ltd.

2. Aggarwal, J. C. (2008). Theory & Principles of Education. UP: Vikas Publishing House Pvt Ltd.
3. Lal, R. B., &Palod, S. (2008). Educational Thought and Practice. Meerut: R.Lall Books Depot.
4. Richard, L.D. (2000). Management.NewYork : The Dryden Press.
5. Prakash, S. (1999).Educational planning. New Delhi: Gyan Publishing House.