



# **SNS COLLEGE OF TECHNOLOGY**



**(An Autonomous Institution)**

**Approved by AICTE, Recognized by UGC & Affiliated to Anna  
University Accredited by NBA-AICTE, NAAC-UGC with 'A++'  
Grade**

Saravanampatti , Coimbatore -641035

**CURRICULUM AND SYLLABUS  
REGULATION 2023  
CHOICE BASED CREDIT SYSTEM**

**DEPARTMENT OF COMPUTER SCIENCE AND  
ENGINEERING**

**M.E – COMPUTER SCIENCE AND ENGINEERING**

## VISION

To evolve as a center of excellence in the field of Computer Science and Engineering for developing technically competent professionals with ethical values to serve the needs of industry and society.

## MISSION

- To equip the graduates with advanced problem solving and reflective thinking skills by offering contemporary educational experience.
- To enrich the technical knowledge of the students in diversified areas of Computer Science and Engineering by adopting student-centric & activity- based learning and outcome-based education with state of the art equipment.
- To imbibe new knowledge with technical transformations by collaborating with Industry, Government bodies, R&D Organizations and Foreign Universities.
- To produce high-quality Computer Science and Engineering professionals adapt to change the technological environment with all-round leadership qualities, team spirit and entrepreneur skill set.

## PROGRAMME EDUCATIONAL OBJECTIVES (PEOs)

**PEO1:** Graduates will apply the principles of mathematics, computer science and scientific investigation to solve real world problems in Information Technology Industry and for pursuing higher education.

**PEO2:** Graduates will apply current industry accepted computing practices with new emerging technologies and modern engineering tools to analyze, design, implement and verify high quality computer-based solutions for real world problems.

**PEO3:** Graduates will be leaders and managers by effectively communicating at both technical and interpersonal levels.

**PEO4:** Graduates will apply appropriate knowledge of societal impacts of computing technologies ethically in the course of career related activities for the profession, nation and society.

**PEO5:** Graduates will be successfully employed for pursuing a lifelong learning by applying basic principles and practices of computing to make software projects successfully which meet the objectives of the research.

## PROGRAMME OUTCOMES (POs)

**PO1: Engineering Knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

**PO2: Problem Analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

**PO3: Design/Development of Solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

**PO4: Conduct Investigations of Complex Problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

**PO5: Modern Tool Usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.

**PO6: The Engineer and Society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

**PO7: Environment and Sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

**PO8: Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

**PO9: Individual and Team Work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

**PO10: Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

**PO11: Project Management and Finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

**PO12: Life-Long Learning:** Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

## **PROGRAMME SPECIFIC OUTCOMES (PSOs)**

**PSO1: Rudiments of Computer Science:** Ability to understand, analyze the theoretical foundations of Computer science and apply problem solving methodologies, programming techniques and tools to solve the real-world issues.

**PSO2: Software fundamentals and its development:** Ability to understand an apparent picture of software development life cycle and acquire the programming skills under various platforms for successful implementation of automation systems.

**PSO3: Research Ability and Entrepreneurship:** Ability to use the Knowledge in multiple domains to identify the research gap in the real-world environment, hence this provides an obvious line of attack to innovate new ideas and helps to become a successful entrepreneur.



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 COIMBATORE-35  
 DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING  
R 2023 – CURRICULUM  
M.E – COMPUTER SCIENCE & ENGINEERING



S No	Subject Area	Credits Per Semester				Total credits
		I	II	III	IV	
1	FC	4				4
2	PC	14	11			25
3	PE	3	6	6		15
4	EEC	3	2	8	12	25
5	OE			3		3
<b>Total Credits</b>		24	19	17	12	<b>72</b>

SEMESTER I										
S No.	Course Code	Course	L	T	P	J	Contact hrs/week	Credit	Int/Ext	Category
<b>Theory Courses</b>										
1.	23MAT601	Operations Research	3	1	0	0	4	4	40/60	FC
2.	23CST601	Advanced Data Structures and Algorithm	3	0	0	0	3	3	40/60	PC
3.	23CST602	Research Methodology	3	0	0	0	3	3	40/60	PC
4.	23CST603	Computer Networks and Management	3	0	0	0	3	3	40/60	PC
5.	23CST604	Computer Architecture	3	0	0	0	3	3	40/60	PC
6.	23CSEXX	Professional Elective – I	3	0	0	0	3	3	40/60	PE
7.	23GEB601	Design Thinking	1	0	0	4	5	3	50/50	EEC
8.		Audit Course-I	2	0	0	0	2	-	-	
<b>Practical Courses</b>										
9.	23CSP601	Data Structures Laboratory	0	0	2	0	2	1	60/40	PC
10.	23CSP602	Networking Laboratory	0	0	2	0	2	1	60/40	PC

	<b>Total</b>	<b>20</b>	<b>1</b>	<b>4</b>	<b>4</b>	<b>29</b>	<b>24</b>		
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### SEMESTER II

S No.	Course Code	Course	L	T	P	J	Contact hrs/week	Credit	Int/Ext	Category
<b>Theory Courses</b>										
1.	23CST605	Advanced Operating Systems	3	0	0	0	3	3	40/60	PC
2.	23CST606	Web Technology	3	0	0	0	3	3	40/60	PC
3.	23CST607	Internet of Things	3	0	0	0	3	3	40/60	PC
4.		Professional Elective-II	3	0	0	0	3	3	40/60	PE
5.		Professional Elective-III	3	0	0	0	3	3	40/60	PE
6.		Audit Course-II	2	0	0	0	2	0	-	EEC
7.		Career course-I	2	0	0	0	2	2	40/60	EEC
<b>Practical Courses</b>										
8.	23CSP603	Operating System Laboratory	0	0	2	0	2	1	60/40	PC
9.	23CSP604	Web Technology Lab	0	0	2	0	2	1	60/40	PC
		<b>Total</b>	<b>19</b>	<b>0</b>	<b>4</b>	<b>0</b>	<b>23</b>	<b>19</b>		

### SEMESTER III

S No.	Course Code	Course	L	T	P	J	Contact hrs/week	Credit	Int/Ext	Category
<b>Theory Courses</b>										
1.		Professional Elective-IV	3	0	0	0	3	3	40/60	PE
2.		Professional Elective-V	3	0	0	0	3	3	40/60	PE
3.		Open Elective	3	0	0	0	3	3	40/60	OE
4.		Career Course II	2	0	0	0	2	2	40/60	EEC

Practical Courses										
5.	23CSP701	Project –I	0	0	0	12	12	6	60/40	EEC
<b>Total</b>			<b>11</b>	<b>0</b>	<b>0</b>	<b>12</b>	<b>23</b>	<b>17</b>		
SEMESTER IV										
S No.	Course Code	Course	L	T	P	J	Contact hrs/week	Credit	Int/Ext	Category
Practical Courses										
1.	23CSP702	Project –II	0	0	0	24	24	12	60/40	EEC
<b>Total</b>			<b>0</b>	<b>0</b>	<b>0</b>	<b>24</b>	<b>24</b>	<b>12</b>		

**TOTAL CREDITS: 72**

**\*\*Courses from the curriculum of other PG programmes**

**PROFESSIONAL CORE (PC)**

S.NO.	COURSE CODE	COURSE TITLE	CONTACT PERIODS	L	T	P	J	C
1.	23CST601	Advanced Data Structures and Algorithm	3	3	0	0	0	3
2.	23CST602	Research Methodology	3	3	0	0	0	3
3.	23CST603	Computer Networks and Management	3	3	0	0	0	3
4.	23CST604	Computer Architecture	3	3	0	0	0	3
5.	23CST605	Advanced Operating Systems	3	3	0	0	0	3
6.	23CST606	Web Technology	4	3	0	0	0	3
7.	23CST607	Internet of Things	3	3	0	0	0	3
8.	23CSP601	Data Structures Laboratory	4	0	0	4	0	2
9.	23CSP602	Networking Laboratory	4	0	0	4	0	2
10.	23CSP603	Operating System Laboratory	4	0	0	4	0	2
11.	23CSP604	Web Technology Laboratory	4	0	0	4	0	2

**PROFESSIONAL ELECTIVES– (PE)**

S.NO.	COURSE CODE	COURSE TITLE	CONTACT PERIODS	L	T	P	J	C
<b>PROFESSIONAL ELECTIVE I</b>								
1.	23CSE601	Grid Computing	3	3	0	0	0	3
2.	23CSE602	XML and Web Services	3	3	0	0	0	3
3.	23CSE603	Bioinformatics	3	3	0	0	0	3
4.	23CSE604	Digital Imaging	3	3	0	0	0	3
5.	23CSE605	Adhoc Networks	3	3	0	0	0	3
6.	23CSE606	Agent Based Intelligent Systems	3	3	0	0	0	3
<b>PROFESSIONAL ELECTIVE II</b>								
7.	23CSE607	Software Quality Assurance	3	3	0	0	0	3
8.	23CSE608	Data Warehousing and Data Mining	3	3	0	0	0	3
9.	23CSE609	Cyber Forensics and Information Security	3	3	0	0	0	3
10.	23CSE610	Mobile Computing	3	3	0	0	0	3
11.	23CSE611	Multimedia Systems	3	3	0	0	0	3
12.	23CSE612	Network Security	3	3	0	0	0	3
<b>PROFESSIONAL ELECTIVE III</b>								
13.	23CSE613	Visualization Techniques	3	3	0	0	0	3
14.	23CSE614	Soft Computing	3	3	0	0	0	3
15.	23CSE615	Performance Evaluation of Computer Systems and Networks	3	3	0	0	0	3

16.	23CSE616	Information and Cyber Warfare	3	3	0	0	0	3
17.	23CSE617	Distributed Computing	3	3	0	0	0	3
18.	23CSE618	Information Security	3	3	0	0	0	3
<b>PROFESSIONAL ELECTIVE IV</b>								
19.	23CSE619	Software Project Management	3	3	0	0	0	3
20.	23CSE701	Component Based Technology	3	3	0	0	0	3
21.	23CSE702	Cloud Computing	3	3	0	0	0	3
22.	23CSE703	Big Data Analytics	3	3	0	0	0	3
23.	23CSE704	Social Network Mining Analysis	3	3	0	0	0	3
24.	23CSE705	Robotic Process Automation	3	3	0	0	0	3
<b>PROFESSIONAL ELECTIVE V</b>								
25.	23CSE706	Human Computer Interaction	3	3	0	0	0	3
26.	23CSE707	Knowledge Engineering	3	3	0	0	0	3
27.	23CSE708	Machine Learning	3	3	0	0	0	3
28.	23CSE709	Deep Learning	3	3	0	0	0	3
29.	23CSE710	Virtual Systems	3	3	0	0	0	3

**EMPLOYABILITY ENHANCEMENT COURSES (EEC)**

S.NO.	COURSE CODE	COURSE TITLE	CONTACT PERIODS	L	T	P	J	C
1.	23GEB601	Design Thinking	5	1	0	0	4	3
2.	23CSP701	Project – I	12	0	0	0	12	6
3.	23CSP702	Project - II	24	0	0	0	24	12
4.		Audit Course I	1	0	0	0	2	-
5.		Audit Course II	2	0	0	0	2	-
6.		Career Course I	2	0	0	0	0	2
7.		Career Course II	2	0	0	0	0	2

**OPEN ELECTIVE OFFERED TO OTHER PROGRAMMES**

S.NO.	COURSE CODE	COURSE TITLE	CONTACT PERIODS	L	T	P	J	C
1.	23CSO701	Knowledge Management	3	3	0	0	0	3
2.	23CSO702	Managing Innovation and Entrepreneurship	3	3	0	0	0	3
3.	23CSO703	Fundamentals of Machine Learning	3	3	0	0	0	3
4.	23CSO704	Enterprise Resource Planning & Management	3	3	0	0	0	3
5.	23CSO705	Introduction to Augmented Reality / Virtual Reality	3	3	0	0	0	3

**CAREER COURSE**

S.NO.	COURSE CODE	COURSE TITLE	CONTACT PERIODS	L	T	P	J	C
1.	23GET601	Professional Development	2	2	0	0	0	2
2.	23GET602	Quality Assurance in Engineering Education	2	2	0	0	0	2
3.	23GET603	Holistic Education	2	2	0	0	0	2

**AUDIT COURSE**

S.NO.	COURSE CODE	COURSE TITLE	CONTACT PERIODS	L	T	P	J	C
1.	23GEA601	English for Research Paper Writing	2	2	0	0	0	0
2.	23GEA602	Disaster Management	2	2	0	0	0	0
3.	23GEA603	Value Education	2	2	0	0	0	0
4.	23GEA604	Constitution of India	2	2	0	0	0	0
5.	23GEA605	Pedagogy Studies	2	2	0	0	0	0
6.	23GEA606	Sustainable Career Development	2	2	0	0	0	0





COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO 1	PSO 2	PSO 3		
CO1	3	3		2	1				2		1	2					
CO2	3	3		2	1				2		1	2					
CO3	3	3		2					2		1	2					
CO4	3	3		2					2		1	2					
CO5	3	3		2					2		1	2					
<b>23CST601</b>													<b>L</b>	<b>T</b>	<b>P</b>	<b>J</b>	<b>C</b>
<b>ADVANCED DATA STRUCTURES AND ALGORITHMS</b>													<b>3</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>3</b>
<b>UNIT I</b>		<b>ROLE OF ALGORITHMS IN COMPUTING &amp; COMPLEXITY ANALYSIS</b>											<b>9</b>				
Algorithms – Algorithms as a Technology -Time and Space complexity of algorithms- Asymptotic analysis-Average and worst-case analysis-Asymptotic notation-Importance of efficient algorithms- Program performance measurement - Recurrences: The Substitution Method – The Recursion-Tree Method- Data structures and algorithms.																	
<b>UNIT II</b>		<b>HIERARCHICAL DATA STRUCTURES</b>											<b>9</b>				
Binary Search Trees: Basics – Querying a Binary search tree – Insertion and Deletion- Red Black trees: Properties of Red-Black Trees – Rotations – Insertion – Deletion -B-Trees: Definition of B - trees – Basic operations on B-Trees – Deleting a key from a B-Tree- Heap – Heap Implementation – Disjoint Sets - Fibonacci Heaps: structure – Mergeable-heap operations- Decreasing a key and deleting a node-Bounding the maximum degree.																	
<b>UNIT III</b>		<b>GRAPHS</b>											<b>9</b>				
Elementary Graph Algorithms: Representations of Graphs – Breadth-First Search – Depth-First Search – Topological Sort – Strongly Connected Components- Minimum Spanning Trees: Growing a Minimum Spanning Tree – Kruskal and Prim- Single-Source Shortest Paths: The Bellman-Ford algorithm – Single-Source Shortest paths in Directed Acyclic Graphs – Dijkstra’s Algorithm; Dynamic Programming - All-Pairs Shortest Paths: Shortest Paths and Matrix Multiplication – The Floyd-Warshall Algorithm																	
<b>UNIT IV</b>		<b>ALGORITHM DESIGN TECHNIQUES</b>											<b>9</b>				
Dynamic Programming: Matrix-Chain Multiplication – Elements of Dynamic Programming – Longest Common Subsequence- Greedy Algorithms: – Elements of the Greedy Strategy- An Activity-Selection Problem - Huffman Coding.																	
<b>UNIT V</b>		<b>NP COMPLETE AND NP HARD</b>											<b>9</b>				
NP-Completeness: Polynomial Time – Polynomial-Time Verification – NP- Completeness and Reducibility – NP-Completeness Proofs – NP-Complete Problems.																	
													<b>L : 45</b>	<b>T: 0</b>	<b>P: 0</b>	<b>J: 0</b>	<b>Total: 45 PERIODS</b>
<b>REFERENCES</b>																	
1	S.Sridhar,” Design and Analysis of Algorithms”, Oxford University Press, 1st Edition, 2014.																
2	Adam Drozdex, “Data Structures and algorithms in C++”, Cengage Learning, 4th Edition, 2013.																
3	T.H. Cormen, C.E.Leiserson, R.L. Rivest and C.Stein, "Introduction to Algorithms", Prentice Hall of India, 3rd Edition, 2012.																
4	Mark Allen Weiss, “Data Structures and Algorithms in C++”, Pearson Education, 3rd Edition, 2009.																



**UNIT I RESEARCH METHODOLOGY 9**

Meaning of research problem, Sources of research problem, Criteria Characteristics of a good research problem, Errors in selecting a research problem, Scope and objectives of research problem.

**UNIT II DATA COLLECTION METHODS 9**

Data collection methods- Primary data – observation method, personal interview, telephonic interview, mail survey, questionnaire design. Secondary data- internal sources of data, external sources of data.

**UNIT III SAMPLING METHODS 9**

Scales – measurement, Types of scale – Thurstone’s Case V scale model, Osgood’s Semantic differential scale, Likert scale, Q- sort scale. Sampling methods- Probability sampling methods –simple random sampling with replacement, simple random sampling without replacement, stratified sampling, cluster sampling. Non-probability sampling method – convenience sampling, judgment sampling, quota sampling.

**UNIT IV HYPOTHESES TESTING 8**

Testing of hypotheses concerning means -One mean and difference between two means –One tailed and Two tailed tests, concerning variance – One Tailed Chi-square test.

**UNIT V REPORT WRITING & IPR 10**

Report writing- Types of Report, Guidelines to review report, typing instructions, Oral Presentation-Layout of research Paper-Ethical issues related to publishing, Plagiarism and Self Plagiarism. Patenting under PCT. Patent Rights: Scope of Patent Rights. Licensing and transfer of technology. New developments in IPR; IPR of Biological Systems, Computer Software etc. Traditional knowledge Case Studies, IPR and IITs.

**L : 45 T: 0 P: 0 J: 0 Total: 45 PERIODS**

**REFERENCES**

- 1 Kothari.C.R.,”Research Methodology -Methods and Techniques”, New Age Publications,New Delhi,2009.
- 2 Panneerselvam, R., Research Methodology, Prentice-Hall of India, New Delhi, 2004.
- 3 Wadehra, B.L. 2000. Law relating to patents, trademarks, copyright designs and geographical indications.
- 4 Carlos, C.M., 2000. Intellectual property rights, the WTO and developing countries: the TRIPS agreement and policy options. Zed Books, New York
- 5 Donald Cooper, Pamela Schindler, Business Research Methods, Mc-Graw Hill Higher Education, 12th Edition,2010

**COURSE OUTCOMES**

At the end of the course student should be able to:

- CO1** Identify the framework for selecting the research problem
- CO2** Make use of different data collection method to formulate the raw data for research.
- CO3** Examine the different probability sampling methods for analysis
- CO4** Analyze major challenges for IoT
- CO5** Combine the writing ethics and IPR components for develop the research

<b>23CST603</b>	<b>COMPUTER NETWORKS AND MANAGEMENT</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>J</b>	<b>C</b>
		<b>3</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>3</b>
<b>UNIT I</b>	<b>HIGH SPEED NETWORKS</b>					<b>9</b>

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 P: 0 J: 0 Total: 45 PERIODS**

**REFERENCES**

- 1 William Stallings, "High Speed Networks And Internet", Pearson Education, Second Edition, 2002.
- 2 Warland&PravinVaraiya, "High Performance Communication Networks", Jean Harcourt Asia Pvt. Ltd., II Edition, 2001.
- 3 IrvanPepelnjk, Jim Guichard and Jeff Aparcar, "MPLS and VPN architecture", Cisco Press, Volume 1 and 2, 2003.
- 4 High-speed networks: TCP/IP and ATM design principles by William Stallings, Ist Edition, Prentice hall, 1998.
- 5 High Performance TCP/IP Networking: Concepts, issues and solutions: By Mahoob Hassan Raj and Jain PHI Publisher, 1998.

**COURSE OUTCOMES**

At the end of the course student should be able to:

- CO1** Describe and interpret the basics of high speed networking technologies.
- CO2** Apply the networking concepts to optimize and troubleshoot high-speed network.
- CO3** Know techniques involved to support real-time traffic and congestion control.
- CO4** Demonstrate the Congestion control techniques in real time ATM Network traffic.
- CO5** Provided with different levels of quality of service (qos) to different applications.

**CO/PO Mapping****(S/M/W indicates strength of correlation)3-Strong, 2-Medium, 1-Weak**

COs	Programme Outcomes (POs) / Programme Specific Outcomes(PSOs)														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO 1	PSO 2	PSO 3
CO1	3	2	1	2	2	2						2	3		
CO2	2		2						2				2		1
CO3		3	2		2			2	2	2		1	2	2	2
CO4		2			2						2	1	1	2	
CO5	2	2			3	2	3				3				3

<b>23CST604</b>	<b>COMPUTER ARCHITECTURE</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>J</b>	<b>C</b>
		<b>3</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>3</b>
<b>UNIT I</b>	<b>FUNDAMENTALS OF COMPUTER DESIGN AND PIPELINING</b>					<b>9</b>
	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.					
<b>UNIT II</b>	<b>INSTRUCTION LEVEL PARALLELISM WITH DYNAMIC APPROACHES</b>					<b>9</b>
	Concepts – Dynamic Scheduling – Dynamic hardware prediction – Multiple issue – Hardware based speculation – Limitations of ILP – Case studies.					
<b>UNIT III</b>	<b>INSTRUCTION LEVEL PARALLELISM WITH SOFTWARE APPROACHES</b>					<b>9</b>
	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.					
<b>UNIT IV</b>	<b>MULTIPROCESSORS AND MULTICORE ARCHITECTURES</b>					<b>9</b>
	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.					
<b>UNIT V</b>	<b>MEMORY AND I/O</b>					<b>9</b>
	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.					
		<b>L : 45</b>	<b>T : 0</b>	<b>P : 0</b>	<b>J : 0</b>	<b>Total: 45 PERIODS</b>

#### REFERENCES

- 1 William Stallings, “High Speed Networks And Internet”, Pearson Education, Second Edition, 2002.
- 2 Warland&PravinVaraiya, “High Performance Communication Networks”, Jean Harcourt Asia Pvt. Ltd., II Edition, 2001.
- 3 IrvanPepelnjk, Jim Guichard and Jeff Apar, “MPLS and VPN architecture”, Cisco Press, Volume 1 and 2, 2003.
- 4 High-speed networks: TCP/IP and ATM design principles by William Stallings, Ist Edition, Prentice hall, 1998.
- 5 High Performance TCP/IP Networking: Concepts, issues and solutions: By Mahoob Hassan Raj and Jain PHI Publisher, 1998.

#### COURSE OUTCOMES

At the end of the course student should be able to:

- CO1** Learn the fundamental organization of computer system
- CO2** Learn various techniques of instruction-level parallelism, including superscalar execution, branch prediction, and speculation, in design of high-performance processors.
- CO3** Learn various techniques of instruction-level parallelism with software approaches.
- CO4** Learn from additional topics in computer architecture, such as multi-core processors, thread-level parallelism, and warehouse computing
- CO5** Understand memory hierarchy design, memory access time formula, performance improvement techniques, and trade-offs.

**CO/PO Mapping****(S/M/W indicates strength of correlation)3-Strong, 2-Medium, 1-Weak**

COs	Programme Outcomes (POs) / Programme Specific Outcomes(PSOs)														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO 1	PSO 2	PSO 3
CO1	3				2				1			3	2		1
CO2	2						3					1	2		1
CO3	2	1			3							3	2		1
CO4	2	1	1									1	2		1
CO5	2	1	1		1							1	2		1

**23GEB601**

**DESIGN THINKING**

**L T P J C**

(Common to M.E CSE, ST, PSE, VLSI, TE)

**1 0 0 4 3**

**UNIT I**

**INTRODUCTION TO DESIGN THINKING**

**3+12**

An brief insight to Design Thinking and Innovation- People Centered Design & Evoking the ‘Right Problem’- Purpose of Design Thinking- Design Thinking Framework

**UNITII**

**PROCESS IN DESIGN THINKING (EMPATHY, DEFINE**

**3+12**

Design Thinking Process – Empathy – Uncovering and Investigating Community Concerns - Define : Examine and Reflect on the problem - Reconsider and arrive at the right problem to solve - Research with the users and Context - Question Framing and Conducting Research - User Stories and Design Strategy

**UNIT III**

**CONCEPTING AND BUILDING (IDEA, CREATE)**

**3+12**

Generating Ideas-Identifying top three ideas-Bundling the Ideas and create an concepts-Stories and Scenarios to that concepts-Rapid Prototyping

**UNIT IV**

**TESTING, REFINING AND PITCHING THE IDEAS**

**3+12**

Importance of Testing with People-Testing our Design with People-Conducting the usability Test-Record Results, Enhance, Retest and Redefine Results-Creating a Pitch for our design.

**UNIT V**

**VALUE PROPOSITION DESIGN**

**3+12**

Introduction-Key Partners- Key Activities- Key Resources- Value Propositions- Customer Relationship- Customer Segments- Channels- Cost Structure- Revenue Streams-Case study.

**L :15 T: 0 P: 0 J: 60 T:75 PERIODS**

**REFERENCES**

- 1 Idris Mootee, Design Thinking for Strategic Innovation - What They Can't Teach You at Business or Design School, 1<sup>st</sup> Edition, 2017, Wiley
- 2 Yves Pigneur, Greg Bernarda, Alan Smith, Trish Papadacos Alex Osterwalder, Value Proposition Design: How to Create Products and Services Customers Want, 2015, Wiley
- 3 Brown, Tim, and Barry Katz. Change by Design: How Design Thinking Transforms Organizations and Inspires Innovation, 2009, Harper Business.

**COURSE OUTCOMES :**

At the end of the course students should be able to

- CO1** Able to empathize with a broad group of stakeholders to understand their needs through the ethnographic method.
- CO2** Able to define and re-define innovation challenges by asking the right questions, and not necessarily focusing on the right answers.
- CO3** Able to develop many creative ideas through structured brainstorming sessions
- CO4** Able to develop rapid prototypes to bring their ideas into reality as quickly as possible, and obtain feedback.
- CO5** Able develop visual literacy and articulacy to explain design decisions



**23CSP601****DATA STRUCTURES LABORATORY****L T P J C****0 0 2 0 1****LIST OF EXPERIMENTS**

1. Min Heap & Max Heap
2. Red Black Trees
3. Fibonacci Heap
4. AVL Tree
5. B-Tree
6. Prims & Kurskals Algorithm
7. Floyds Algorithm
8. Job Sequencing with Deadlines
9. 0/1 Knapsack using Dynamic Programming
10. Graph coloring using backtracking

**L :0 T: 0 P: 30 J: 0****Total:30 PERIODS****COURSE OUTCOMES**

At the end of the course student should be able to:

- CO1** Demonstrate an ability to identify, real time oriented problems and
- CO2** Design and implement basic data structures.
- CO3** Improve their problem solving skills and algorithm design skills.
- CO4** Have proficiency in Design and develop Optimization Algorithms
- CO5** Design and develop Dynamic programming algorithms.

**CO/PO Mapping****(S/M/W indicates strength of correlation)3-Strong, 2-Medium, 1-Weak**

COs	Programme Outcomes (POs) / Programme Specific Outcomes(PSOs)														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO 1	PSO 2	PSO 3
CO1	3		2	2	1	1						1	3	2	1
CO2	2	2	3	1						1		1		1	
CO3	2		2	2	1	1					1		2	1	1
CO4	3	2	3	2	2	1	2	2	1			2	2	2	3
CO5	3	2	3	1						1		1	3	1	

**LIST OF EXPERIMENTS**

1. Implementation of Socket Programming
  - 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.

**L :0   T: 0   P: 30   J: 0   Total:30 PERIODS**

**COURSE OUTCOMES**

At the end of the course student should be able to:

- CO1** Demonstrate socket based programs for basic applications
- CO2** Develop and simulate the various Internet applications programs
- CO3** Implement routing and congestion control programs
- CO4** Implement various Internet services
- CO5** Gain knowledge on Network Simulators and their application

**CO/PO Mapping**

**(S/M/W indicates strength of correlation)3-Strong, 2-Medium, 1-Weak**

COs	Programme Outcomes (POs) / Programme Specific Outcomes (PSOs)														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO 1	PSO 2	PSO 3
CO1	3	2	1	2	2	2						2	3		2
CO2	2		2		2				2				2		2
CO3		3	2		2				2	2		1	2	2	2
CO4		2			2						2	1	1	2	
CO5	2	2			3	2					3				3

**UNIT I INTRODUCTION****9**

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.

**UNIT II DISTRIBUTED OPERATING SYSTEMS****9**

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.

**UNIT III DISTRIBUTED RESOURCE MANAGEMENT****9**

Distributed File systems – Architecture – Mechanisms – Design Issues – Distributed Shared Memory – 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 P: 0 J: 0 Total: 45 PERIODS****REFERENCES**

- 1 MukeshSinghal and N. G. Shivaratri, “Advanced Concepts in Operating Systems”, McGraw-Hill, 2000.
- 2 Abraham Silberschatz, Peter B. Galvin, G. Gagne, “Operating System Concepts”,Sixth Edition, Addison Wesley Publishing Co., 2003.
- 3 Andrew S. Tanenbaum, “Modern Operating Systems”, Second Edition, Addison Wesley, 2001.

**COURSE OUTCOMES**

At the end of the course student should be able to:

- CO1** Understand and solve problems involving process control, mutual exclusion, deadlock and synchronization.
- CO2** Summarize the major security issues associated with distributed systems along with the range of techniques available for increasing system security.
- CO3** Best in distributed resource management algorithms and mechanisms.
- CO4** Understand and implement the fault tolerance and recovery mechanisms.
- CO5** Summarize the major security issues associated with multiprocessor systems and distributed database systems.

**CO/PO Mapping****(S/M/W indicates strength of correlation)3-Strong, 2-Medium, 1-Weak**

COs	Programme Outcomes (POs) / Programme Specific Outcomes(PSOs)														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO 1	PSO 2	PSO 3
CO1	3	2		2								2	3	2	
CO2	2	2	3	2	1				1				3	2	
CO3		3		3		2					3	2		2	2
CO4	1	3		2		2					2	1	3		
CO5		2	2	2		3			2		2	1		2	2

**UNIT I INTRODUCTION****9**

Web essentials – clients – servers - communication – markup languages – XHTML – simple XHTML pages style sheets – CSS.

**UNIT II CLIENT SIDE PROGRAMMING****9**

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**

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**

Representing Web data – data base connectivity – JDBC – Dynamic Web pages – XML – DTD – XML schema – DOM -XSLT– SAX – Xquery.

**UNIT V WEB APPLICATIONS****9**

Building Web applications –WSDL-RDF- cookies – sessions – open source environment – PHP – MYSQL – case studies.

**L : 45 T: 0 P: 0 J: 0 Total: 45 PERIODS****REFERENCES**

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

**COURSE OUTCOMES**

At the end of the course student should be able to:

- CO1** Design web sites utilizing multiple tools and techniques.
- CO2** Demonstrate technical skills required of web developers through the use of Java, Client and server side scripting languages such as javascript, PERL and PHP.
- CO3** Understand basics in technologies and protocols used on internet and how to effectively use internet technologies.
- CO4** Understand basics in technologies and protocols used on internet and how to effectively use internet technologies.
- CO5** Design well formed JSP and Servlet documents.

**CO/PO Mapping****(S/M/W indicates strength of correlation)3-Strong, 2-Medium, 1-Weak**

COs	Programme Outcomes (POs) / Programme Specific Outcomes(PSOs)														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO 1	PSO 2	PSO 3
CO1	2		2		2				1		1	2	1		3
CO2														2	
CO3	2	2	3		1				2		2			3	
CO4	2	1	2										2	3	2
CO5	2		3						3	2	2				

**UNIT I INTRODUCTION**

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**

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**

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**

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**

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 P: 0 J: 0 Total: 45 PERIODS**

**REFERENCES**

- 1 The Internet of Things in the Cloud: A Middleware Perspective - Honbo Zhou – CRC Press – 2012.
- 2 Architecting the Internet of Things - Dieter Uckelmann; Mark Harrison; Florian Michahelles - (Eds.) – Springer – 2011.
- 3 Networks, Crowds, and Markets: Reasoning About a Highly Connected World - David Easley and Jon Kleinberg, Cambridge University Press – 2010.
- 4 The Internet of Things: Applications to the Smart Grid and Building Automation by – Olivier Hersent, Omar Elloumi and David Boswarthick - Wiley -2012.
- 5 Olivier Hersent, David Boswarthick, Omar Elloumi , “The Internet of Things – Key applications and Protocols”, Wiley, 2012.

**COURSE OUTCOMES**

At the end of the course student should be able to:

- CO1** Identify and design the new models for market strategic interaction
- CO2** Design business intelligence and information security for WoB
- CO3** Analyze various protocols for IoT
- CO4** Design a middleware for IoT
- CO5** Analyze and design different models for network dynamics

**CO/PO Mapping****(S/M/W indicates strength of correlation)3-Strong, 2-Medium, 1-Weak**

COs	Programme Outcomes (POs) / Programme Specific Outcomes(PSOs)														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO 1	PSO 2	PSO 3
CO1	3	2	3	2	3	2	2		2		2			3	2
CO2	3			2		2	2					2		2	3
CO3	3	3	2			2						2	2		2
CO4		2	2	2					2			2		2	
CO5	3	2	2									3		2	3

### 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 B must be output before any C's can be output.
- 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.
- 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.]

**L :0 T: 0 P: 60 J: 0 Total:60 PERIODS**

### COURSE OUTCOMES

At the end of the course student should be able to:

**CO1** Develop applications for handling deadlock in operating systems.

**CO2** Deal with multithreading and multiple processor for achieving program efficiency.

**CO3** Implement programs for network communication and to identify the TCP/IP settings.

**CO4** Deal with network configuration management and network operating system.

**CO5** Implement programs for real time distributed communication

<b>CO/PO Mapping</b>															
<b>(S/M/W indicates strength of correlation)3-Strong, 2-Medium, 1-Weak</b>															
COs	Programme Outcomes (POs) / Programme Specific Outcomes(PSOs)														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO 1	PSO 2	PSO 3
CO1	3	2		2									3	2	
CO2		2			1									2	
CO3				3							3				2
CO4	3	3		2							2	1			2
CO5	2	2		2							2	1			2

### 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.

**L :0 T: 0 P: 60 J: 0 Total:60 PERIODS**

### COURSE OUTCOMES

At the end of the course student should be able to:

- CO1** Design and implement dynamic websites with good aesthetic sense of designing and latest technical know-how's.
- CO2** Good grounding of Web Application Terminologies, Internet Tools, E -Commerce and other web services.
- CO3** Get introduced in the area of Online Game programming.
- CO4** Design web pages through coding using HTML and construct and manipulate web databases
- CO5** Build interactive applications using PHP.

CO/PO Mapping															
(S/M/W indicates strength of correlation)3-Strong, 2-Medium, 1-Weak															
COs	Programme Outcomes (POs) / Programme Specific Outcomes(PSOs)														
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CO1			3								1		3		
CO2	2	2	3								2		3		2
CO3			2								2		2	1	
CO4											2			2	
CO5	2	2	3								3		3		2

23CSP701

**PROJECT - I**

**L T P J C**  
**0 0 0 20 8**

**PROCEDURE TO FOLLOW**

1. Identification of the Project
2. The students need to empathize, define, Ideate, Prototype/Design based on their domain interest
3. Creating a model/ Implement the Existing project / simulate the project using various tools/programming languages. Analyze data, evaluate the results, conclude the appropriate solution and suggest for future work.
4. Report should summarize the methodology to be adopted, work plan for the proposed project work
5. Chosen Existing System Implementation

**L : 0 T: 0 P: 0 J: 20 Total:300 PERIODS**

**COURSE OUTCOMES**

At the end of the course student should be able to:

- CO1** Identify, define and justify scope of the chosen problem
- CO2** Categorize and summarize an appropriate list of literature review, analyze previous researchers' Work and relate them to the project
- CO3** Propose possible solutions for the existing problem
- CO4** Define an optimized solution to solve the problem
- CO5** Acquire knowledge about the project documentation and present their project phase I work in reputed conference

<b>CO/PO Mapping</b> <b>(S/M/W indicates strength of correlation)3-Strong, 2-Medium, 1-Weak</b>															
COs	Programme Outcomes (POs) / Programme Specific Outcomes(PSOs)														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO 1	PSO 2	PSO 3
CO1	2											1	2		
CO2		3		2								2	3		
CO3			3				2					2		2	3
CO4	2				2				2	2	3	2		3	3
CO5						1		2				1		1	2

23CSP702

**PROJECT - II**

**L T P J C**  
**0 0 0 24 12**

**PROCEDURE TO FOLLOW**

- Proposed System Implementation
- Presenting review paper
- Report should summarize the Proposed methodology adopted
- Thesis Preparation

**L : 0 T: 0 P: 0 J: 24 Total:360 PERIODS**

**COURSE OUTCOMES**

At the end of the course student should be able to:

- CO1** Use different experimental techniques like software/ Computational / analytical tools results after analyzing
- CO2** Conduct tests on existing set ups/ equipment and draw logical conclusions.
- CO3** Conversant with technical report writing to a peer reviewed national / International Journal
- CO4** Present and convince their topic of study to the engineering community.
- CO5** Present and defend their work in front of technically qualified audience.

<b>CO/PO Mapping</b> <b>(S/M/W indicates strength of correlation)3-Strong, 2-Medium, 1-Weak</b>															
COs	Programme Outcomes (POs) / Programme Specific Outcomes(PSOs)														
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CO1	2			2									3		
CO2		2	3								3		3		3
CO3	2				3					3					
CO4	3	2				2	2		3			3		2	2
CO5	3	2						2							

## PROFESSIONAL ELECTIVE

<b>23CSE601</b>	<b>GRID COMPUTING</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>J</b>	<b>C</b>
		<b>3</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>3</b>

### **UNIT I INTRODUCTION TO GRID COMPUTING 9**

Introduction – The Grid – Past, Present and Future – Applications of grid computing Organizations and their roles.

### **UNIT II GRID COMPUTING ARCHITURE 9**

Grid computing anatomy – Next generation of Grid computing initiatives–Merging the Grid Services architecture with Web services architecture.

### **UNIT III GRID COMPUTING TECHNOLOGIES 9**

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 9**

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.

**L : 45 T: 0 P: 0 J: 0 Total: 45 PERIODS**

## REFERENCES

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

## COURSE OUTCOMES

At the end of the course student should be able to:

- CO1** Understand and explain the basic concepts of Grid Computing.
- CO2** Explain the advantages of using Grid Computing within a given environment.
- CO3** Understand the application and tools of Grid Computing.
- CO4** Know the genesis of Grid Computing environment.

**CO5** Prepare for any upcoming Grid deployments and be able to get started with a potentially available Grid setup.

<b>CO/PO Mapping</b> <b>(S/M/W indicates strength of correlation)3-Strong, 2-Medium, 1-Weak</b>															
COs	Programme Outcomes(POs) / Programme Specific Outcomes(PSOs)														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO 1	PSO 2	PSO 3
CO1	3	2	2								2		3		2
CO2				3	2		2								
CO3			3		2			1			2		3		
CO4	3		3		3		2		2					2	2
CO5	3		3		3		3			2		3	2	2	3

**23CSE602**

**XML AND WEB SERVICES**

**L T P J C**  
**3 0 0 0 3**

**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 9**

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.

**UNIT IV IMPLEMENTING XML IN E-BUSINESS 9**

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.

**UNIT V XML AND CONTENT MANAGEMENT 9**

Semantic Web – Role of Meta data in web content – Resource Description Framework – RDF schema – Architecture of semantic web – content management workflow – XLANG –WSFL.

**L : 45 T: 0 P: 0 J: 0 Total: 45 PERIODS**

**REFERENCES**

- 1 Ron schmelzer et al, “XML and Web Services”, Pearson Education, 2002.
- 2 SandeepChatterjee and James Webber, “Developing Enterprise Web Services: An Architect’s Guide”, Prentice Hall, 2004.16
- 3 Frank P. Coyle, “XML, Web Services and the Data Revolution”, Pearson Education, 2002.
- 4 Keith Ballinger, “.NET Web Services Architecture and Implementation”, Pearson Education, 2003.
- 5 Henry Bequet and MeerajKunnumpurath, “Beginning Java Web Services”, Apress, 2004.

**COURSE OUTCOMES**

At the end of the course student should be able to:

**CO1** Assess and evaluate the role of XML for the management and delivery of electronic information.

**CO2** Understand the principles and role of structured generic markup.

**CO3** Deploy and publish web services.

**CO4** Understand web services and its infrastructure.

**CO5** Write XML and Content Management

<b>CO/PO Mapping</b> <b>(S/M/W indicates strength of correlation)3-Strong, 2-Medium, 1-Weak</b>															
COs	Programme Outcomes(POs) / Programme Specific Outcomes(PSOs)														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO 1	PSO 2	PSO 3
CO1	3	2			1								2		
CO2	1	3					2						2	2	
CO3	3						1			1	2		2		3
CO4		2			3						2	2			2
CO5	2	2		2	3						3	2			3



- 2 Westhead.D.R, Parish.J.H,Twyman.R.M, Instant Notes in Bio Informatics, BIOS Scientific Publishers 2000
- 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", 2<sup>nd</sup>

### COURSE OUTCOMES

At the end of the course student should be able to:

- CO1** Have knowledge of the main methods and tools used to gather, analyze, interpret and present data.
- CO2** Apply standard scientific principles in carrying out different types of problems.
- CO3** Understand the various concepts of database and networking used for patterns.
- CO4** Use the various search engines used in market today and use the best efficient search engine to refine the data's from database for pattern recognition.
- CO5** Develop various software tools and the different methods used for pattern matching.

<b>CO/PO Mapping</b> <b>(S/M/W indicates strength of correlation)3-Strong, 2-Medium, 1-Weak</b>															
COs	Programme Outcomes(POs) / Programme Specific Outcomes(PSOs)														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO 1	PSO 2	PSO 3
CO1	3	2		2	2					2		2	3		
CO2	3	3		2						2		3	3		2
CO3	3			1					2			2	2		
CO4	2	3	2	1	2		2		3	2		2		2	
CO5	2	3	3	1	3		2		2	2		2		2	2

**UNIT I INTRODUCTION 9**

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.

**UNIT II DIGITAL IMAGE FUNDAMENTALS 9**

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.

**UNIT III IMAGE ENHANCEMENT IN THE FREQUENCY DOMAIN 9**

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.

**UNIT IV IMAGE RESTORATION 9**

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.

**UNIT V OBJECT RECOGNITION AND INTERPRETATION 9**

Patterns and pattern classes –Decision – Theoretic methods-Structural methods.

**L : 45 T: 0 P: 0 J: 0 Total: 45 PERIODS**

**REFERENCES**

- 1 Rafel C Gonzalez and Richard E Woods “Digital Image Processing”, Third Edition, PHI,2009.
- 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.

**COURSE OUTCOMES**

At the end of the course student should be able to:

**CO1** Acquire the fundamental concepts of a digital image processing system

**CO2** Identify and exploit analogies between the mathematical tools used for 1D and 2D signal

analysis and processing

**CO3** Analyze the image enhancement in the frequency domain through the Fourier transform

**CO4** Design and implement with MAT lab algorithms for digital image restoration operations

**CO5** Apply pattern classes in object recognition

<b>CO/PO Mapping</b>															
<b>(S/M/W indicates strength of correlation)3-Strong, 2-Medium, 1-Weak</b>															
COs	Programme Outcomes(POs) / Programme Specific Outcomes(PSOs)														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO 1	PSO 2	PSO 3
CO1	3	2		2	2					2			2		2
CO2	3	3		2	2		2			2			2		
CO3	2	-			2		2					2	2		
CO4	2	3		3	3				2			2	2		3
CO5	3	3		3	2				2	2		2	2		3

**UNIT I AD-HOC MAC 9**

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.

**UNIT II AD-HOC NETWORK ROUTING 9**

Issues – Classifications of routing protocols – Table Driven Routing Protocols, on-demand Routing Protocols, Hybrid Routing Protocols, Hierarchical Routing Protocols and Power aware Routing Protocols.

**UNIT III MULTICAST ROUTING AND TRANSPORT LAYER 9**

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.

**UNIT IV WSN –MAC 9**

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.

**UNIT V WSN ROUTING, LOCALIZATION & QOS 9**

Issues in WSN routing – OLSR, AODV. Localization – Indoor and Sensor Network Localization. QoS in WSN – coverage and Exposure.

**L : 45 T: 0 P: 0 J: 0 Total: 45 PERIODS**

**REFERENCES**

- 1 C.Siva Ram Murthy and B.S.Manoj, “Ad Hoc Wireless Networks – Architectures and Protocols”, Pearson Education, 2004.
- 2 Feng Zhao and Leonidas Guibas, “Wireless Sensor Networks”, Morgan Kaufman Publishers,2004.
- 3 C.K.Toh, “Ad Hoc Mobile Wireless Networks”, Pearson Education, 2002.
- 4 Thomas Krag and SebastinBuettrich, “Wireless Mesh Networking”, O’Reilly Publishers,

**COURSE OUTCOMES**

At the end of the course student should be able to:

- CO1** Gain knowledge on key concepts of MAC protocols to enhance the wireless adhoc network
- CO2** Design the routing strategy to enable the efficient routing mechanism

**CO3** Various TCP over adhoc networks and apply them in real world applications

**CO4** Understand the concepts of Wireless Sensor networks and its functioning

**CO5** Analyze the QoS parameters on implementing WSN.

<b>CO/PO Mapping</b> <b>(S/M/W indicates strength of correlation)3-Strong, 2-Medium, 1-Weak</b>															
COs	Programme Outcomes(POs) / Programme Specific Outcomes(PSOs)														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO 1	PSO 2	PSO 3
CO1		3				2			3			2	2		
CO2		1		2					2				2		
CO3	2		1	3						1					2
CO4		2							2		1		3		2
CO5	2		1	3		1		2		1			2		2

<b>23CSE606</b>	<b>AGENT BASED INTELLIGENT SYSTEMS</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>J</b>	<b>C</b>
		<b>3</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>3</b>

**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.

**L : 45 T: 0 P: 0 J: 0 Total: 45 PERIODS**

**REFERENCES**

- 1 Stuart Russell and Peter Norvig, “Artificial Intelligence - A Modern Approach”, 2nd Edition,Prentice Hall, 2002.
- 2 Nils.J.Nilsson, Principles of Artificial Intelligence, Narosa Publishing House.
- 3 J.Ferber, Multi-agent Systems-An Introduction to Distributed Artificial Intelligence, Addison Wesley, 1999.
- 4 Michael Wooldridge, “An Introduction to Multi Agent System”, John Wiley, 2002.
- 5 Patrick Henry Winston, Artificial Intelligence, III Edition, AW, 1999.

**COURSE OUTCOMES**

At the end of the course student should be able to:

- CO1** Acquire the basics on capabilities, strength and limitations of various artificial intelligence and machine learning techniques.
- CO2** Analyze the various knowledge representation strategies
- CO3** Apply techniques for planning to solve real time problems through artificial intelligence and machine learning.
- CO4** .Describe decision support systems for complex problems
- CO5** Apply various knowledge learning methods for solving real world problems.

<b>CO/PO Mapping</b> <b>(S/M/W indicates strength of correlation)3-Strong, 2-Medium, 1-Weak</b>															
COs	Programme Outcomes(POs) / Programme Specific Outcomes(PSOs)														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO 1	PSO 2	PSO 3
CO1			2		3					1	2		2		2
CO2		2	1		3								2	2	1
CO3	3	2		1									3	2	
CO4		2		3	3	1	3					2		2	
CO5		2			3	1	2				2			2	

<b>23CSE607</b>	<b>SOFTWARE QUALITY ASSURANCE</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>J</b>	<b>C</b>
		<b>3</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>3</b>

**UNIT I INTRODUCTION TO SOFTWARE QUALITY 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 BASICS OF TESTING 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 SOFTWARE TESTING STRATERGIES 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 INFRASTRUCTURE AND MANAGEMENT COMPONENTS 9**

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.

**UNIT V STANDARDS, CERTIFICATION AND ASSESSMENT 9**

Project progress control – costs – quality management standards – project process standards – Management and its role in SQA – SQA unit-Issues and Challenges in SQA.

**L : 45 T: 0 P: 0 J: 0 Total: 45 PERIODS**

**REFERENCES**

- 1 Daniel Galin, Software quality assurance – from theory to implementation , Pearson education, 2009.
- 2 AdityaMathur, Foundations of software testing, Pearson Education, 2008.
- 3 SrinivasanDesikan and Gopaldaswamy Ramesh, Software testing – principles and practices, Pearson education, 2006.
- 4 Alan C Gillies, “Software Quality Theory and Management”, Cengage Learning, Second edition, 2003.

## COURSE OUTCOMES

At the end of the course student should be able to:

**CO1** Assure quality that can be delivered in the software and usually related to process and

**CO2** Understand the basic testing as satisfy the user requirements.

**CO3** Understand the levels of software testing.

**CO4** Gain the advanced knowledge on software quality and metrics.

**CO5** Gain advanced knowledge on software quality assurance.

<b>CO/PO Mapping</b>															
<b>(S/M/W indicates strength of correlation)3-Strong, 2-Medium, 1-Weak</b>															
COs	Programme Outcomes(POs) / Programme Specific Outcomes(PSOs)														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO 1	PSO 2	PSO 3
CO1	3		1		1			2						3	
CO2	3		3		1		2						2	3	
CO3					2			2						2	
CO4	3		3		2		3		2			2		3	2
CO5	2		3		1				2			2		2	2

<b>23CSE608</b>	<b>DATA WAREHOUSING AND DATA MINING</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>J</b>	<b>C</b>
		<b>3</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>3</b>

**UNIT I DATA WAREHOUSING AND BUSINESS ANALYSIS 9**

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.

**UNIT II DATA MINING 9**

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.

**UNIT III CLASSIFICATION AND PREDICTION 9**

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 Classification Methods – Prediction – Accuracy and Error Measures – Evaluating the Accuracy of a Classifier or Predictor – Ensemble Methods – Model Section.

**UNIT IV CLUSTER ANALYSIS 9**

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 MINING OBJECT, SPATIAL, MULTIMEDIA, TEXT AND WEB DATA 9**

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.

**L : 45 T: 0 P: 0 J: 0 Total: 45 PERIODS**

**REFERENCES**

- 1 Alex Berson and Stephen J. Smith “Data Warehousing, Data Mining & OLAP”, Tata McGraw – Hill Edition, Thirteenth Reprint 2008.
- 2 Jiawei Han and MichelineKamber “Data Mining Concepts and Techniques” Elsevier, Third Edition, print 2011. (Unit II: Chapters 1 to 7;

- 3 Ian H. Witten, Eibe Frank, Mark A. Hall “Data Mining: Practical Machine Learning Tools and Techniques” Elsevier 2011.
- 4 Pete Warden, “Big Data Glossary”, O’Reilly , 2011.
- 5 M.Golfarelli, S.Rizzi,” Data warehouse Design: Modern Principles and Methodologies”, McGraw-Hill, 2009.
- 6 Margaret H.Dunham,”Data Mining: Introductory and Advanced Topics”, Prentice Hall, 2003.
- 7 Pang-Ning Tsa, Michael Stunbach and Vipin Kumar,” Introduction to Data mining” Pearson Addison Wesley, 2005.
- 8 Viktor Mayer-Schonberger, Kenneth Cukier, “Big Data: A Revolution That Will Transform How We Live, Work, and Think”, 2013.

### **COURSE OUTCOMES**

At the end of the course student should be able to:

- CO1** Evaluate the different models used for OLAP and data preprocessing.
- CO2** Enlist various algorithms used for Data Mining Techniques.
- CO3** Design and implement systems for data Mining.
- CO4** Propose data mining solutions for different applications.
- CO5** Overview the developing areas - web mining, text mining, and ethical aspects of data mining.

<b>CO/PO Mapping</b>															
<b>(S/M/W indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak</b>															
COs	Programme Outcomes(POs) / Programme Specific Outcomes(PSOs)														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO 1	PSO 2	PSO 3
CO1			2												2
CO2		3	1	1	2									3	1
CO3	3		2										3		2
CO4		3	3	3	3						2	3		3	3
CO5					3	2						3			

<b>23CSE609</b>	<b>CYBER FORENSICS AND INFORMATION SECURITY</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>J</b>	<b>C</b>
		<b>3</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>3</b>

**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**

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.

**UNIT IV SECURITY INVESTIGATION & SECURITY ANALYSIS 9**

Need for Security, Business Needs, Threats, Attacks, Legal, Ethical and Professional issues. Risk Management: Identifying and Assessing Risk, Assessing and Controlling Risk.

**UNIT V PHYSICAL DESIGN & LOGICAL DESIGN 9**

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.

**L : 45 T: 0 P: 0 J: 0 Total: 45 PERIODS**

**REFERENCES**

- 1 Cyber Forensics-A Field Manual for Collecting, Examining, and Preserving Evidence of Computer Crimes by Albert J Marcella, Robert s. Greenfield -Auerbach Publications, 2<sup>nd</sup> Edition,2007.
- 2 Michael E Whitman and Herbert J Mattord, "Principles of Information Security", Cengage Learning, 4<sup>th</sup> edition, 2011.
- 3 Albert Marcella Jr., Doug Menendez "Cyber Forensics: A Field Manual for Collecting, Examining, and Preserving" Auerbach Publications, 2<sup>nd</sup> edition, 2008.
- 4 Albert J Marcella Jr., Frederic Guillossou "Cyber Forensics: From Data to Digital Evidence", Wiley Corporate F & A, 2012.
- 5 Micki Krause, Harold F. Tipton, "Handbook of Information Security Management", Vol 1-3 CRC Press LLC, 2004.
- 6 Stuart McClure, Joel Scrambray, George Kurtz, "Hacking Exposed", Tata McGraw-

Hill, 2003.

7 Matt Bishop, “Computer Security Art and Science”, Pearson/PHI, 2002.

**COURSE OUTCOMES**

At the end of the course student should be able to:

- CO1** Gain advanced knowledge and understanding of cyber laws.
- CO2** Be familiar with how threats to an organization are discovered, analyzed and dealt with.
- CO3** Compare the various layers of defense-in-depth strategy and determine the strengths and weakness based on the assessment.
- CO4** Be an expert in information security governance and related legal and regulatory issues and understanding external and internal threats to an organization.
- CO5** Be familiar with how threats to an organization are discovered, analyzed and can be master in fundamentals of secret and public cryptography and familiar with advanced network security issues.

<b>CO/PO Mapping</b> <b>(S/M/W indicates strength of correlation)3-Strong, 2-Medium, 1-Weak</b>															
COs	Programme Outcomes(POs) / Programme Specific Outcomes(PSOs)														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO 1	PSO 2	PSO 3
CO1	2	2										3	2		3
CO2	2	3	2					2					1		
CO3	3	3		2		1									
CO4	3			2		1		2							
CO5	3		3	2				2		2	2		2		2

**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 9**

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 9**

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.

**L : 45 T: 0 P: 0 J: 0 Total: 45 PERIODS**

**REFERENCES**

- 1 Jochen Schiller, “Mobile Communications”, Second Edition, Pearson Education, 2009.
- 2 William Stallings, “Wireless Communications and Networks”, Second Edition, Pearson Education, 2002.
- 3 Raj Kamal, “Mobile Computing”, First Edition , Oxford University Press, 2007.
- 4 KavehPahlavan, PrasanthKrishnamoorthy, “Principles of Wireless Networks”, First Edition, Pearson Education, 2006.
- 5 UweHansmann, LotharMerk, Martin S. Nicklons and Thomas Stober, “Principles of Mobile Computing”, First Edition , Springer, 2003.
- 6 C.K.Toth, “Ad Hoc Mobile Wireless Networks”, Second Edition, Pearson Education, 2009.
- 7 Jochen Schiller, “Mobile Communications”, Second Edition, Pearson Education, 2009.

**COURSE OUTCOMES**

At the end of the course student should be able to:

- CO1** Familiarize the fundamental concepts of wireless networks.
- CO2** Understand and identify the GSM, GPRS and Bluetooth software model for mobile computing
- CO3** Understanding of the characteristics and limitations of mobile based routing protocols.
- CO4** Analyze TCP over wire and wireless channels
- CO5** Promote the awareness of the life-long learning, business ethics, professional ethics and current marketing scenarios.

<b>CO/PO Mapping</b> <b>(S/M/W indicates strength of correlation)3-Strong, 2-Medium, 1-Weak</b>															
COs	Programme Outcomes(POs) / Programme Specific Outcomes(PSOs)														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO 1	PSO 2	PSO 3
CO1		3	2		3								3		
CO2			3								2		2	1	
CO3	2			2											2
CO4	1	3			1							2			2
CO5	2			2		3		2			2	3			

**23CSE611**

**MULTIMEDIA SYSTEMS**

**L T P J C**  
**3 0 0 0 3**

**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.

**L : 45 T: 0 P: 0 J: 0 Total: 45 PERIODS**

**REFERENCES**

- 1 Ralf Steinmetz and KlaraNahrstedt, “Multimedia Systems”, Springer, First Edition 2004.
- 2 Ralf Steinmetz and KlaraNahrstedt ,“Media Coding and Content Processing”, Second Edition , Prentice hall, 2004.
- 3 TayVaughan,“Multimedia - Making it work”, Tata McGraw Hill Edition, Eighth Edition, Tata McGraw Hill ,2011.
- 4 Mark J.B., Sandra K.M., “Multimedia Applications Development using DVI technology”, First Edition , McGraw Hill, 1992.
- 5 K.R.Rao, Zoran S. Bojkovic, DragoradA.Milovacovic, D.A.Milovacovic ,Multimedia Communication Systems: Techniques, Standards, and Networks, Prentice Hall, First Edition, 2002.

**COURSE OUTCOMES**

At the end of the course student should be able to:

- CO1** Describe the types of media and define multimedia system.
- CO2** Understand multimedia operating systems using various tools and techniques.
- CO3** Describe the process of digitizing (quantization) of different analog signals (text, graphics, sound and video).
- CO4** Describe mechanisms for providing QoS guarantees in the network and to propose experiments to analyse their performance.
- CO5** Apply acquired knowledge in the field of multimedia in practice and independently continue to expand knowledge in this field.

<b>CO/PO Mapping</b>															
<b>(S/M/W indicates strength of correlation)3-Strong, 2-Medium, 1-Weak</b>															
COs	Programme Outcomes(POs) / Programme Specific Outcomes(PSOs)														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO 1	PSO 2	PSO 3
CO1	3	2	3	2									2		3
CO2	2	3	2	2	3								3		
CO3	2	2											2		2
CO4	2	2		2				2					3	2	2
CO5	2	3		3	2						2	2	2		2

<b>23CSE612</b>	<b>NETWORK SECURITY</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>J</b>	<b>C</b>
		<b>3</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>3</b>

**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.

**L : 45 T: 0 P: 0 J: 0 Total: 45 PERIODS**

**REFERENCES**

- 1 William Stallings, Cryptography & Network Security - Principles & Practice, Prentice Hall, Fifth Edition, 2006.
- 2 Kaufman, Perlman, Speciner, “Network Security, Private Communication in a Public World”, Pearson Education, Second Edition, 2006.
- 3 Bruce Schneier, “Applied Cryptography”, Second Edition, John Wiley & Sons, 2009.
- 4 Man Young Rhee, “Internet Security”, First Edition , John Wiley & Sons, 2003.
- 5 Charles Pfleeger& Shari Lawrence Pfleeger, “Security in Computing”, Pearson Education, Fourth Edition, 2006.
- 6 Bragg, Rhodes-Ousley, Strassberg, “The Complete Reference, Network Security”, Sixth Edition , Tata McGraw Hill Publications, 2004.
- 7 Kahate, “Cryptography and Network Security”, Eighth Edition, Tata McGraw Hill Publications, 2006
- 8 Wenbo Mao, “Modern Cryptography, Theory & Practice”, First Edition, Pearson Education, 2008.

**COURSE OUTCOMES**

At the end of the course student should be able to:

**CO1** Basic concepts of system level security.

- CO2** Understand the most common type of cryptographic algorithm.
- CO3** Understand security protocols for protecting data on networks
- CO4** Digitally sign emails and files
- CO5** Understand vulnerability assessments and the weakness of using passwords

<b>CO/PO Mapping</b>															
<b>(S/M/W indicates strength of correlation)3-Strong, 2-Medium, 1-Weak</b>															
COs	Programme Outcomes(POs) / Programme Specific Outcomes(PSOs)														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO 1	PSO 2	PSO 3
CO1	3	2		2	1				3			2		2	
CO2	3	2		3	1			3					3	2	
CO3			3					3							3
CO4		1	2					3							
CO5		2	2		2	2		3			1	2		2	2

<b>23CSE613</b>	<b>VISUALIZATION TECHNIQUES</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>J</b>	<b>C</b>
		<b>3</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>3</b>

**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.

**L : 45 T: 0 P: 0 J: 0 Total: 45 PERIODS**

**REFERENCES**

- 1 Colin Ware, “Information Visualization Perception for Design” Morgan Kaufmann Publishers, Third Edition , 2013.
- 2 Robert Spence “Information visualization – Design for interaction”, Pearson Education, Second Edition, 2007.
- 3 Thomas strothotte, “Computer Visualization – Graphics Abstraction & interactivity”, First Edition, Morgan Kaufmann Publishers, 2007.
- 4 Stuart.K.Card, Jock.D.Mackinlay and Ben Shneiderman, “Readings in Information Visualization Using Vision to think”, First Edition , Morgan Kaufmann Publishers, 2008.

**COURSE OUTCOMES**

At the end of the course student should be able to:

- CO1** Design and create data visualizations
- CO2** Conduct exploratory data analysis using visualization.

**CO3** Compare Visualization techniques to create visualizations

**CO4** Identify appropriate data visualization techniques given particular requirements imposed by the data

**CO5** Apply appropriate design principles in the creation of presentations and visualizations.

<b>CO/PO Mapping</b> <b>(S/M/W indicates strength of correlation)3-Strong, 2-Medium, 1-Weak</b>															
COs	Programme Outcomes(POs) / Programme Specific Outcomes(PSOs)														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO 1	PSO 2	PSO 3
CO1	2										3		3		
CO2		1			2			1					2		
CO3	2		3							1	3				
CO4	1			3							2				2
CO5		2		3		1		3		2		3			3

**23CSE614**

**SOFT COMPUTING**

**L T P J C**  
**3 0 0 0 3**

**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.

**L : 45 T: 0 P: 0 J: 0 Total: 45 PERIODS**

**REFERENCES**

1. Jyh-Shing Roger Jang, Chuen-Tsai Sun, Eiji Mizutani, “Neuro-Fuzzy and Soft Computing”, First Edition , Prentice-Hall of India, 2003.
2. S.Rajasekaran and G.A.VijayalakshmiPai , “Neural Networks Fuzzy Logic and Genetic Algorithms”, First edition , Prentice Hall of India,2003.
3. David E. Goldberg, “Genetic Algorithms in Search, Optimization and Machine Learning”, First Edition , Addison Wesley, 1997.
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.

## COURSE OUTCOMES

At the end of the course student should be able to:

- CO1** Identify and select a suitable Soft Computing technology to solve the problem, construct a solution and implement a Soft Computing solution.
- CO2** Unify and exact mathematical basics as well as the general principles of various soft computing.
- CO3** Understand the importance of optimization techniques and genetic programming
- CO4** Understand and know different concepts related to neural networks, including different Architectures, training skills and its applications.
- CO5** Understand and know different concepts related to Fuzzy logic, including different theoretical models, training skills and its applications.

<b>CO/PO Mapping</b> (S/M/W indicates strength of correlation)3-Strong, 2-Medium, 1-Weak															
COs	Programme Outcomes(POs) / Programme Specific Outcomes(PSOs)														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO 1	PSO 2	PSO 3
CO1	3	3			1										1
CO2		1		1	2			1					1		1
CO3			3				1				2	2		1	2
CO4		3	1		1								2	2	
CO5	2	3						3					3		

**23CSE615 PERFORMANCE EVALUATION OF COMPUTER SYSTEMS AND NETWORKS**

**L T P J C**  
**3 0 0 0 3**

**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.

**L : 45 T: 0 P: 0 J: 0 Total: 45 PERIODS**

**REFERENCES**

1. James D.McCabe, Network Analysis, Architecture and Design, Second Edition, Elsevier, 2003.
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.



<b>23CSE616</b>	<b>INFORMATION AND CYBER WARFARE</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>J</b>	<b>C</b>
		<b>3</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>3</b>

**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

**L : 45 T: 0 P: 0 J: 0 Total: 45 PERIODS**

**REFERENCES**

1. Jeffrey Carr, “Inside Cyber Warfare: Mapping the Cyber Underworld”, Second Edition, O’Reilly Media Inc., 2012.
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.

**COURSE OUTCOMES**

At the end of the course student should be able to:

- CO1** Distinguish between cyber warfare and Cyber playing field with respect to state and non state attack while identifying their strength and weakness.
- CO2** Evaluate various national and international interpretations as they pertain to cyber warfare, compare and contrast this interpretation for current and future cyber warfare conflict.
- CO3** Analyze various cyber weapons with the concept of creation, usage and dissemination of cyber weapons.
- CO4** Be familiar with how threats to an organization are discovered. Analyzed and dealt with.
- CO5** Master in fundamentals of secret and public cryptography and familiar with advanced network security issues.

<b>CO/PO Mapping</b> <b>(S/M/W indicates strength of correlation)3-Strong, 2-Medium, 1-Weak</b>															
COs	Programme Outcomes(POs) / Programme Specific Outcomes(PSOs)														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO 1	PSO 2	PSO 3
CO1	3							2					2	3	
CO2		3				1							2		
CO3	2				2			2			2	3		3	3
CO4	2	2				2									
CO5		2		3	1							2			2

**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.

**L : 45 T: 0 P: 0 J: 0 Total: 45 PERIODS**

**REFERENCES**

1. Andrew.S.Tanenbaum, Maarten Van Steen, “Distributed Systems Principles and Paradigms”, Second Edition, Pearson Education, 2007.
2. George Coulouris, Jean Dollimore, Tim Kindberg, “Distributed Systems Concepts and Design”, Fifth Edition, Addition Wesley, 2011.
3. HagitAttiya and Jennifer Welch, “Distributed Computing: Fundamentals, Simulations and Advanced Topics”, Second Edition, Wiley Publications, 2004.
4. MukeshSinghal, “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 Wesley, 2004.
6. Pradeep.K.Sinha, “Distributed Operating System Concepts and Design”, Sixth Edition, PHI, 1997.
7. Nancy A.Lynch, “Distributed Algorithms”, First Edition, Morgan Kaufmann Publishers, 2007.

## COURSE OUTCOMES

At the end of the course student should be able to:

- CO1** Understand and apply the various web services.
- CO2** Understand the Distributed Algorithms and to apply in real time applications.
- CO3** Understand the concepts of Consistency and Replication.
- CO4** Know the securing the Distributed System and to recover from a Failure.
- CO5** Analyze the strengths and limitations of the tools and devices for development of distributed computing systems.

<b>CO/PO Mapping</b> <b>(S/M/W indicates strength of correlation)3-Strong, 2-Medium, 1-Weak</b>															
COs	Programme Outcomes(POs) / Programme Specific Outcomes(PSOs)														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO 1	PSO 2	PSO 3
CO1			2	3				1					3	3	
CO2			1		3		2						2		
CO3			3	2								2	2		
CO4	3	2		1										2	3
CO5			2	3	1		2	2			2				2

<b>23CSE618</b>	<b>INFORMATION SECURITY</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>J</b>	<b>C</b>
		<b>3</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>3</b>

**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.

**L : 45 T: 0 P: 0 J: 0 Total: 45 PERIODS**

**REFERENCES**

1. Matt Bishop, “Computer Security art and science”, Second Edition, Pearson Education, 2010.
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.

**COURSE OUTCOMES**

At the end of the course student should be able to:

- CO1** Master in information security to apply various security mechanisms.
- CO2** Master the understanding in various cryptographic algorithms to achieve Information Security.

**CO3** Acquire familiarity in design security principles in information systems.

**CO4** Familiarized with various types of attacks, threats and identifying vulnerabilities.

**CO5** Know the research issues in network security.

<b>CO/PO Mapping</b> <b>(S/M/W indicates strength of correlation)3-Strong, 2-Medium, 1-Weak</b>															
COs	Programme Outcomes(POs) / Programme Specific Outcomes(PSOs)														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO 1	PSO 2	PSO 3
CO1	2						3		1				2		
CO2	2	2		2		3								1	2
CO3		2			1					2					
CO4	3			3			1	2							2
CO5	2						3		1				2		3

<b>23CSE619</b>	<b>SOFTWARE PROJECT MANAGEMENT</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>J</b>	<b>C</b>
		<b>3</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>3</b>

**UNIT I INTRODUCTION TO SOFTWARE PROJECT MANAGEMENT 9**

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.

**UNIT II PROJECT EVALUATION 9**

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.

**UNIT III SOFTWARE EFFORT ESTIMATION 9**

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.

**UNIT IV RISK MANAGEMENT 9**

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.

**UNIT V ORGANIZATIONAL BEHAVIOR 9**

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.

**L : 45 T: 0 P: 0 J: 0 Total: 45 PERIODS**

**REFERENCES**

1. Bob Hughes and Mike Cotterell, "Software Project Management", Fourth Edition, 2006.
2. Pressman, Roger, "Software Engineering", A Practitioner's approach. McGrawHill, 2009.
3. Ramesh, Gopaldaswamy, "Managing Global Projects", Tata McGraw Hill, 2005.
4. Humphrey, Watts, "Managing the Software Process", Addison Wesley, 2006.
5. Wheelwright and Clark, "Revolutionising product development", The Free Press, 2000.

**COURSE OUTCOMES**

At the end of the course student should be able to:

- CO1** Participate in software development project and will be able to take responsibility of a project team and
- CO2** Apply theoretical knowledge on project management and software development ideas into practice.
- CO3** Evaluate a project to develop the scope of work, provide accurate cost estimation and to plan the various activities.
- CO4** Understand and use risk management techniques to identify the factors that put a project at risk and to quantify the likely effect of risk on project timescales.
- CO5** Identify the resources required for a project and to produce a work plan and resource schedule.

<b>CO/PO Mapping</b> (S/M/W indicates strength of correlation)3-Strong, 2-Medium, 1-Weak															
COs	Programme Outcomes(POs) / Programme Specific Outcomes(PSOs)														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO 1	PSO 2	PSO 3
CO1	2						3		1					3	
CO2		1		2		3							3	2	2
CO3					1					2				2	
CO4							3	2	1				2		
CO5				3			1	2							2

<b>23CSE701</b>	<b>COMPONENT BASED TECHNOLOGY</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>J</b>	<b>C</b>
		<b>3</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>3</b>

**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 – app domains – 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.

**L : 45 T: 0 P: 0 J: 0 Total: 45 PERIODS**

**REFERENCES**

1. Clemens Szyperski, “Component Software: Beyond Object-Oriented Programming”, Pearson Education publishers, 2003.
2. Ed Roman, “Enterprise Java Beans3.1”, Sixth Edition , Wiley , 2010.
3. Mowbray, “Inside CORBA”, Pearson Education, New Delhi, 2003.
4. Freeze, “Visual Basic Development Guide for COM & COM+”, BPB Publication,New Delhi, 2001.
5. Hortsamann, Cornell, “CORE JAVA Vol-II” Sun Press, New Delhi, 2002.

**COURSE OUTCOMES**

At the end of the course student should be able to:

**CO1** Understand the fundamentals of software components and their architecture

**CO2** Develop a Java Thread and create bean for any application

**CO3** Develop and implement CORBA based technology and its services

**CO4** Illustrate and deploy .NET based components and controls

**CO5** Understand and learn about the required component based connectors, development and testing Tools.

<b>CO/PO Mapping</b> <b>(S/M/W indicates strength of correlation)3-Strong, 2-Medium, 1-Weak</b>															
COs	Programme Outcomes(POs) / Programme Specific Outcomes(PSOs)														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO 1	PSO 2	PSO 3
CO1	3			2					2	2		2			
CO2	3	3	3	2	2		2		2	2		2	3		2
CO3	2		3	1	2		2		2	2		2	3	2	
CO4	2	3			2			2	3	2		2	2	2	3
CO5	3	3			2				3	2		2			

**23CSE702**

**CLOUD COMPUTING**

**L T P J C**  
**3 0 0 0 3**

**UNIT I UNDERSTANDING CLOUD COMPUTING 9**

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.

**UNIT II DEVELOPING CLOUD SERVICES 9**

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.

**UNIT III CLOUD COMPUTING FOR EVERYONE 9**

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.

**UNIT IV USING CLOUD SERVICES 9**

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.

**UNIT V OTHER WAYS TO COLLABORATE ONLINE 9**

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.

**L : 45 T: 0 P: 0 J: 0 Total: 45 PERIODS**

**REFERENCES**

1. Michael Miller, Cloud Computing: Web-Based Applications, Collaborate Online, Que Publishing, August 2008 .
2. John W.Rittinghouse, James F.Ransome, " Cloud Computing Implementation, Management and Security" CRC Press Taylor & Francis group, 2012.
3. Borko Furht, Armando Escalante, "Hand book of cloud computing(Hard Cover)", Springer New York, 2010.
4. Haley Beard, "Cloud Computing Best Practices", Emereo Pty Limited,2 Edition, August 2009.

**COURSE OUTCOMES**

At the end of the course student should be able to:

- CO1** Understand about the concepts of cloud computing paradigm, recognize its various forms of cloud storage and its challenges
- CO2** Understand and develop various cloud and web services
- CO3** Know the use of cloud computing in all the necessary services and communities
- CO4** Understand about scheduling and managing projects using cloud services and to manage various collaborations
- CO5** Analyze the various web mail services and tools for online collaboration

<b>CO/PO Mapping</b> <b>(S/M/W indicates strength of correlation)3-Strong, 2-Medium, 1-Weak</b>															
COs	Programme Outcomes(POs) / Programme Specific Outcomes(PSOs)														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO 1	PSO 2	PSO 3
CO1	3	3	3		1	2				1		2	3		
CO2	3	3	2	1		2	2			2		2	2		
CO3	3	2	3		2	1			1	3	1	2		3	2
CO4	2	2	3	2	2		1	1	1	2		1		3	
CO5	1		1		2	2		3	2	2	3	2		3	

**UNIT I INTRODUCTION TO BIG DATA****9**

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.

**UNIT II DATA ANALYSIS****9**

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.

**UNIT III STREAM COMPUTING****9**

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.

**UNIT IV PREDICTIVE ANALYTICS AND VISUALIZATION****9**

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:

**UNIT V FRAMEWORKS AND APPLICATIONS****9**

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.

**L : 45 T: 0 P: 0 J: 0 Total: 45 PERIODS****REFERENCES**

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
8. Corrigan, “Harness the Power of Big data – The big data platform”, McGraw Hill, 2012.
9. Glenn J. Myatt, Making Sense of Data, John Wiley & Sons, 2007
10. Pete Warden, Big Data Glossary, O’Reilly, 2011.
11. Jiawei Han, Micheline Kamber “Data Mining Concepts and Techniques”, Second Edition, Elsevier, Reprinted 2008.

### COURSE OUTCOMES

At the end of the course student should be able to:

**CO1** Identify the need for big data analytics for a domain.

**CO2** Use Hadoop, Map Reduce Framework.

**CO3** Apply big data analytics for a give problem.

**CO4** Suggest areas to apply big data to increase business outcome.

**CO5** Contextually integrate and correlate large amounts of information automatically to gain faster insights.

<b>CO/PO Mapping</b>															
<b>(S/M/W indicates strength of correlation)3-Strong. 2-Medium. 1-Weak</b>															
COs	Programme Outcomes(POs) / Programme Specific Outcomes(PSOs)														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO 1	PSO 2	PSO 3
CO1	3	3	2							2				2	2
CO2		2		2	2			2					3		
CO3	2	2	2		2										2
CO4				3									2		
CO5			3	2			2				2			2	3

<b>23CSE704</b>	<b>SOCIAL NETWORK MINING ANALYSIS</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>J</b>	<b>C</b>
		<b>3</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>3</b>

**UNIT I INTRODUCTION 9**

Introduction to Web - Limitations of current Web – Development of Semantic Web – Emergence of the Social Web – Statistical Properties of Social Networks -Network analysis - Development of Social Network Analysis - Key concepts and measures in network analysis - Discussion networks - Blogs and online communities - Web-based networks.

**UNIT II MODELING AND VISUALIZATION 9**

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

**UNIT III MINING COMMUNITIES 9**

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

**UNIT IV EVOLUTION 9**

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

**UNIT V APPLICATIONS 9**

A Learning Based Approach for Real Time Emotion Classification of Tweets, A New Linguistic Approach to Assess the Opinion of Users in Social Network Environments, Explaining Scientific and Technical Emergence Forecasting, Social Network Analysis for Biometric Template Protection.

**L : 45 T: 0 P: 0 J: 0 Total: 45 PERIODS**

**REFERENCES**

1. Ajith Abraham, Aboul Ella Hassanien, Václav Snášel, —Computational Social Network Analysis: Trends, Tools and Research Advances. Springer. 2012
2. Borko Furht, —Handbook of Social Network Technologies and Applications, Springer, 1 st edition, 2011
3. Charu C. Aggarwal, —Social Network Data Analytics, Springer; 2014
4. Giles, Mark Smith, John Yen, —Advances in Social Network Mining and Analysis, Springer, 2010.

## COURSE OUTCOMES

At the end of the course student should be able to:

**CO1** Work on the internal components of the social network

**CO2** Model and visualize the social network

**CO3** Mine the behaviour of the users in the social network

**CO4** Predict the possible next outcome of the social network

**CO5** Apply social network in real time applications

<b>CO/PO Mapping</b>															
<b>(S/M/W indicates strength of correlation)3-Strong, 2-Medium, 1-Weak</b>															
COs	Programme Outcomes(POs) / Programme Specific Outcomes(PSOs)														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO 1	PSO 2	PSO 3
CO1	2	3	2		1								2		2
CO2	2	3	2					2		3				3	
CO3				1					2	2				1	
CO4			3			2		2		1			1		3
CO5	2	2		2	3	1		3	2		2	2	2	3	

<b>23CSE705</b>	<b>ROBOTIC PROCESS AUTOMATION</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>J</b>	<b>C</b>
		<b>3</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>3</b>

**UNIT I INTRODUCTION TO VISUAL COMMUNICATION 9**

Need for and the Importance of Human and Visual Communication. Communication a expression, skill and process, Understanding Communication: SMRC-Model.

**UNIT II FUNDAMENTAL CONCEPTS OF INDUSTRIAL AUTOMATION 9**

Fundamental concepts in manufacturing and automation, definition of automation, reasons for automating. Types of production and types of automation, automation strategies, levels of automation.

**UNIT III DIRECT AND INVERSE KINEMATICS 9**

Mathematical representation of Robots - Position and orientation – Homogeneous transformation  
 Various joints- Representation using the Denavit Hattenberg parameters -Degrees of freedom-Direct kinematics-Inverse kinematics- SCARA robots- Solvability – Solution methods-Closed form solution.

**UNIT IV MANIPULATOR DIFFERENTIAL MOTION AND STATICS 9**

Linear and angular velocities-Manipulator Jacobian-Prismatic and rotary joints– Inverse -Wrist and arm singularity - Static analysis - Force and moment Balance.

**UNIT V TRANSFER LINES AND AUTOMATED ASSEMBLY 9**

General terminology and analysis, analysis of transfer lines without storage, partial automation. Automated flow lines with storage buffers. Automated assembly-design for automated assembly, types of automated assembly systems, part feeding devices, analysis of multi-station assembly machines. AS/RS, RFID system, AGVs, modular fixturing. Flow line balancing.

**L : 45 T: 0 P: 0 J: 0 Total: 45 PERIODS**

**TEXT BOOKS**

1. R.K.Mittal and I.J.Nagrath, Robotics and Control, Tata McGraw Hill, New Delhi,4th Reprint, 2005
2. Mikell P Groover, “Automation Production Systems and Computer- Integrated Manufacturing” Pearson Education, New Delhi, 2001.

**REFERENCES**

1. Ashitava Ghoshal, Robotics-Fundamental Concepts and Analysis’, Oxford University Press, Sixth impression, 2010
2. Joffrey Boothroyd, Peter Dewhurst and Winston A. Knight, “Product Design for manufacture and Assembly”, CRC Press, 2011
3. S.Ghoshal, “ Embedded Systems & Robotics” – Projects using the 8051 Microcontroller”, Cengage Learning, 2009.

4. Steve F Krar, "Computer Numerical Control Simplified", Industrial Press, 2001.

### COURSE OUTCOMES

At the end of the course student should be able to:

- CO1** Ability to understand basic concept of robotics
- CO2** Knowledge of industrial automation by transfer lines and automated assembly lines
- CO3** To analyze Instrumentation systems and their applications
- CO4** Know about the differential motion add statics in robotics
- CO5** Ability to design an automated system

<b>CO/PO Mapping</b>															
<b>(S/M/W indicates strength of correlation)3-Strong, 2-Medium, 1-Weak</b>															
COs	Programme Outcomes(POs) / Programme Specific Outcomes(PSOs)														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO 1	PSO 2	PSO 3
CO1	2	2		1						2		2	2		
CO2	2					2									
CO3	3	3	3				2		2	2			3	2	
CO4				2	2							2			
CO5	2	2	3	2	3	2	2	2	2	3	2		2	3	2

<b>23CSE706</b>	<b>HUMAN COMPUTER INTERACTION</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>J</b>	<b>C</b>
		<b>3</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>3</b>

**UNIT I FOUNDATIONS OF HCI 9**

The Human: I/O channels – Memory – Reasoning and problem solving; The Computer: Devices – Memory – processing and networks; Interaction: Models – frameworks – Ergonomics – styles – elements – interactivity- Paradigms. – Case Studies

**UNIT II DESIGN & SOFTWARE PROCESS 9**

Interactive Design: Basics – process – scenarios – navigation – screen design – Iteration and prototyping. HCI in software process: Software life cycle – usability engineering – Prototyping in practice – design rationale. Design rules: principles, standards, guidelines, rules. Evaluation Techniques – Universal Design.

**UNIT III MODELS AND THEORIES 9**

HCI Models: Cognitive models: Socio-Organizational issues and stakeholder requirements – Communication and collaboration models-Hypertext, Multimedia and WWW.

**UNIT IV MOBILE HCI 9**

Mobile Ecosystem: Platforms, Application frameworks- Types of Mobile Applications: Widgets, Applications, Games- Mobile Information Architecture, Mobile 2.0, Mobile Design: Elements of Mobile Design, Tools. – Case Studies

**UNIT V WEB INTERFACE DESIGN 9**

Designing Web Interfaces – Drag & Drop, Direct Selection, Contextual Tools, Overlays, Inlays and Virtual Pages, Process Flow – Case Studies.

**L : 45 T: 0 P: 0 J: 0 Total: 45 PERIODS**

**REFERENCES**

1. Alan Dix, Janet Finlay, Gregory Abowd, Russell Beale, —Human Computer Interaction, 3rd Edition, Pearson Education, 2004 .
2. Brian Fling, —Mobile Design and Development, First Edition, O’Reilly Media Inc., 2009 .
3. Bill Scott and Theresa Neil, —Designing Web Interfaces, First Edition, O’Reilly, 2009.

**COURSE OUTCOMES**

At the end of the course student should be able to:

- CO1** Design effective dialog for HCI
- CO2** Design effective HCI for individuals and persons with disabilities.
- CO3** Assess the importance of user feedback.
- CO4** Explain the HCI implications for designing multimedia/ ecommerce/ e-learning Web sites.

**CO5** Develop meaningful user interface

<b>CO/PO Mapping</b>															
<b>(S/M/W indicates strength of correlation)3-Strong, 2-Medium, 1-Weak</b>															
COs	Programme Outcomes(POs) / Programme Specific Outcomes(PSOs)														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO 1	PSO 2	PSO 3
CO1	2	2	3			2			3			2	3		2
CO2	2		2		1			1			2			2	
CO3			3	2		2			2			2			
CO4	3	1							3	2					2
CO5	2	1				2	2		1	2			3	2	3

<b>23CSE707</b>	<b>KNOWLEDGE ENGINEERING</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>J</b>	<b>C</b>
		<b>3</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>3</b>

**UNIT I INTRODUCTION TO KNOWLEDGE ENGINEERING 9**

Introduction – Data- Information and Knowledge - Skills of a Knowledge Engineer – Introduction to Knowledge Based systems – Types of Knowledge Based Systems

**UNIT II KNOWLEDGE ACQUISITION 9**

Information Gathering- Information Retrieval- Natural Language Processing-Information Extraction and Filtering

**UNIT III KNOWLEDGE REPRESENTATION AND REASONING 9**

Using Knowledge – Logic Rules and Representations – Developing Rule based System – Semantic Networks - Frames-.Uses of AI Language.

**UNIT IV METHODOLOGIES 9**

Need for methodologies – problem solving methods - KADS – Hybrid methodologies – Hybrid Knowledge base.

**UNIT V UNCERTAINTY 9**

Uncertain Reasoning: Uncertainty and Expert Systems – Confidence Factors – Probabilistic Reasoning-Fuzzy Logic .Ontologies – Design Principles for cognitive assistants.

**L : 45 T: 0 P: 0 J: 0 Total: 45 PERIODS**

**TEXT BOOKS**

1. Simon Kendal and Malcolm creen “An Introduction to knowledge Engineering”, Springer, First Edition, 2007.
2. Gheorghe Tecuci, Dorin Marcu, Mihai Boicu, David A. Schum, “Knowledge Engineering - Building Cognitive Assistants for Evidence Based Reasoning”, Cambridge University Press, 2016.

**REFERENCES**

1. John Debenham, “Knowledge Engineering - Unifying Knowledge Base and Database Design”, Springer 2007.
2. John G. Breslin Alexandre Passant Stefan Decker “The Social Semantic Web”, Springer 2010.

**COURSE OUTCOMES**

At the end of the course student should be able to:

- CO1** Understand the concepts central to the creation of knowledge bases
- CO2** Understand the basics of knowledge acquisition methods

**CO3** Analyze the various knowledge representations

**CO4** Know the different methodologies in problem solving

**CO5** Understand the uncertain reasoning and design principles

<b>CO/PO Mapping</b>															
<b>(S/M/W indicates strength of correlation)3-Strong, 2-Medium, 1-Weak</b>															
COs	Programme Outcomes(POs) / Programme Specific Outcomes(PSOs)														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO 1	PSO 2	PSO 3
CO1	3	2									2		3	1	
CO2	2				2	1		3							
CO3		3	1	2	3		2					3			2
CO4	2						1			3				2	
CO5	3	2		3	2			1			2		3	1	

**UNIT I STATISTICAL THEORY AND REGRESSION****9**

Linear methods for Regression – Gauss-Markov theorem – Multiple regression – Subset selection – Ridge regression – Principal components regression – Partial least squares - Linear discriminant analysis – Logistic regression.

**UNIT II SUPERVISED LEARNING****9**

Decision Tree Learning - Bayesian Learning - Bayes Theorem – Concept Learning – Maximum Likelihood – Minimum Description Length Principle – Bayes Optimal Classifier – Gibbs Algorithm – Naïve Bayes Classifier – Bayesian Belief Network – EM Algorithm.

**UNIT III DEEP LEARNING****9**

Neural Network Representation – Problems – Perceptron – Multilayer Networks and Back Propagation Algorithms - Convolutional neural networks - Recurrent neural networks – Create and deploy neural networks using Tensor Flow and Keras.

**UNIT IV UNSUPERVISED LEARNING****9**

Association rules – Cluster analysis – Self organizing maps – Principal components, curves and surfaces – Non-negative matrix factorization – Independent component analysis – Multidimensional scaling – Ensemble learning.

**UNIT V REINFORCEMENT LEARNING****9**

Introduction - Single State Case - Elements of Reinforcement Learning – Model Based Learning - Temporal Difference Learning – Q Learning Algorithm – Generalization - Partially Observable States.

**L : 45 T: 0 P: 0 J: 0 Total: 45 PERIODS****REFERENCES**

1. Tom M. Mitchell, “Machine Learning”, McGraw-Hill Education (India) Private Limited, 2013.
2. Trevor Hastie, Robert Tibshirani, Jerome Friedman, “The Elements of Statistical Learning: Data Mining, Inference, and Prediction”, Springer; Second Edition, 2009.
3. Alpaydin Ethem, “Introduction to Machine Learning”, MIT Press, Second Edition, 2010.
4. Gareth James, Daniela Witten, Trevor Hastie, Robert Tibshirani, “An Introduction to Statistical Learning: with Applications in R”, Springer; First Edition 2013.

**COURSE OUTCOMES**

At the end of the course student should be able to:

- CO1** Compare and Contrast various about regression methods.
- CO2** Illustrate various supervised learning algorithms.
- CO3** Create and deploy deep neural network applications.
- CO4** Synthesize the usage of unsupervised learning algorithms.

**CO5** Apply reinforcement learning algorithms to solve problems.

<b>CO/PO Mapping</b>															
<b>(S/M/W indicates strength of correlation)3-Strong, 2-Medium, 1-Weak</b>															
COs	Programme Outcomes(POs) / Programme Specific Outcomes(PSOs)														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO 1	PSO 2	PSO 3
CO1	1		3	1	3					1		2	3		
CO2		3	3	2							1			2	3
CO3	2	1			2		2						2	3	
CO4	2	2	3	2			1	1			3		2		
CO5	2	1		3		1			2					2	

**23CSE709**

**DEEP LEARNING**

**L T P J C**  
**3 0 0 0 3**

**UNIT I INTRODUCTION 9**

Introduction to machine learning- Linear models (SVMs and Perceptrons, logistic regression)- Intro to Neural Nets: What a shallow network computes- Training a network: loss functions, back propagation and stochastic gradient descent- Neural networks as universal function approximates.

**UNIT II DEEP NETWORKS 9**

History of Deep Learning- A Probabilistic Theory of Deep Learning- Back propagation and regularization, batch normalization- VC Dimension and Neural Nets-Deep Vs Shallow Networks Convolutional Networks- Generative Adversarial Networks (GAN), Semi-supervised Learning.

**UNIT III DIMENSIONALITY REDUCTION 9**

Linear (PCA, LDA) and manifolds, metric learning - Auto encoders and dimensionality reduction in networks - Introduction to Convnet - Architectures – AlexNet, VGG, Inception, ResNet - Training a Convnet: weights initialization, batch normalization, hyperparameter optimization.

**UNIT IV OPTIMIZATION AND GENERALIZATION 9**

Optimization in deep learning– Non-convex optimization for deep networks- Stochastic Optimization Generalization in neural networks- Spatial Transformer Networks- Recurrent networks, LSTM - Recurrent Neural Network Language Models- Word-Level RNNs & Deep Reinforcement Learning - Computational & Artificial Neuroscience

**UNIT V CASE STUDY AND APPLICATIONS 9**

Imagenet- Detection-Audio WaveNet-Natural Language Processing Word2Vec - Joint Detection-BioInformatics- Face Recognition- Scene Understanding- Gathering Image Captions.

**L : 45 T: 0 P: 0 J: 0 Total: 45 PERIODS**

**REFERENCES**

1. Cosma Rohilla Shalizi, Advanced Data Analysis from an Elementary Point of View, 2015.
2. Deng & Yu, Deep Learning: Methods and Applications, Now Publishers, 2013.
3. Ian Goodfellow, Yoshua Bengio, Aaron Courville, Deep Learning, MIT Press, 2016.
4. Michael Nielsen, Neural Networks and Deep Learning, Determination Press, 2015.

**COURSE OUTCOMES**

At the end of the course student should be able to:

- CO1** Understand basics of deep learning.
- CO2** Implement various deep learning models.
- CO3** Realign high dimensional data using reduction techniques.

**CO4** Analyze optimization and generalization in deep learning.

**CO5** Explore the deep learning applications.

<b>CO/PO Mapping</b>															
<b>(S/M/W indicates strength of correlation)3-Strong, 2-Medium, 1-Weak</b>															
COs	Programme Outcomes(POs) / Programme Specific Outcomes(PSOs)														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO 1	PSO 2	PSO 3
CO1	3			2		1							2		
CO2	2		2			1	2		2	2	2		1	2	3
CO3		3	2					2							
CO4		2		3	2							1	3	2	3
CO5			3		3	2				2	3		3		

**23CSE710**

**VIRTUAL SYSTEMS**

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**UNIT I BASIC CONCEPTS 9**

Introduction of Virtual Reality: Fundamental Concept and Components of Virtual Reality. Primary Features and Present Development on Virtual Reality.

**UNIT II Models of Virtual Reality 9**

Multiple Models of Input and Output Interface in Virtual Reality: Input -- Tracker, Sensor, Digital Glove, Movement Capture, Video-based Input, 3D Menus & 3DScanner etc. Output -- Visual /Auditory / HapticDevices

**UNIT III Visual Computation in Virtual Reality 9**

Fundamentals of Computer Graphics. Software and Hardware Technology on Stereoscopic Display. Advanced Techniques in CG: Management of Large Scale Environments & Real Time Rendering.

**UNIT IV Techniques & Tools in Virtual Reality 9**

Interactive Techniques in Virtual Reality: Body Track, Hand Gesture, 3D Manus, Object Grasp. Development Tools and Frameworks in Virtual Reality: Frameworks of Software Development Tools in VR. X3D Standard; Vega, MultiGen, Virtoolsetc.

**UNIT V Application 9**

Application of VR in Digital Entertainment: VR Technology in Film & TV Production. VR Technology in Physical Exercises and Games. Demonstration of Digital Entertainment by VR.

**L : 45 T: 0 P: 0 J: 0 Total: 45 PERIODS**

**TEXT BOOKS**

1. Alan B. Craig, Understanding Augmented Reality, Concepts and Applications, Morgan Kaufmann, 2013.
2. Burdea, G. C. and P. Coffet. Virtual Reality Technology, Second Edition. Wiley-IEEE Press, 2003/2006.

**REFERENCES**

1. Alan Craig, William Sherman and Jeffrey Will, Developing Virtual Reality Applications, Foundations of Effective Design, Morgan Kaufmann, 2009
2. Alan B Craig, William R Sherman and Jeffrey D Will, Developing Virtual Reality Applications: Foundations of Effective Design, Morgan Kaufmann, 2009
3. Doug A Bowman, Ernest Kujiff, Joseph J LaViola, Jr and Ivan Poupyrev, 3D User Interfaces, Theory and Practice, Addison Wesley, USA, 2005

## COURSE OUTCOMES

At the end of the course student should be able to:

- CO1** Identify, examine, and develop software that reflects fundamental techniques for the design and deployment of VR experiences.
- CO2** Choose, develop, explain, and defend the use of particular designs for VR experiences.
- CO3** Evaluate the benefits and drawbacks of specific VR techniques on the human body
- CO4** Identify and examine state-of-the-art VR design problems and solutions from the industry and academia.
- CO5** Summarize, distill, and design a research contribution within academic VR

<b>CO/PO Mapping</b>															
<b>(S/M/W indicates strength of correlation)3-Strong, 2-Medium, 1-Weak</b>															
COs	Programme Outcomes(POs) / Programme Specific Outcomes(PSOs)														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO 1	PSO 2	PSO 3
CO1	3	1						3						2	
CO2	3	3	2	3	3			2					3	3	
CO3	2	2	3	3	2								2		1
CO4		2	2	2	3						2		2	1	2
CO5	2	3	3	3	3							2	3	2	2