ANNA UNIVERSITY, CHENNAI
UNIVERSITY DEPARTMENTS
M.TECH. INFORMATION TECHNOLOGY
REGULATIONS – 2015
CHOICE BASED CREDIT SYSTEM

PROGRAMME EDUCATIONAL OBJECTIVES (PEOs) :

I. To prepare students to excel in research and to succeed in Information Technology profession through global, rigorous post graduate education.
II. To provide students with a solid foundation in computing, communication and information technologies that is required to become a successful IT professional or a researcher in the field of computer science and information technology.
III. To train students with good computing and communication knowledge so as to comprehend, analyze, design, and create novel software products and communication protocols for the real life problems.
IV. To inculcate students in professional and ethical attitude, effective communication skills, teamwork skills, multidisciplinary approach, and an ability to relate information technology issues to broader social context.
V. To provide student with an academic environment aware of excellence, leadership, written ethical codes and guidelines, and the life-long learning needed for a successful professional career

PROGRAMME OUTCOMES (POs):

On successful completion of the programme,

1. Graduates will demonstrate knowledge of information technology, computer science and communication engineering.
2. Graduates will demonstrate an ability to identify, formulate and solve computing and communication problems.
3. Graduate will demonstrate an ability to design effective and useful software and carry out research in the fields of computing and communication.
4. Graduates will demonstrate an ability to implement a system, component or process as per needs and specifications.
5. Graduates will demonstrate an ability to implement the projects that require knowledge from related fields like electronics and communication.
6. Graduate will demonstrate skills to use modern computing paradigms and computing platforms to develop products and projects that are useful to the society.
7. Graduates will demonstrate knowledge of professional and ethical responsibilities.
8. Graduate will be able to communicate effectively in both verbal and written form.
9. Graduate will show the understanding of impact of information technology solutions on the society and also will be aware of contemporary issues.
10. Graduate will develop confidence for self education and ability for life-long learning.

Attested

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Programme Educational Objectives	Programme Outcomes									
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
I	√		√							√
II	√	√	√	√	√					√
III			√	√	√		√			
IV							√	√	√	
V				√	√				√	√

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			PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
YEAR 1	SEM 1	Advances in Databases	√		√	√	√					
		Advanced Computer Architecture	√			√	√					
		Integrated Software Engineering Methodology	√	√	√	√	√					
		Advances In Data Structures and Algorithms	√	√	√	√	√					
		Probability and Statistical Methods		√	√							√
		Elective I										
	SEM 2	Data Science and Analytics	√	√	√	√	√					
		Advanced Java and Internet	√		√	√	√	√				
		Advanced Operating Systems	√		√	√	√					
		Distributed and Cloud Computing Technologies	√		√	√	√				√	
		Network Engineering	√			√	√	√			√	
		Elective II										
YEAR 2	SEM 1	Cryptography and Information Security	√		√	√	√				√	
		Wireless and Mobile Networks	√			√	√				√	
		Elective III										
		Elective IV										
		Project Work Phase I		√	√	√	√			√	√	√
		Technical Seminar and Report Writing				√	√			√		√
	SEM 2	Project Work Phase II		√	√	√	√			√	√	√

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ANNA UNIVERSITY, CHENNAI
UNIVERSITY DEPARTMENTS
M.TECH. INFORMATION TECHNOLOGY
REGULATIONS – 2015
CHOICE BASED CREDIT SYSTEM
CURRICULA AND SYLLABI

SEMESTER - I

SL. NO.	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
THEORY								
1.	IF 7102	Advances In Databases	PC	3	3	0	0	3
2.	IF 7101	Advanced Computer Architecture	PC	3	3	0	0	3
3.	IF 7103	Integrated Software Engineering Methodology	PC	3	3	0	0	3
4.	IF 7151	Advances In Data Structures and Algorithms	PC	3	3	0	0	3
5.	MA 7159	Probability and Statistical Methods	FC	4	4	0	0	4
6.		Elective I	PE	3	3	0	0	3
PRACTICALS								
7.	IF 7111	Data Structures Laboratory	PC	4	0	0	4	2
			TOTAL	**23**	**19**	**0**	**4**	**21**

II SEMESTER

SL. NO.	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
THEORY								
1.	IF 7202	Data Science and Analytics	PC	5	3	2	0	4
2.	IF 7201	Advanced Java and Internet	PC	5	3	2	0	4
3.	IF 7251	Advanced Operating Systems	PC	3	3	0	0	3
4.	IF 7203	Distributed and Cloud Computing	PC	3	3	0	0	3
5.	IF 7204	Network Engineering	PC	3	3	0	0	3
6.		Elective II	PE	3	3	0	0	3
PRACTICALS								
7.	IF 7211	Distributed Systems Laboratory	PC	4	0	0	4	2
			TOTAL	**26**	**18**	**4**	**4**	**22**

III SEMESTER

SL. NO.	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
THEORY								
1.	IF 7301	Cryptography and Information Security	PC	3	3	0	0	3
2.	IF 7302	Wireless and Mobile Networks	PC	3	3	0	0	3
3.		Elective III	PE	3	3	0	0	3
4.		Elective IV	PE	3	3	0	0	3
PRACTICALS								
5.	IF 7311	Technical Seminar and Report Writing	EEC	2	0	0	2	1
6.	IF 7312	Project Work Phase I	EEC	12	0	0	12	6
			TOTAL	**26**	**12**	**0**	**14**	**19**

IV SEMESTER

SL. NO.	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
PRACTICALS								
1.	IF 7411	Project Work Phase II	EEC	24	0	0	24	12
			TOTAL	**24**	**0**	**0**	**24**	**12**

TOTAL NO. OF CREDITS:74

ANNA UNIVERSITY, CHENNAI
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M.TECH. INFORMATION TECHNOLOGY (PART-TIME)
REGULATIONS – 2015
CHOICE BASED CREDIT SYSTEM
CURRICULA AND SYLLABI I TO VI SEMESTERS

I SEMESTER

SL. NO.	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
THEORY								
1.	IF 7101	Advanced Computer Architecture	PC	3	3	0	0	3
2.	IF 7151	Advances in Data Structures and Algorithms	PC	3	3	0	0	3
3.	MA 7159	Probability and Statistical Methods	FC	4	4	0	0	4
PRACTICALS								
4.	IF 7111	Data Structures Laboratory	PC	2	0	0	4	2
			TOTAL	**12**	**11**	**0**	**4**	**12**

II SEMESTER

SL. NO.	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
THEORY								
1.	IF 7251	Advanced Operating Systems	PC	3	3	0	0	3
2.	IF 7201	Advanced Java and Internet	PC	5	3	2	0	4
3.	IF 7202	Data Science And Analytics	PC	5	3	2	0	4
4.	IF 7204	Network Engineering	PC	3	3	0	0	3
			TOTAL	**16**	**12**	**4**	**0**	**14**

III SEMESTER

SL. NO.	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
THEORY								
1.	IF 7102	Advances In Databases	PC	3	3	0	0	3
2.	IF 7103	Integrated Software Engineering Methodology	PC	3	3	0	0	3
3.	IF 7302	Wireless and Mobile Networks	PC	3	3	0	0	3
PRACTICALS								
4.	IF 7311	Technical Seminar and Report Writing	EEC	2	0	0	2	1
			TOTAL	**11**	**9**	**0**	**2**	**10**

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IV SEMESTER

SL. NO.	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
THEORY								
1.	IF 7203	Distributed and Cloud computing	PC	3	3	0	0	3
2.		Elective I	PE	3	3	0	0	3
3.		Elective II	PE	3	3	0	0	3
PRACTICALS								
4.	IF 7211	Distributed Systems Laboratory	PC	4	0	0	4	2
			TOTAL	**13**	**9**	**0**	**4**	**11**

V SEMESTER

SL. NO.	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
THEORY								
1.	IF 7301	Cryptography and Information Security	PC	3	3	0	0	3
2.		Elective III	PE	3	3	0	0	3
PRACTICALS								
3.	IF 7312	Project Work Phase I	EEC	12	0	0	12	6
			TOTAL	**18**	**6**	**0**	**12**	**12**

VI SEMESTER

SL. NO.	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
THEORY								
1.		Elective IV	PE	3	3	0	0	3
PRACTICALS								
2.	IF 7411	Project Work Phase II	EEC	24	0	0	24	12
			TOTAL	**27**	**3**	**0**	**12**	**15**

TOTAL NO. OF CREDITS:74

FOUNDATION COURSES (FC)

SL.No	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
1.		Probability and Statistical Methods	FC	4	4	0	0	4

PROFESSIONAL CORE (PC)

SL. NO.	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
1.		Advances In Database	PC	3	3	0	0	3
2.		Network engineering	PC	3	3	0	0	3
3.		Integrated software Engineering Methodology	PC	3	3	0	0	3
4.		Advances In Data Structures and Algorithms	PC	3	3	0	0	3
5.		Data Structures Laboratory	PC	3	0	0	4	2
6.		Data Science and Analytics	PC	3	3	2	0	4
7.		Advanced Java and Internet	PC	3	3	2	0	4
8.		Advanced Operating Systems	PC	3	3	0	0	3
9.		Distributed and Cloud Computing	PC	3	3	0	0	3
10.		Advanced Computer Architecture	PC	3	3	0	0	3
11.		Distributed Systems Laboratory	PC	3	0	0	4	2
12.		Wireless and Mobile Networks	PC	3	3	0	0	3
13.		Cryptography And Information Security	PC	3	3	0	0	3

PROFESSIONAL ELECTIVES (PE)

SL. NO.	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
1.	IF 7001	3G and 4G Wireless Networks	PE	3	**3**	**0**	**0**	**3**
2.	IF 7004	Building Internet of Things	PE	3	3	0	0	3
3.	MM 7151	Advance Computer Graphics and Animation	PE	3	3	0	0	3
4.	IF 7006	Cyber Forensics	PE	3	3	0	0	3
5.	IF 7008	Design of Software Agents	PE	3	3	0	0	3
6.	IF 7010	E - Learning	PE	3	3	0	0	3
7.	IF 7011	Grid Computing Technologies	PE	3	3	0	0	3
8.	IF 7013	Knowledge Engineering	PE	3	3	0	0	3
9.	IF 7016	Semantic Web	PE	3	3	0	0	3
10.	BD 7071	Text Mining	PE	3	3	0	0	3
11.	IF 7071	Bio Informatics	PE	3	3	0	0	3
12.	IF 7014	Machine Learning	PE	3	3	0	0	3
13.	IF 7017	Social Network Analysis	PE	3	3	0	0	3
14.	IF 7003	Artificial Intelligence	PE	3	3	0	0	3
15.	IF 7005	Compiler Design	PE	3	3	0	0	3
16.	IF 7072	Computer Vision	PE	3	3	0	0	3
17.	IF 7007	Data Warehousing and Data Mining	PE	3	3	0	0	3
18.	IF 7009	Digital Signal Processing	PE	3	3	0	0	3
19.	IF 7015	Open Source Technologies	PE	3	3	0	0	3
20.	IF 7074	Human Computer Interaction	PE	3	3	0	0	3
21.	MM 7152	Digital Image Processing and Pattern Recognition	PE	3	3	0	0	3
22.	IF 7012	Information Retrieval	PE	3	3	0	0	3
23.	IF 7077	Service Oriented Architecture	PE	3	3	0	0	3
24.	IF 7018	Soft Computing and Application	PE	3	3	0	0	3
25.	IF 7019	Software Quality Assurance and Testing	PE	3	3	0	0	3
26.	IF 7451	Unix Internals	PE	3	3	0	0	3
27.	IF 7002	Ad hoc Mobile Wireless Networks	PE	3	3	0	0	3
28.	IF 7073	GPU Architecture and Programming	PE	3	3	0	0	3
29.	IF 7020	Virtualization	PE	3	3	0	0	3
30.	IF 7076	Operations Research	PE	3	3	0	0	3
31.	MM 7071	Digital Video Processing	PE	3	3	0	0	3
32.	MM 7252	Video Processing and Analytics	PE	3	3	0	0	3
33.	SW 7151	Software Architecture	PE	3	3	0	0	3
34.	IF 7075	Mobile Application Development	PE	3	3	0	0	3

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EMPLOYABILITY ENHANCEMENT COURSES (EEC)

SL NO	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
1.		Project Work Phase I	EEC	2	0	0	2	1
2.		Technical Seminar and Report Writing	EEC	12	0	0	12	6
3.		Project Work Phase II	EEC	24	0	0	24	12

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IF 7102 **ADVANCES IN DATABASES** **L T P C**
3 0 0 3

OBJECTIVES:

- To learn the modeling and design of databases.
- To acquire knowledge on parallel and distributed databases and its applications.
- To study the usage and applications of Object Oriented and Intelligent databases.
- To understand the usage of Mobile Databases.
- To learn emerging databases such as XML, Cloud and Big Data.
- To acquire inquisitive attitude towards research topics in databases.

UNIT I PARALLEL AND DISTRIBUTED DATABASES 9

Database System Architectures: Centralized and Client-Server Architectures – Server System Architectures – Parallel Systems- Distributed Systems – Parallel Databases: I/O Parallelism – Inter and Intra Query Parallelism – Inter and Intra operation Parallelism – Design of Parallel Systems- Distributed Database Concepts - Distributed Data Storage – Distributed Transactions – Commit Protocols – Concurrency Control – Distributed Query Processing – Case Studies

UNIT II OBJECT AND OBJECT RELATIONAL DATABASES 9

Overview of Object Database concepts - Object-Relational features: Object Database extensions to SQL - The ODMG Object Model and the Object Definition Language ODL-Object Database Conceptual Design - Object Query Language OQL - Overview of C++ Language Binding in the ODMG Standard .

UNIT III INTELLIGENT DATABASES 9

Active Databases: Syntax and Semantics (Starburst, Oracle, DB2)- Taxonomy- Applications- Design Principles for Active Rules- Temporal Databases: Overview of Temporal Databases- TSQL2- Deductive Databases-Recursive Queries in SQL- Spatial Databases- Spatial Data Types- Spatial Relationships- Spatial Data Structures-Spatial Access Methods- Spatial DB Implementation.

UNIT IV MOBILE DATABASES 9

Mobile Databases: Location and Handoff Management - Effect of Mobility on Data Management - Location Dependent Data Distribution - Mobile Transaction Models -Concurrency Control - Transaction Commit Protocols

UNIT V EMERGING TECHNOLOGIES 9

Multimedia Databases-XML Databases: XML Schema- XML Query Languages- Storing XML in Databases-XML and SQL- Web Databases- Data Warehousing - Data Mining-Cloud Based Databases -Introduction to Big Data-Storage-Analysis.

TOTAL: 45 PERIODS

OUTCOMES:

Upon Completion of the course, the students will be able,

- To develop in-depth understanding of relational databases and skills to optimize database performance in practice.
- To discuss and critique on each type of databases.
- To design faster algorithms in solving practical database problems.
- To implement intelligent databases and various data models.

REFERENCES:

1. Henry F Korth, Abraham Silberschatz, S. Sudharshan, “Database System Concepts”, Sixth Edition, McGraw Hill, 2011.
2. R. Elmasri, S.B. Navathe, “Fundamentals of Database Systems”, Sixth Edition, Pearson Education/Addison Wesley, 2010.
3. Carlo Zaniolo, Stefano Ceri, Christos Faloutsos, Richard T.Snodgrass, V.S.Subrahmanian, Roberto Zicari, “Advanced Database Systems”, Morgan Kaufmann publishers,2006.
4. Vijay Kumar, “Mobile Database Systems”, John Wiley & Sons, 2006.
5. C.J.Date, A.Kannan, S.Swamynathan, “An Introduction to Database Systems”, Eighth Edition, Pearson Education, 2006.

IF 7101 ADVANCED COMPUTER ARCHITECTURE L T P C
3 0 0 3

OBJECTIVES:

- To understand the evolution of computer architecture.
- To understand the state-of-the-art in computer architecture.
- To understand the design challenges in building a system.

UNIT I PIPELINING AND ILP 11

Fundamentals of Computer Design - Measuring and Reporting Performance - Instruction Level Parallelism and Its Exploitation - Concepts and Challenges - Overcoming Data Hazards with Dynamic Scheduling – Dynamic Branch Prediction - Speculation - Multiple Issue Processors – Case Studies.

UNIT II THREAD-LEVEL PARALLELISM 8

Multi-threading – Multiprocessors - Centralized and Distributed Shared Memory Architectures – Cache Coherence Issues - Performance Issues – Synchronization Issues – Models of Memory Consistency .

UNIT III SIMD AND GPU ARCHITECTURES 8

SIMD Extensions for Multimedia – Graphics Processing Units – GPU Computational Structures – GPY ISA – GPU Memory Structures – Case Study.

UNIT IV MEMORY HIERARCHY DESIGN 9

Introduction - Optimizations of Cache Performance - Memory Technology and Optimizations – Name Mapping Implementations - Virtual Memory and Virtual Machines - Design of Memory Hierarchies - Case Studies.

UNIT V INTERCONNECT AND STORAGE 9

Interconnection Networks – Buses, Crossbar and Multi-Stage Switches – Multi-Core Processor Architectures - Case Study. Warehouse- Scale Computers - Programming Models and Workloads – Storage Architectures – Physical Infrastructure – Case Study

TOTAL : 45 PERIODS

OUTCOMES:

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

- Compare and evaluate the performance of various architectures.
- Design sub-systems to meet specific performance requirements.
- Analyze the requirements of large systems to select and build the right infrastructure.

REFERENCES:

1. John L. Hennessey and David A. Patterson, “Computer Architecture – A quantitative approach”, Morgan Kaufmann / Elsevier, Fifth edition, 2012.
2. Richard Y. Kain, “Advanced Computer Architecture a Systems Design Approach”, PHI, 2011.
3. Hwang, Kai, A. Ramachandran, and R. Purushothaman. Advanced computer architecture: parallelism, scalability, programmability. Vol. 199. New York: McGraw-Hill, 1993.

IF 7103 INTEGRATED SOFTWARE ENGINEERING METHODOLOGY L T P C
3 0 0 3

OBJECTIVES:

- To provide information about wider engineering issues that form the background to developing complex, evolving (software-intensive) systems
- To plan a software engineering process to account for quality issues and non-functional requirements;
- To employ a selection of concepts and techniques to complete a small-scale analysis and design in mini projects
- To impart knowledge to translate requirement specifications into a design, and then realize that design practically, all using an appropriate software engineering methodology.
- To provide basic knowledge about software project management
- To learn UML models and tools
- To apply design patterns on various applications

UNIT I SOFTWARE PRODUCT AND PROCESS 9

Introduction – S/W Engineering Paradigm — Life Cycle Models –Introduction to System Concepts - Managing Complex Software — Properties – Object Oriented Systems Development – Object Basics – Systems Development Life Cycle Rumbaugh Methodology - Booch Methodology - Jacobson Methodology – Unified Process

UNIT II SOFTWARE REQUIREMENTS 9

Systems Engineering - Analysis Concepts - Functional and Non-Functional – Software Document – Requirement Engineering Process – Feasibility Studies – Software Prototyping – Prototyping in the Software Process – Data – Functional and Behavioral Models – Structured Analysis and Data Dictionary. Unified Approach – Unified Modeling Language – Static behavior diagrams – Dynamic Behavior diagrams – Object Constraint Language.

UNIT III DESIGN CONCEPTS AND PRINCIPLES 9

Design Process And Concepts – Modular Design – Design Heuristic – Architectural Design – Data Design – User Interface Design – Requirements to Design – Design Axioms – Logical Architecture - Designing Objects with Responsibilities – Object Design – Designing for Visibility. Patterns – Analysis and Design patterns – GoF Patterns - Mapping designs to code –Test Driven development and refactoring – UML Tools and UML as blueprint.

UNIT IV SOFTWARE TESTING 9

Taxonomy of Software Testing – Types of S/W Test – Black Box Testing – Testing Boundary Conditions – Structural Testing – Test Coverage Criteria Based on Data Flow Mechanisms – Regression Testing – Unit Testing – Integration Testing – Validation Testing – System Testing and Debugging – Software Implementation Techniques.

UNIT V SOFTWARE PROJECT MANAGEMENT 9

Measures and Measurements – ZIPF's Law – Software Cost Estimation – Function Point Models – COCOMO Model – Delphi Method – Scheduling – Earned Value Analysis – Error Tracking – Software Configuration Management – Program Evolution Dynamics – Software Maintenance – Project Planning – Project Scheduling– Risk Management – CASE Tools

TOTAL : 45 PERIODS

OUTCOMES:

Upon Completion of the course, the students should be able to

- Implement mini projects incorporating the basic principles of software engineering
- Familiar with the basic concepts of software design, implementation
- Familiar with software testing of simple mini projects
- Familiar with the Rational Rose and its equivalent open source tools for understanding basic software engineering concepts
- Design and implement some basic cost estimation models

- Critically analyze and apply software project management principles in simple projects\
- Familiarize with the topics of object oriented System designs
- Design patterns using UML
- Apply design patterns to various applications

REFERENCES:

1. Ian Sommerville, “Software engineering”, Ninth Edition, Pearson Education Asia, 2010.
2. Roger S. Pressman, “Software Engineering – A practitioner’s Approach”, Seventh Edition, Tata McGraw-Hill International Edition, 2009.
3. Ivar Jacobson, “Object Oriented Software Engineering”, Pearson Education,1992
4. Pankaj Jalote, “An Integrated Approach to Software Engineering”, Third Edition, Narosa publications, 2011.
5. Craig Larman. “Applying UML and Patterns – An introduction to Object-Oriented Analysis and Design and Iterative Development”, 3rd edition, Pearson Education, 2005.
6. Fowler, Martin. UML Distilled. 3rd edition, Pearson Education. 2004.
7. Michael Blaha and James Rumbaugh, “Object-oriented modeling and design with UML”, Prentice-Hall of India, 2005.
8. Grady Booch, “Object Oriented Analysis and Design”, 2nd edition, Pearson Education, 2000.
9. Ali Bahrami, “ Object Oriented Systems Development”, Tata McGrawHill, 1999.

IF 7151 ADVANCES IN DATA STRUCTURES AND ALGORITHMS L T P C

3 0 0 3

OBJECTIVES:

- To understand the usage of algorithms in computing.
- To learn and use hierarchical data structures and its operations
- To learn the usage of graphs and its applications.
- To select and design data structures and algorithms that is appropriate for problems. To study about NP Completeness of problems.

UNIT I ROLE OF ALGORITHMS IN COMPUTING 9

Algorithms – Algorithms as a Technology- Insertion Sort – Analyzing Algorithms – Designing Algorithms- Growth of Functions: Asymptotic Notation – Standard Notations and Common Functions- Recurrences: The Substitution Method – The Recursion-Tree Method

UNIT II HIERARCHICAL DATA STRUCTURES 9

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- Fibonacci Heaps: structure – Mergeable-heap operations- Decreasing a key and deleting a node-Bounding the maximum degree.

UNIT III GRAPHS 9

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; All-Pairs Shortest Paths: Shortest Paths and Matrix Multiplication – The Floyd-Warshall Algorithm;

UNIT IV ALGORITHM DESIGN TECHNIQUES 9

Dynamic Programming: Matrix-Chain Multiplication – Elements of Dynamic Programming – Longest Common Subsequence- Greedy Algorithms: An Activity-Selection Problem – Elements of the Greedy Strategy- Huffman Codes.

UNIT V NP COMPLETE AND NP HARD **9**

NP-Completeness: Polynomial Time – Polynomial-Time Verification – NP- Completeness and Reducability – NP-Completeness Proofs – NP-Complete Problems

TOTAL: 45 PERIODS

OUTCOMES:

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

- Design data structures and algorithms to solve computing problems.
- Design algorithms using graph structure and various string matching algorithms to solve real-life problems.
- Apply suitable design strategy for problem solving

REFERENCES:

1. Alfred V. Aho, John E. Hopcroft, Jeffrey D. Ullman, “Data Structures and Algorithms”, Pearson Education, Reprint 2006.
2. Robert Sedgewick and Kevin Wayne, “ALGORITHMS”, Fourth Edition, Pearson Education.
3. S.Sridhar,”Design and Analysis of Algorithms”, First Edition, Oxford University Press. 2014
4. Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest, Clifford Stein, “Introduction to Algorithms”, Third Edition, Prentice-Hall, 2011.

MA 7159 PROBABILITY AND STATISTICAL METHODS **L T P C**
4 0 0 4

OBJECTIVES:

- To introduce the basic concepts of one dimensional and two dimensional Random Variables.
- To provide information about Estimation theory, Correlation, Regression and Testing of hypothesis.
- To enable the students to use the concepts of multivariate normal distribution and principle components analysis.

UNIT I ONE DIMENSIONAL RANDOM VARIABLES **9+3**

Random Variables - Probability Function – Moments – Moment Generating Functions and Their Properties – Binomial, Poisson, Geometric, Uniform, Exponential, Gamma and Normal Distributions – Functions of a Random Variable.

UNIT II TWO DIMENSIONAL RANDOM VARIABLES **9+3**

Joint Distributions – Marginal and Conditional Distributions – Functions of Two Dimensional Random Variables – Regression Curve – Correlation.

UNIT III ESTIMATION THEORY **9+3**

Unbiased Estimators – Method of Moments – Maximum Likelihood Estimation - Curve fitting by Principle of Least Squares – Regression Lines.

UNIT IV TESTING OF HYPOTHESES **9+3**

Sampling Distributions - Type I and Type II Errors - Tests based on Normal, t,2 and F Distributions For Testing Of Mean, Variance And Proportions – Tests for Independence of Attributes and Goodness of Fit.

UNIT V MULTIVARIATE ANALYSIS **9+3**

Random Vectors and Matrices - Mean Vectors and Covariance Matrices - Multivariate Normal Density and Its Properties - Principal Components: Population Principal Components - Principal Components from Standardized Variables.

TOTAL= 45+15=60 PERIODS

OUTCOMES:

- The course provides the basic concepts of Probability and Statistical techniques for solving mathematical problems which is useful in solving Engineering problems.

REFERENCES:

1. Jay L. Devore, “Probability and Statistics for Engineering and the Sciences”, Thomson and Duxbury, 2002.
2. Richard Johnson. ”Miller & Freund’s Probability and Statistics for Engineer”, Prentice Hall , Seventh Edition, 2007.
3. Richard A. Johnson and Dean W. Wichern, “Applied Multivariate Statistical Analysis”, Pearson Education, Fifth Edition, 2002.
4. Gupta S.C. and Kapoor V.K.”Fundamentals of Mathematical Statistics”, Sultan and Sons, 2001.
5. Dallas E Johnson et al., “Applied multivariate methods for data analysis”, Thomson and Duxbury press, 1998.

IF 7111 DATA STRUCTURES LABORATORY L T P C
0 0 4 2

OBJECTIVES:

- To acquire the knowledge of using advanced tree structures.
- To learn the usage of heap structures.
- To understand the usage of graph structures and spanning trees.

EXPERIMENTS:

1. Implementation of Merge Sort and Quick Sort-Analysis
2. Implementation of a Binary Search Tree
3. Red-Black Tree Implementation
4. Heap Implementation
5. Fibonacci Heap Implementation
6. Graph Traversals
7. Spanning Tree Implementation
8. Shortest Path Algorithms (Dijkstra's algorithm, Bellmann Ford Algorithm)
9. Implementation of Matrix Chain Multiplication
10. Activity Selection and Huffman Coding Implementation.

TOTAL: 60 PERIODS

OUTCOMES:

Upon Completion of the course, the students will be able to:

- Design and implement basic and advanced data structures extensively.
- Design algorithms using graph structures
- Design and develop efficient algorithms with minimum complexity using design techniques.

IF 7202 DATA SCIENCE AND ANALYTICS L T P C
3 2 0 4

OBJECTIVES:

- To know the fundamental concepts of data science and analytics
- To learn various techniques for mining data streams
- To learn Event Modelling for different applications.
- To know about Hadoop and Map Reduce procedure

UNIT I INTRODUCTION TO DATA SCIENCE AND BIG DATA 9

Introduction to Data Science – Applications - Data Science Process – Exploratory Data analysis – Collection of data – Graphical presentation of data – Classification of data – Storage and retrieval of data – Big data – Challenges of Conventional Systems - Web Data – Evolution Of Analytic Scalability - Analytic Processes and Tools - Analysis vs Reporting - Modern Data Analytic Tools - Statistical Concepts: Sampling Distributions - Re-Sampling - Statistical Inference - Prediction Error.

UNIT II DATA ANALYSIS 9

Correlation – Regression – Probability – Conditional Probability – Random Variables – Analysis using Mean, Median, Mode, Standard Deviation, Skewness, Kurtosis- Regression Modeling - Multivariate Analysis - Bayesian Modeling - Inference and Bayesian Networks - Support Vector and Kernel Methods - Analysis of Time Series: Linear Systems Analysis - Nonlinear Dynamics –

UNIT III DATA MINING TECHNIQUES 9

Rule Induction - Neural Networks: Learning and Generalization - Competitive Learning - Principal Component Analysis and Neural Networks - Fuzzy Logic: Extracting Fuzzy Models from Data - Fuzzy Decision Trees - Stochastic Search Methods- Neuro-Fuzzy Modelling – Association rule mining – Clustering – Outlier Analysis – Sequential Pattern Mining – Temporal mining – Spatial mining – Web mining.

UNIT IV MINING DATA STREAMS 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 - Real time Analytics Platform(RTAP) Applications - Case Studies - Real Time Sentiment Analysis, Stock Market Predictions.

UNIT V FRAMEWORKS AND VISUALIZATION 9

Map Reduce – Hadoop, Hive, MapR – Sharding – NoSQL Databases – Cloud databases - S3 - Hadoop Distributed File Systems – Visualizations - Visual Data Analysis Techniques - Interaction Techniques – Social Network Analysis – Collective Inferencing – Egonets - Systems and Applications.

TOTAL:75 PERIODS

OUTCOMES:

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

- Work with big data platform and its analysis techniques.
- Design efficient algorithms for mining the data from large volumes.
- Model a framework for Human Activity Recognition
- Development with cloud databases

REFERENCES

1.Michael Berthold, David J. Hand, “Intelligent Data Analysis”, Springer, 2007.

2.Anand Rajaraman and Jeffrey David Ullman, “Mining of Massive Datasets”, Cambridge University Press, 2012.

3.Bill Franks, “Taming the Big Data Tidal Wave: Finding Opportunities in Huge Data Streams with Advanced Analytics”, John Wiley & sons, 2012.

4.Jiawei Han, Micheline Kamber “Data Mining Concepts and Techniques”, Second Edition, Elsevier, Reprinted 2008**.**

5. Rachel Schutt, Cathy O'Neil, “Doing Data Science”, O'Reilly Publishers, 2013.

6. Foster Provost, Tom Fawcet, “Data Science for Business”, O'Reilly Publishers, 2013.

7. Bart Baesens, “Analytics in a Big Data World: The Essential Guide to Data Science and its Applications“, Wiley Publishers, 2014.

8. S. N. Sivanandam, S. N Deepa, “Introduction to Neural Networks Using Matlab 6.0”, Tata McGraw- Hill Education, 2006.

IF 7201 **ADVANCED JAVA AND INTERNET** **L T P C**
3 2 0 4

OBJECTIVES:

- To understand the Java environment
- To learn Java application development using Swings and Middleware technology
- To explore advanced Java concepts
- To learn the Internet Programming

UNIT I JAVA BASICS AND ADVANCED FEATURES 9

JAVA basics - Inheritance - Inner Classes - Interfaces - New Interfaces - Streams - File and I/O - Threads - Packages - JAR files – Reflection – Ref objects – Logging - Concurrency utilities –JVM Tool Interface – Java VisualVM

UNIT II AWT, SWING AND MIDDLEWARES 9

AWT - Event Handling -SWING - Applets and Applications - JAVA Networking – Image I/O – Print Service - Collection Classes - JDBC - RMI – CORBA IDL – Scripting for the JAVA platform – Input method framework - JAVA beans

UNIT III ADVANCED JAVA CONCEPTS 9

Java management Extensions (JMX) – Java Native Interface (JNI) - JConsole - Java Mission Control (JMC) – Java Flight Recorder (JFR) – Java Platform Debugger Architecture (JPDA) – Java2D -

UNIT IV MARKUP LANGUAGES AND INTERNET PROGRAMMING 9

Hyper-Text Markup Language (HTML) – Cascading Style Sheets (CSS) – Extensible Markup Language (XML) and API – Java API for XML Processing (JAXP)– Extensible Style Sheet Language (XSL) – Document Type Definition (DTD) – XML schema – Document Object Model (DOM) Parser – SAX parser - JAXR – Java Architecture for XML binding (JAXB) – Java API for XML web services (JAX-WS) – Java Authentication and Authorization service (JAAS)

UNIT V INTERNET PROGRAMMING FRAMEWORKS 9

Servlet – JSP – Session management – Cookies – Java web start – Java plug-ins – Deployment, Plug-in and web start tools – Internationalization Tools – Internationalization of Applications - JAVA web security – Current Trends

TOTAL: 75 PERIODS

OUTCOMES:

Upon the completion of the course the student should be able

- To become familiar with the Java environment
- To develop Java application using Swings and Middleware technology
- To practice advanced Java concepts
- To work in the Internet frameworks

REFERENCES

1. Kogent Learning Solutions Inc,"JAVA 7 Programming Black Book", DreamTech Press, 2010.
2. http://docs.oracle.com/javase/7/docs/

IF 7251 **ADVANCED OPERATING SYSTEMS** **L T P C**
3 0 0 3

OBJECTIVES:

- To learn the fundamentals of Operating system.
- To gain knowledge on Distributed operating system concepts that includes architecture, Mutual exclusion algorithms, Deadlock detection algorithms and agreement protocols.
- To gain insight on to the distributed resource management components viz. the algorithms for implementation of distributed shared memory, recovery and commit protocols.
- To know the components and management aspects of Real time, Mobile operating systems.

UNIT I OPERATING SYSTEM BASICS **9**

Overview – Synchronization Mechanisms – Process and Threads- Process Scheduling – Deadlocks: Detection – Prevention- Recovery – Models of Resources – Memory Management.

UNIT II DISTRIBUTED OPERATING SYSTEM **9**

Issues in Distributed Operating System – Architecture – Communication Primitives – Lamport's Logical clocks – Causal Ordering of Messages – Distributed Mutual Exclusion Algorithms – Centralized and Distributed Deadlock Detection Algorithms – Agreement Protocols.

UNIT III DISTRIBUTED RESOURCE MANAGEMENT **9**

Distributed File System – Design Issues - Distributed Shared Memory – Algorithms for Implementing Distributed Shared memory–Issues in Load Distributing – Scheduling Algorithms – Synchronous and Asynchronous Check Pointing and Recovery – Fault Tolerance – Two-Phase Commit Protocol – Non-blocking Commit Protocol – Security and Protection.

UNIT IV REAL TIME & MOBILE OPERATING SYSTEMS **9**

Basic Model of Real Time Systems - Characteristics- Applications of Real Time Systems – Real Time Task Scheduling - Handling Resource Sharing - Mobile Operating Systems –Micro Kernel Design - Client Server Resource Access – Processes and Threads - Memory Management - File system-Android.

UNIT V CASE STUDIES **9**

Linux System: Design Principles - Kernel Modules - Process Management Scheduling - Memory Management - Input-Output Management - File System - Inter process Communication. Windows XP: Design Principles - System Components - Process and Thread Management - Memory Management - File System. iphone iOS4: Architecture and SDK Framework - Media Layer - Services Layer - Core OS Layer - File System.

TOTAL:45 PERIODS

OUTCOMES:

Upon Completion of the course, the students should be able to:

- A complete overview of process management & memory management of Operating system.
- Ability to demonstrate the Mutual exclusion, Deadlock detection and agreement protocols of Distributed operating system.

REFERENCES:

1. Mukesh Singhal, Niranjan G Shivaratri, "Advanced Concepts in Operating Systems – Distributed, Database, and Multiprocessor Operating Systems", Tata McGraw-Hill, 2001.
2. Abraham Silberschatz; Peter Baer Galvin; Greg Gagne, "Operating System Concepts", Ninth Edition, John Wiley & Sons, 2012.
3. Andrew S.Tanenbaum, "Modern Operating System", Third Edition, Prentice Hall Inc., 2008.
4. Rajib Mall, "Real-Time Systems: Theory and Practice", Pearson Education India, 2006.
5. H M Deital, P J Deital and D R Choffnes, "Operating Systems", Pearson Education, 2004.
6. Neil Smyth, "iPhone iOS 4 Development Essentials – Xcode", Fourth Edition, Payload media,2011.
7. Neil Smyth, "Android 4.4 for App Development-Essentials", Payload Media, 2014.

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IF 7203 DISTRIBUTED AND CLOUD COMPUTING L T P C
3 0 0 3

OBJECTIVES:

- To learn distributed communication
- To understand distributed resource management
- To study the basics of cloud computing
- To study about virtualization and cloud resource management

UNIT I DISTRIBUTED COMMUNICATION 7

Introduction to Distributed Systems – Characterization of Distributed Systems – Distributed Architectural Models –Remote Invocation – Request-Reply Protocols – Remote Procedure Call – Remote Method Invocation – Group Communication – Coordination in Group Communication– Ordered Multicast – Time Ordering – Physical Clock Synchronization – Logical Time and Logical Clocks.

UNIT II DISTRIBUTED RESOURCE MANAGEMENT 11

Global States– Distributed Mutual Exclusion – Election Algorithms – Distributed Deadlock – Distributed File System Architecture – HDFS – Map Reduce.

UNIT III INTRODUCTION TO CLOUD 9

Cloud Computing Overview – Origins of Cloud computing – Cloud components - Essential characteristics – On-demand self-service , Broad network access , Location independent resource pooling , Rapid elasticity , Measured service. Architectural influences – High-performance Computing, Utility and Enterprise Grid Computing, Autonomic Computing, Service Consolidation, Horizontal scaling, Web services, High scalability Architecture. Cloud Benefits – Cloud Deployment Model: Public Clouds – Private Clouds – Community Clouds - Hybrid Clouds - Advantages of Cloud Computing.

UNIT IV VIRTUALIZATION TECHNIQUES 9

Introduction to Virtual Machines, Emulation :Interpretation and Binary Translation,Process Virtual machines and System Virtual machinesVirtualization : Virtualization and cloud computing - Need of virtualization – limitations – Types of Hardware Virtualization: Full Virtualization – Para Virtualization – Case Studies : Xen,VMware – Desktop Virtualization – Network Virtualization.

UNIT V CLOUD RESOURCES MANAGEMENT AND ISSUES 9

Cloud architecture: Cloud delivery model,Cloud Storage Architectures, Software as a Service (SaaS): SaaS service providers – Google App Engine, Salesforce.com and googleplatfrom – Benefits – Operational benefits - Economic benefits – Evaluating SaaS – Platform as a Service (PaaS): PaaS service providers – Right Scale – Salesforce.com – Rackspace – Force.com – Services and Benefits – Infrastructure-as-a -Service (IaaS): IaaS Service Providers – Amazon EC2 – GoGrid.

TOTAL:45PERIODS

OUTCOMES:

Upon the completion of the course the student should be able

- To appreciate distributed communication
- To design distributed resource management
- To become familiar with the basics of cloud computing
- To implement virtualization and cloud resource management

REFERENCES:

1. George Coulouris, Jean Dollimore, Tim Kindberg, Distributed Systems Concepts and Design, Fifth Edition, Pearson Education Asia, 2012.
2. Distributed Systems - Principles and Paradigms, Andrew S. Tanenbaum,Maarten Van Steen, Second Edition, Pearson Prentice Hall, 2006.
3. MukeshSinghal, Advanced Concepts In Operating Systems, McGraw Hill Series in Computer Science, 1994.

4. Cloud Computing A Practical Approach - Anthony T.Velte, Toby J. Velte, Robert Elsenpeter Tata-McGraw- Hill , New Delhi – 2010.
5. James E. Smith and Ravi Nair, Virtual Machines, Morgan Kaufman, 2005.
6. Kai Hwang, Geofrey C. Fox and Jack J. Dongarra, Distributed and Cloud Computing, Morgan Kaufmann, 2012.
7. Boris Lublinsky, Kevin T. Smith, Alexey Yakubovich, ProfessionalHadoop Solutions, Wrox, Wiley, 2013.

IF 7204 NETWORK ENGINEERING L T P C
3 0 0 3

OBJECTIVES:

- To provide an introduction to the principles and practices of Network Engineering.
- To understand the architecture of the network devices.
- To learn QoS related methodologies.
- To explore the emerging technologies in network engineering.

UNIT I FOUNDATIONS OF NETWORKING 9

Communication Networks –Network Elements –Switched Networks and Shared media Networks – Probabilistic Model and Deterministic Model –Datagrams and Virtual Circuits –Multiplexing– Switching -Error and Flow Control –Congestion Control –Layered Architecture –Network Externalities –Service Integration.

UNIT II QUALITY OF SERVICE 9

Traffic Characteristics and Descriptors –Quality of Service and Metrics –Best Effort model and guaranteed Service Model –Limitations of IP networks –Scheduling and Dropping Policies for BE and GS models –Traffic Shaping Algorithms–End to End Solutions –Laissez Faire Approach – Possible improvements in TCP –Significance of UDP in Inelastic Traffic

UNIT III HIGH PERFORMANCE NETWORKS 9

Integrated Services Architecture –Components and Services –Differentiated Services Networks – Per Hop Behavior –Admission Control–MPLS Networks –Principles and Mechanisms –Label Stacking–RSVP–RTP/RTCP.

UNIT IV NETWORK DEVICE ARCHITECTURE 9

Network Devices –Switch–Router–Hardware Components-Software –Configuration–Routing Concepts-Static Routing –Dynamics Routing –Routing Information Protocol –Configuration –Open Shortest Path First Protocol –Configuration –Access Control List –Standard –Extended –Named. Multiplexers, Modems and Internet Access Devices –Switching and Routing Devices-Router Structure -Configuring EGP –RIP –OSPF –IS-IS-Hub -Bridges –Routers –Link Virtualization - Multicast Architecture.

UNIT V SOFTWARE DEFINED NETWORKING 9

Evolution of SDN -Control Plane - Control and data plane separation - Network Virtualization - Data Plane - Programming SDNs - Verification and Debugging - openflow networks.

TOTAL: 45 PERIODS

OUTCOMES:

Upon Completion of the course, the students will be able to:

- Explain the of the principles of network engineering.
- Knowledge of network engineering concepts and techniques.
- recent development in network engineering

REFERENCES:
1.Mahbub Hassan and Raj Jain, 'High Performance TCP/IP Networking', Pearson Education/PHI, 2009.
2.Larry L Peterson and Bruce S Davie, 'Computer Networks: A Systems Approach', Fifth Edition, Morgan Kaufman Publishers, 2012.
3.Jean Warland and Pravin Vareya, 'High Performance Networks', Morgan Kauffman Publishers, 2002
4.James Macfarlane," Network Routing Basics: Understanding IP Routing in Cisco Systems", Wiley edition 1 2006.
5.Wendell Odom and Rick McDonald, "Routers and Routing Basics CCNA 2 Companion Guide (Cisco Networking Academy)", Cisco press, 2006.
6. Thomas Nadeau , Ken Gray, "SDN - Software Defined Networks", O'reilly Publishers, 2013.

IF 7211 DISTRIBUTED SYSTEMS LABORATORY L T P C
0 0 4 2

OBJECTIVES:

- This laboratory is focused on developing web applications in the cloud. By the end of this module the student will have a detailed overview of the design and development process involved in creating a cloud based application.
- Student would do any four of the following exercises

DISTRIBUTED SYSTEMS IMPLEMENTATIONS:

1. Connect a minimum of 3 nodes and implement a group chat amongst them.
2. Implement any one of the message ordering algorithms on the previously implemented system.
3. Implement an election algorithm to elect a co-ordinator for the system.
4. Perform clock synchronization on the system, with the co-ordinator node's time as reference.

CLOUD EXPERIMENTS:

5.Create a VM image which has a C compiler along with an operating system and do the following experiments
   a. Fibonacci Series
   b. File Operations
6. Install Virtualbox with different flavours of linux or windows OS on top of windows7 or 8
7. Install GAE and run a quicksort using python.
8. Install and run EucalyptusFaststart .
9. Create two nodes in Eucalyptus and exchange data.

MINI PROJECT

1. Simulate a cloud scenario using Cloud Sim and run a scheduling algorithm not present in Cloud Sim

or

2. Installhadoop and manipulate a large dataset and run on Hadoop

TOTAL: 60 PERIODS

OUTCOME:

- To be able to develop distributed and cloud based applications

IF 7301 CRYPTOGRAPHY AND INFORMATION SECURITY L T P C
3 0 0 3

OBJECTIVES:

- To understand the mathematics behind Cryptography.
- To understand the standard algorithms used to provide confidentiality, integrity and authenticity.
- To get the knowledge of various security practices applied in the field of information technology.

UNIT I FUNDAMENTALS AND MATHEMATICS OF CRYPTOGRAPHY 9

Overview - Classical Crypto Systems – Substitution Ciphers –Transposition Ciphers- Stream and Block Ciphers – Introduction to Number Theory – Congruences – Chinese Remainder theorem – Modular Arithmetic-Modular Exponentiation – Fermats and Eulers Theorem - Finite Fields – GF(2n) Fields.

UNIT II ENCRYPTION TECHNIQUES 9

Symmetric Encryption Techniques – DES – AES- Public-Key Cryptography and RSA – Key Management - Diffie-Hellman Key Exchange – Elliptic Curve Cryptography – Symmetric Key Distribution – Kerberos - X.509 Authentication Service - differential cryptanalysis - linear cryptanalysis - side channel attack - lattice reduction attack - Merkle-Hellman knapsack attack - Hellman's time-memory tradeoff (TMTO) attack

UNIT III HASH FUNCTIONS AND SIGNATURES 9

Message Authentication and Hash Functions – Description of MD Hash Family – Secure Hash Algorithms – SHA 512 - Digital Signatures and Authentication Protocols – Digital Signature Standard – Process, Services, Attacks on Digital Signature- Digital Signature Schemes.

UNIT IV INFORMATION SECURITY PRONCIPLES 9

Information Security-Statistical database security -Access Control Models - Discretionary Access Control (DAC)-Mandatory Access Control (MAC)- Role-Based Access Control (RBAC); Network and Internet Security-E-mail security-User Safety-Program Security -- Viruses, Worms-Firewalls-Intrusion Detection, Fault tolerance and recovery-Information Warfare-Security Administration

UNIT V APPLICATIONS 9

Multilevel Security- Multilevel Security Architectures- Oracle Virtual Database System-Identification/Authentication-Database Intrusion Control- Survivable Database Systems-Distributed databases- Secure transaction processing - Security in Data warehousing- Data Mining and Security- Cloud Security- Web Databases-Semi-structured Databases XML Security-Case studies- System Security-Windows security- UNIX security and Security-Enhanced Linux (SELinux)-Web security- Cross Site Scripting, Cross Site Request Forgery, SQL Injection.

TOTAL: 45 PERIODS

OUTCOMES:

Upon Completion of the course, the students should be able to,

- Apply the basic security algorithms required by any computing system.
- Predict the vulnerabilities across any computing system and hence be able to design a security solution for any computing system.

REFERENCES:

1. Douglas R. Stinson. Cryptography Theory and Practice (2nd ed). CRC Press, 2002
2. Alfred J. Menezes, Paul C. van Oorshot, Scott A. Vanstone. Handbook of Applied Cryptography. CRC Press, 1997.
3. William Stallings, “Cryptography and Network Security – Principles and Practices”, Pearson Education, Sixth Edition, 2013.
4. Wade Trappe and Lawrence C. Washington, “Introduction to Cryptography with Coding Theory” Second Edition, Pearson Education, 2007.
5. Mark Stamp, “Information Security: Principles and Practice”, Wiley Inter Science, 2011.
6. OWASP top ten security vulnerabilities: http://xml.coverpages.org/OWASP-TopTen.pdf
7. Charles B. Pfleeger, Shari Lawrence Pfleeger, “Security in Computing”, Fourth Edition, Pearson Education, 2007.

IF 7302 WIRELESS AND MOBILE NETWORKS L T P C
OBJECTIVES 3 0 0 3

- To become familiar with the prevailing wireless environment
- To understand 3G and 4G cellular networks
- To study about WiFi and WiMax standards
- To learn about the two types of ad hoc networks in practice
- To explore mobile computing architecture and mobile application development

UNIT I WIRELESS SCENARIO 9

Aspects of Mobility - Applications - Location Dependant Services - Mobile devices - Device Portability - WiFi Alliance - WiMax Forum - Bluetooth Technology - 3GPP - OMA - Ad hoc Networks - Satellites - Interoperability - Machine to Machine Communication - Differences between M2M and IoT - Wearable Computing

UNIT II 3G AND 4G CELLULAR NETWORKS 9

Evolution of Cellular Networks - IMT 2000 and UMTS - UMTS Architecture - User Equipment - RNS - UTRAN - Node B - RNC Functions - USIM - Protocol Stack - CS and PS domain - IMS Architecture – 3.5G and 3.9G - 4G LAN and Cellular Networks - LTE - Control plane - NAS and RRC - User plane - PDCP, RLC and NAC – Current Trends

UNIT III WIRELESS DATA NETWORKS 9

IEEE 802.11 WLAN – Architecture and Protocol Stack – Physical Layer, MAC Layer – CSMA/CA, Virtual Carrier Sensing, IFS, Fragmentation and Reassembly – Security – WEP, 802.1x Authentication – WiMax Networks – IEEE 802.16, Physical Layer – Building blocks – Reference Model

UNIT IV WIRELESS AD HOC NETWORKS 9

Principles of Ad hoc Networking – Ad hoc Networks in Practice - Sensor Networks - Data Centric computing , Geographic and Energy Aware Routing, In Network Processing, Data Aggregation, Data Dissemination – Bluetooth – Piconet and Scatternet – Protocol Stack

UNIT V MOBILE COMPUTING ARCHITECTURE 9

Three tier Architecture - Presentation Tier - Application Tier - Middleware , ICAP, Web Services - Data Tier - Database Middleware , Sync ML - Content Aware System - Client Context Manager - Composite Capabilities / Preferences Profile (CC/PP) - Policy and Security Managers - Pervasive Application Architecture with MVC Pattern - Secure Pervasive Access Architecture

TOTAL : 45 PERIODS

OUTCOMES

Upon completion of the course, the students should be able

- To have awareness of the existing wireless scenario
- To deploy 3G networks
- To design and implement wireless ad hoc networks
- To design and implement mobile applications efficiently

REFERENCES:

1. Asoke K Talukder, Hasan Ahmed, Roopa R Yavagal, “Mobile Computing Technology, Applications and Service Creation”, 2nd ed, Tata McGraw Hill, 2010.
2. Feng Zhao and Leonidas Guibas, ‘Wireless Sensor Networks’, Morgan Kaufmann Publishers, 2004.
3. Gottapu Sasibhushana Rao, "Mobile Cellular Communication", Pearson Education, 2013
4. Reza B'Far, "Mobile Computing Principles: Designing and Developing Mobile Applications with UML and XML", Cambridge Press University, 2009
5. Jochen Burthardt et al, ‘Pervasive Computing Technology and Architecture of Mobile Internet Applications’, Pearson Education, 2003.
6. Pattnaik Prasant Kumar and Mall Rajib, "Fundamentals of Mobile Computing", PHI, 2012

7. Carlos De Morais Cordeiro, Dharma Prakash Agrawal “Ad Hoc and Sensor Networks Theory and Applications (2nd Edition), World Scientific Publishing, 2011.
8. Maciej Stasiak, Mariusz Glabowski, Arkadiusz Wisniewski, Piotr Zwierzkowski, "Wireless Networks: From GSM to LTE", John Wiley Publications, 2010
9. Reto Meier, Wrox Wiley, “Professional Android 2 Application Development”, 2010

IF 7001 3G AND 4G WIRELESS NETWORKS L T P C
3 0 0 3

OBJECTIVES:

- To learn various generations of wireless and cellular networks.
- To study about fundamentals of 3G Services, its protocols and applications.
- To study about evolution of 4G Networks, its architecture and applications.
- To study about Wi MAX networks, protocol stack and standards.
- To understand about the emerging trends of smart phones and evolution of latest standards like DLNA, NFC and femtocells

UNIT I INTRODUCTION 9

Introduction: History of Mobile Cellular Systems - First Generation - Second Generation - Generation 2.5 - Overview of 3G & 4G. 3GPP and 3GPP2 standards

UNIT II 3G NETWORKS 9

Evolution from GSM, 3G Services and Applications - UMTS network structure - Core network - UMTS Radio access - HSPA – HSUPA- HSDPA- CDMA 1X – WCDMA

UNIT III 4G LTE 10

LTE: Introduction, Radio interface architecture - Physical layer, Access procedures - System Architecture Evolution (SAE) - Communication protocols – Interfaces- LTE Advanced.

UNIT IV WIMAX NETWORKS 8

Introduction to WiMax Networks– IEEE 802.16 – Frame Format – Protocols - OFDM – MIMO - IEEE 802.20 – Applications.

UNIT V DLNA & NFC REVOLUTION 9

Introduction and Evolution - Applications of DLNA and NFC – DLNA Architecture and Protocol stack - Smart phone and NFC – Mobile Commerce and NFC – NFC tags –Security Issues – Femtocells from the network operators and user’s point of view.

TOTAL: 45 PERIODS

OUTCOMES:

Upon the completion of the course the student should be able

- To appreciate the evolution of cellular networks.
- To deploy 3G Services.
- To explore the developments in 4G Networks.
- To implement Wi MAX networks, protocol stack and standards.

REFERENCES:

1. Juha Korhonen, “Introduction to 3G Mobile Communication”, Artech House, 2003
2. Erik Dahlman, Stefan Parkvall, Johan Skold and Per Beming , “3G Evolution HSPA and LTE for Mobile Broadband”, Academic Press, 2008
3. Flavio Muratore, “UMTS Mobile Communication for the Future”, John Wiley & Sons , 2001
4. Harri Holma and Antti Toskala, “HSDPA/HSUPAfor UMTS”, Johan Wiley & Sons, 2006.
5. Martin Sauter, “ 3G & 4G & Beyond: Bringing Networks, Devices and the Web together”, second edition, Wiley, 2013.

IF 7004 **BUILDING INTERNET OF THINGS** **L T P C**
3 0 0 3

OBJECTIVES :

- To understand the fundamentals of Internet of Things.
- To build a small low cost embedded system using Arduino / Raspberry Pi or equivalent boards.
- To apply the concept of Internet of Things in the real world scenario

UNIT I FUNDAMENTALS OF IOT **9**

Introduction-Characteristics-Physical design - Protocols – Logical design – Enabling technologies – IoT Levels – Domain Specific IoTs – IoT vs M2M.

UNIT II IOT DESIGN METHODOLOGY **9**

IoT systems management – IoT Design Methodology – Specifications Integration and Application Development.

UNIT III BUILDING IOT WITH RASPBERRY PI **9**

Physical device – Raspberry Pi Interfaces – Programming – APIs / Packages – Web services -

UNIT IV BUILDING IOT WITH GALILEO/ARDUINO **9**

Intel Galileo Gen2 with Arduino- Interfaces - Arduino IDE – Programming - APIs and Hacks

UNIT V CASE STUDIES and ADVANCED TOPICS **9**

Various Real time applications of IoT- Connecting IoT to cloud – Cloud Storage for Iot – Data Analytics for IoT – Software & Management Tools for IoT

TOTAL: 45 PERIODS

OUTCOMES:

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

- Design a portable IoT using Arduino/ equivalent boards and relevant protocols.
- Develop web services to access/control IoT devices.
- Deploy an IoT application and connect to the cloud.
- Analyze applications of IoT in real time scenario

REFERENCES:

1. Arshdeep Bahga, Vijay Madisetti, “Internet of Things – A hands-on approach”, Universities Press, 2015.
2. Manoel Carlos Ramon, “Intel® Galileo and Intel® Galileo Gen 2: API Features and Arduino Projects for Linux Programmers”, Apress, 2014.
3. Marco Schwartz, “Internet of Things with the Arduino Yun”, Packt Publishing, 2014.

MM 7151 **ADVANCE COMPUTER GRAPHICS AND ANIMATION** **L T P C**
3 0 0 3

OBJECTIVES:

- To understand the basics of geometry processing.
- To understand the fundamentals of pipelined rasterization rendering of meshed objects and curved surfaces.
- To understand and work with advanced rendering methods such as radiosity.
- To design programs for advanced animation methods and
- To become proficient at graphics programming using OpenGL

UNIT I INTRODUCTION 9

Basics, Scope and Applications, Graphics Standards, Display systems, Image formation, Graphics Systems, Coordinate systems, Line-Drawing Algorithms, Parallel Line Algorithms, Circle drawing algorithms, Area Filling, Clipping Algorithms: Line and Polygon, Anti-aliasing.

UNIT II TRANSFORMATIONS 9

Affine Transformations (2D & 3D): Translation, Rotation, Scaling, Reflection and Shearing; Hierarchical Modeling & viewing: The Camera Transformation – Perspective, orthographic and Stereographic views;

UNIT III FRACTALS 9

Fractals and Self similarity – Peano curves – Creating image by iterated functions – Mandelbrot sets – Julia Sets – Random Fractals – Overview of Ray Tracing – Intersecting rays with other primitives –– Reflections and Transparency – Boolean operations on Objects - its applications

UNIT IV ADVANCED RENDERING TECHNIQUE 9

Curves and Surfaces: Bezier, B-Splines and NURBS; Color models; Photorealistic rendering; Global Illumination; Ray tracing; Monte Carlo algorithm; Adding Surface texture- Texture Synthesis – Bump Mapping, Environmental mapping; Advanced Lighting and Shading,

UNIT V ANIMATION 9

Overview of Animation Techniques – Keyframing, Computer Animation; Motion capture and editing; forward/Inverse Kinematics; Deformation models; Facial animation. Raster methods – Design of animation sequences – animation techniques – Key-frame systems – motion specification – direct, dynamics – rigid body animation –– radiosity – collision detection – Graphics file format – Opengl animation procedures

TOTAL:45 PERIODS

OUTCOMES:

Upon completion of this course, the student will:

- Analyze the fundamentals of 2D and 3D computer graphics.
- Discuss the basic algorithms commonly used in 3D computer graphics.
- Describe advanced computer graphics techniques and applications.
- Analyze computer graphics and solid modelling techniques for various applications.

TEXT BOOKS:

1. Donald D. Hearn, M. Pauline Baker, Warren Carithers, "Computer Graphics with Open GL", 4th Edition, Prentice Hall, 2011.
2. Alan Watt and Mark Watt, "Advanced Animation and Rendering Techniques: Theory and Practice", Addison-Wesley, 1992
3. Foley, van Dam, Feiner, Hughes, "Computer Graphics Principles and Practice", Third Edition in C. Addison Wesley, 2014.
4. Edward Angel and Dave Shreiner, "Interactive Computer Graphics: A top-down approach with OpenGL", Sixth Edition Addison Wesley, 2012.
5. Rick Parent, "Computer Animation - Algorithms and Techniques", Third Edition Morgan Kaufman, 2012.

IF 7006 **CYBER FORENSICS** **L T P C**
3 0 0 3

OBJECTIVES:

- To study the fundamentals of computer forensics.
- To have an overview of techniques for Data Recovery and Evidence Collection.
- To study various threats associated with security and information warfare.
- To study the tools and tactics associated with cyber forensics.

UNIT I INTRODUCTION **7**

Computer Forensics Fundamentals – Types of Computer Forensics Technology – Types of Vendor and Computer Forensics Services.

UNIT II COMPUTER FORENSICS EVIDENCE AND CAPTURE **8**

Data Recovery – Evidence Collection and Data Seizure –Duplication and Preservation of Digital Evidence – Computer Image Verification and Authentication.

UNIT III COMPUTER FORENSIC ANALYSIS **10**

Discover of Electronic Evidence – Identification of Data – Reconstructing Past Events Fighting against Macro Threats – Information Warfare Arsenal – Tactics of the Military–Tactics of Terrorist and Rogues – Tactics of Private Companies.

UNIT IV INFORMATION WARFARE **10**

Arsenal – Surveillance Tools- Hackers and Theft of Components- Contemporary computer Crime Identity Theft and Identity Fraud-Organized Crime & Terrorism Avenues Prosecution and Government Efforts- Applying the First Amendment to Computer Related Crime-The Fourth Amendment and Other Legal Issues.

UNIT V COMPUTER FORENSIC CASES **10**

Developing Forensic Capabilities- Searching and Seizing Computer Related Evidence-Processing Evidence and Report Preparation - Future Issues.

TOTAL:45 PERIODS

OUTCOMES:

Upon Completion of the course, the students should be able to

- To apply the concepts of computer forensics.
- To handle threats associated with security and information warfare.
- To design tools and tactics associated with cyber forensics.

REFERENCES:

1. John R. Vacca, “Computer Forensics: Computer Crime Scene Investigation, Volume1, Cengage
2. Learning, 2005.
3. Marjie T Britz , “Computer Forensics and Cyber Crime: An Introduction, 3/E,Pearson Education,
4. 2013.
5. Marie-Helen Maras, “Computer Forensics: Cybercriminals, Laws, and Evidence”, Jones & Bartlett
6. Publishers, 2011.
7. Chad Steel, “Windows Forensics”, W iley India, 2006.Majid Yar, “Cybercrime and Society”, Sag ePublications, 2006.Robert M Slade, “Software Forensics”, Tata Mc Graw Hill, 2004.

IF 7008 **DESIGN OF SOFTWARE AGENTS** **L T P C**
3 0 0 3

OBJECTIVES:

To understand:

- The background of an agent
- The reasoning aspect of agents
- The communication and cooperation of agents
- The application of agent and decision making of multi-agent

UNIT I INTRODUCTION AND INTELLIGENT AGENTS 9

Agents as a paradigm for software engineering - Agents as a tool for understanding human societies- Intelligent Agent: Agents and Objects - Agents and Expert Systems - Agents as Intentional Systems - Abstract Architectures for Intelligent Agents - How to Tell an Agent What to Do

UNIT II REASONING 9

Deduction reasoning agent - Agents as theorem provers - Agent oriented programming - Practical reasoning agent - Means end reasoning- Implementation - Procedural reasoning system- Reactive agent - Hybrid agent

UNIT III COMMUNICATION AND COOPERATION 9

Software tools for ontology - OWL - XML - KIF - Speech acts - Cooperative Distributed Problem Solving - Task Sharing and Result Sharing - Result Sharing - Combining Task and Result Sharing - Handling Inconsistency - Coordination - Multiagent Planning and Synchronization

UNIT IV METHODOLOGIES AND APPLICATIONS 9

Agent-Oriented Analysis and Design - Pitfalls of Agent Development - Mobile Agents - Applications: Agents for Workflow and Business Process Management - Agents for Distributed Sensing - Agents for Information Retrieval and Management - Agents for Electronic Commerce - Agents for Human--Computer Interfaces - Agents for Virtual Environments - Agents for Social Simulation - Other applications

UNIT V MULTIAGENT DECISION MAKING 9

Multiagent Interactions - Making Group decisions - Forming coalitions - Allocating Scarce Resources - Bargaining - Arguing - Logical Foundations

TOTAL : 45 PERIODS

OUTCOMES:

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

- To analyze agent based computing
- To design the reasoning aspects of agents
- To implement communication and cooperation of agents
- To implement multi-agent systems.

REFERENCES:

1. An Introduction to MultiAgent Systems (second edition) by Michael Wooldridge, 2009.
2. Artificial Intelligence: A Modern Approach, Third Edition by Stuart Russell and Peter Norvig, 2010.

IF 7010 **E - LEARNING** **L T P C**
3 0 0 3

OBJECTIVES:

- To learn the basics of e - learning
- To understand the design issues in E - Content creation
- To study about interactive E - Learning
- To learn managing E - Content

UNIT I INTRODUCTION **9**

Developing e-learning-E-learning approaches-E-learning components-Synchronous and asynchronous e-learning-Quality of e-learning-Blended learning-Need to develop an e-learning course-The activities, The team, The technology-work flow to produce and deliver e-learning content

UNIT II DESIGNING AN E-LEARNING CONTENT/COURSE **9**

Identifying and organizing course content-Needs analysis-Analysing the target audience-Identifying course content-Defining learning objectives-Defining the course sequence-Defining instructional, media, evaluation and delivery strategies-Defining instructional methods, Defining the delivery strategy, Defining the evaluation strategy

UNIT III CREATING INTERACTIVE CONTENT **9**

Preparing content-Creating storyboards-Structure of an interactive e-lesson-Techniques for presenting content-Integrating media elements-Courseware development-Authoring tools-Types of authoring tools-Selecting an authoring tool

UNIT IV MANAGING AND EVALUATING LEARNING ACTIVITIES **9**

Course delivery and evaluation-Components of an instructor led or facilitated course-Planning and documenting activities-Facilitating learners' activities-Using communication tools for e-learning-Learning platforms-Proprietary vs. open-source LMS

UNIT V MANAGEMENT AND IMPLEMENTATION OF E-LEARNING **9**

Collaborative learning-Moodle and other open-source solutions-E-learning methods and delivery formats-Evaluating the impacts of e-learning

TOTAL:45 PERIODS

OUTCOMES:

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

- To appreciate the basics of e - learning
- To create the E - Content
- To implement interactive E - Learning
- To manage E - Content

REFERENCES:

1. Clark, R. C. and Mayer, R. E. (2011) *eLearning and the Science of Instruction*. 3rd edition.
2. Means, B., Toyama, Y., and Murphy, R. (2010) Evaluation of Evidence-Based Practices in Online Learning: A Meta-Analysis and Review of Online Learning Studies.
3. Crews, T. B., Sheth, S. N., and Horne, T. M. (2014) Understanding the Learning Personalities of Successful Online Students. *Educause Review*. Jan/Feb 2014.

IF 7011 **GRID COMPUTING TECHNOLOGIES** **L T P C**
3 0 0 3

OBJECTIVES:

- To understand Grid Architecture.
- To understand different types of grids.
- To know Grid standards.
- To acquire the knowledge of Grid computing in various areas.

UNIT I INTRODUCTION **9**

Parallel and Distributed Computing - Cluster Computing - Grid Computing Anatomy and Physiology of Grid - Web and Grid Services.

UNIT II FRAMEWORK **9**

Architecture – Implementation of Grid Architecture – Grid Services OGSI, OGSA, WSRF – Grid Resource and Service Management –Resource Management Framework – Service Negotiation and Acquisition Protocol – Layers of Grid Computing – Building Reliable Services - Grid Monitoring – Sensors and Sensor Management - Grid Security – WS Security – GSI.

UNIT III DATA AND KNOWLEDGE GRID **9**

Data Source – Collective Data Services - Data Management – Collective Data Management – Federation Services – Representing Knowledge – Processing Knowledge - Knowledge Oriented Grid.

UNIT IV GRID MIDDLEWARE **9**

List of Globally Available Toolkits – GT3 – Architecture Details – Grid Service Container – OGSI Implementation – Security Infrastructure - System Level Services – Hosting Environments- Programming Model.

UNIT V APPLICATIONS **9**

Scientific – Medical – Bioinformatics – Federated Computing – ERM – Multiplayer Games - Collaborative Science – Case Study.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

Upon Completion of the course, the students should be able to,

- Create Grid Middleware architecture.
- Explain the services offered by grid.
- To utilize grid for various applications.

REFERENCES

1. Ian Foster, Carl Kesselman, “The Grid 2: Blueprint for a New Computing Infrastructure”, Elsevier Series, Second edition, 2006.
2. Srikumar Venugopal, Krishna Nadiminti, Hussein Gibbins and Rajkumar Buyya, “Designing a Resource Broker for Heterogeneous Grids, Software: Practice and Experience”, Wiley Press, New York, USA, 2008.
3. Fran Berman, Geoffrey Fox, Anthony J.G. Hey, “Grid Computing: Making the Global Infrastructure a Reality”, Wiley, 2003.
4. Maozhen Li, Mark Baker, “The Grid: Core Technologies”, Wiley, 2005.

IF 7013 **KNOWLEDGE ENGINEERING** **L T P C**
3 0 0 3

OBJECTIVES:

- To understand knowledge representation and reasoning techniques.
- To understand the application of knowledge representation and reasoning in actions and planning.

UNIT I INTRODUCTION **9**

Data, information and knowledge. Model of an intelligent system. Models of knowledge representations.

UNIT II REPRESENTATION **9**

Semantic representations: semantic networks, frames; Frame/script systems; Conceptual dependency and conceptual graphs. Ontologies.

UNIT III COMPUTATIONAL LOGIC **9**

Proposition and predicate logic - reasoning about knowledge - Temporal reasoning.

UNIT IV DEFAULTS, UNCERTAINITY **9**

Default Logic - Inference under uncertainty - Bayesian techniques, Fuzzy reasoning, Case-based reasoning, Description logic.

UNIT V ACTIONS **9**

Actions - Situational calculus - Frame problem - Complex actions - Planning - STRIPS - Planning as reasoning - Hierarchical and Conditional Planning.

TOTAL: 45 PERIODS

OUTCOMES:

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

- To implement knowledge representation and reasoning techniques.
- To apply knowledge engineering for the development of intelligent applications

REFERENCES:

1. Simon Kendal and Malcolm Creen, An introduction to Knowledge Engineering, Springer; 2007
2. S. Russell and P. Norvig, Artificial Intelligence, A Modern Approach. Third edition, Pearson Education, 2010.
3. Ronald Brachman, Hector Levesque “Knowledge Representation and Reasoning", The Morgan Kaufmann Series in Artificial Intelligence, 2004.
4. Johan van Benthem, Hans van Ditmarsch, Jan van Eijck and Jan Jaspars, Logic in Action, A new introduction to Logic, Available in http://www.logicinaction.org/, 2014.

IF 7016 **SEMANTIC WEB** **L T P C**
3 0 0 3

OBJECTIVES:

- To learn the importance of semantic web.
- To understand various semantic knowledge representation strategies.
- To learn the concepts of ontology.
- To learn the ontology related tools.

UNIT I INTRODUCTION **9**

The Future of the Internet: Introduction - The Syntactic Web - The Semantic Web - How the Semantic Web Will Work. Ontology in Computer Science - Defining the Term Ontology - Differences among Taxonomies - Thesauri - and Ontologies, Classifying Ontologies - Web Ontologies, Web Ontology Description Languages - Ontology - Categories - and Intelligence.

UNIT II SEMANTIC KNOWLEDGE REPRESENTATION **9**

Knowledge Representation in Description Logic – Introduction - An Informal Example - The Family of Attributive Languages - Inference Problems. RDF and RDF Schema – Introduction- XML Essentials- RDF- RDF Schema-A Summary of the RDF/RDF Schema Vocabulary. OWLIntroduction-Requirements for Web Ontology Description Languages- Header Information- Versioning- and Annotation Properties- Properties- Classes- Individuals- Data types- A Summary of the OWL Vocabulary.

UNIT III RULE LANGUAGES **9**

Rule Languages – Introduction - Usage Scenarios for Rule Languages – Datalog – RuleML – SWRL - TRIPLE. Semantic Web Services – Introduction - Web Service Essentials - OWL-S Service Ontology - An OWL-S Example.

UNIT IV ONTOLOGY DEVELOPMENT **9**

Methods for Ontology Development – Introduction - Uschold and King Ontology Development Method - Toronto Virtual Enterprise Method – Methontology - KACTUS Project Ontology Development Method – Lexicon -Based Ontology Development Method - Simplified Methods Ontology Sources – Introduction – Metadata - Upper Ontologies Other
Ontologic of Interest - Ontology Libraries.

UNIT V SOFTWARE TOOLS **9**

Semantic Web Software Tools – Introduction - Metadata and Ontology Editors – Reasoners - Other tools. Software Agents – Introduction - Agent Forms - Agent Architecture - Agents in the Semantic web Context. Semantic Desktop – Introduction - Semantic Desktop Metadata - Semantic Desktop Ontologies - Semantic Desktop Architecture - Semantic Desktop Related Applications. Ontology Application in Art – Introduction - Ontologies for the Description of Works of Art - Metadata Schemas for The Description of Works of Art - Semantic Annotation of Art Images.

TOTAL:45 PERIODS

OUTCOMES:

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

- Compare conventional web with semantic web.
- Analyze and design semantic knowledge representation modes.
- Construct ontology using different tools.
- Use semantic web services with web applications.

REFERENCES:

1. Karin K. Breitman, Marco Antonio Casanova and Walter Truszowski, “Semantic Web Concepts: Technologies and Applications”, Springer.
2. Heiner Stuckenschmidt, Frank van Harmelen,” Information Sharing on the Semanting Web,” Springer.
3. Grigoris Antoniou, Frank Van,”Semantic Web Primer”,
4. Rudi Studer, Stephan Grimm, Andrees Abeker,”Semantic Web Services: Concepts, Technologies and Applications”, Springer
5. John Davis, Dieter Fensal, Frank Van Harmelen,J. Wiley ,”Towards the Semantic Web: Ontology Driven Knowledge Management”.

BD 7071 **TEXT MINING** **L T P C**
3 0 0 3

OBJECTIVES:

- To understand the basic issues and types of text mining
- To appreciate the different aspects of text categorization and clustering
- To understand the role played by text mining in Information retrieval and extraction
- To appreciate the use of probabilistic models for text mining
- To appreciate the current trends in text mining

UNIT I INTRODUCTION **8**

Overview of text mining- Definition- General Architecture– Algorithms– Core Operations – Pre-processing– Types of Problems- basics of document classification- information retrieval- clustering and organizing documents- information extraction- prediction and evaluation-Textual information to numerical vectors -Collecting documents- document standardization- tokenization- lemmatization- vector generation for prediction- sentence boundary determination -evaluation performance

UNIT II TEXT CATEGORIZATION AND CLUSTERING **10**

Text Categorization – Definition – Document Representation –Feature Selection - Decision Tree Classifiers - Rule-based Classifiers - Probabilistic and Naive Bayes Classifiers - Linear Classifiers- Classification of Linked and Web Data - Meta-Algorithms– Clustering –Definition- Vector Space Models - Distance-based Algorithms- Word and Phrase-based Clustering -Semi-Supervised Clustering - Transfer Learning

UNIT III TEXT MINING FOR INFORMATION RETRIEVAL AND INFORMATION EXTRACTION **10**

Information retrieval and text mining- keyword search- nearest-neighbor methods- similarity- web-based document search- matching- inverted lists- evaluation. Information extraction- Architecture - Co-reference - Named Entity and Relation Extraction- Template filling and database construction – Applications. Inductive -Unsupervised Algorithms for Information Extraction. Text Summarization Techniques - Topic Representation - Influence of Context - Indicator Representations - Pattern Extraction - Apriori Algorithm – FP Tree algorithm

UNIT IV PROBABILISTIC MODELS **9**

Probabilistic Models for Text Mining -Mixture Models - Stochastic Processes in Bayesian Nonparametric Models - Graphical Models - Relationship Between Clustering, Dimension Reduction and Topic Modeling - Latent Semantic Indexing - Probabilistic Latent Semantic Indexing -Latent Dirichlet Allocation- Interpretation and Evaluation - Probabilistic Document Clustering and Topic Models - Probabilistic Models for Information Extraction - Hidden Markov Models - Stochastic Context-Free Grammars - Maximal Entropy Modeling - Maximal Entropy Markov Models -Conditional Random Fields

UNIT V RECENT TRENDS **8**

Visualization Approaches - Architectural Considerations - Visualization Techniques in Link Analysis - Example- Mining Text Streams - Text Mining in Multimedia - Text Analytics in Social Media - Opinion Mining and Sentiment Analysis - Document Sentiment Classification - Opinion Lexicon Expansion - Aspect-Based Sentiment Analysis - Opinion Spam Detection – Text Mining Applications and Case studies

TOTAL: 45 PERIODS

OUTCOMES:

Upon Completion of the course, the students will be able to

- Identify the different features that can be mined from text and web documents
- Use available open source classification and clustering tools on some standard text data sets
- Modify existing classification/clustering algorithms in terms of functionality or features used
- Design a system that uses text mining to improve the functions of an existing open source search engine
- Implement a text mining system that can be used for an application of your choice

REFERENCES:

1. Sholom Weiss, Nitin Indurkhya, Tong Zhang, Fred Damerau "The Text Mining Handbook: Advanced Approaches in Analyzing Unstructured Data", Springer, paperback 2010
2. Ronen Feldman, James Sanger -" The Text Mining Handbook: Advanced Approaches in Analyzing Unstructured Data"-Cambridge University press, 2006.
3. Charu C. Aggarwal ,ChengXiang Zhai**,**Mining Text Data, Springer; 2012

IF 7071 BIOINFORMATICS L T P C
3 0 0 3

OBJECTIVES:

- To learn bio-informatics algorithms

UNIT I **9**

What is Bio-Informatics – Overview- Major databases in Bio Informatics- Molecular biology – Central DogmaData retrieval tools – gene structure - Prokaryotic and Eukaryotic Genomes – Sequence Assembly – Gene mapping – Physical maps – cloning –– the genetic material –– chemical bonds – molecular biology tools – genomic information content.

UNIT II **9**

DNA: working with single DNA sequence : removing vector sequences- verifying restriction maps – PCR design – GC content – counting words – internal repeats – protein coding regions – ORFing – Genomescan Protein: predicting properties – primary structure analysis – transmembrane segments – PROSITE patterns – interpreting scanprosite results- finding domains – CD server results – pfscan results. – Alignment of Pair of Sequences

UNIT III **9**

Phylogenetics – phylogenetic trees –Parsimony – ancestral sequences – strategies for faster searches – consensus trees – tree confidence – comparison of phylogenetic methods – molecular phylogenie. Dot matrix – using scoring matrices – PAM matrices – BLOSUM. - Working with FASTA – Algorithm – output – E-values – Histogram. Working with BLAST – algorithm – output – services – gapped BLAST- PSIBLAST – comparison of FASTA and BLAST. - Multiple sequence alignment - Criteria for Multiple sequence alignment – applications – choosing the right sequences; FASTA, ClustalW, TCoffee methods

UNIT IV **9**

interpreting multiple sequence alignment – getting in right format – converting formats – using Jalview – preparing for publication. - Protein Classification & Structure Prediction - Structure of amino acids – primary structure – secondary structure – folds and motifs – alpha and beta helix – structure based protein classification – protein structure Data bases – folding problem – PROPSEARCH – primary structure analysis and prediction – secondary structure analysis and prediction – motifs – profiles – patterns and fingerprints

UNIT V **9**

Drug Discovery – components – process – Perspectives – Numeric considerations – Algorithms – Hardware – Issues – Protein structure – AbInitio Methods – Heuristic methods – Systems Biology – Tools – Collaboration and Communications – standards - Issues – Security – Intellectual property

TOTAL:45 PERIODS

OUTCOMES:

Upon the completion of this course the student should be able

- To design and implement bio-informatics algorithms

REFERENCES

1. Arthur M. Lesk, “Introduction to Bioinformatics”, Second Edition, Oxford University Press, 2005.
2. T. K. Attwood, D. J. Parry-Smith, and S. Phukan, “Introduction to Bioinformatics”, Pearson Education, 1999.
3. Vittal R. Srinivas, “Bioinformatics – A Modern Approach”, Prentice-Hall of India Pvt. Ltd., 2005
4. S.C Rostogi , Mendiratta, P.Rasogi, “ BioInformatics: methods and applications”,second edition, PHI 2006.
5. Jean Mickel Clavere & Cadrienotredom “Bio Informatics– A beginners guide” Wiley DreamTech, 2003.
6. T.K. Attwood and D.J Perry Smith, “ Introduction to Bio Informatics”, Pearson Education, 1st Edition, 2001.

IF 7014 MACHINE LEARNING L T P C
3 0 0 3

OBJECTIVES:

- To understand the concepts of machine learning.
- To appreciate supervised and unsupervised learning and their applications.
- To understand the theoretical and practical aspects of Probabilistic Graphical
- Models.
- To appreciate the concepts and algorithms of reinforcement learning.
- To learn aspects of computational learning theory.

UNIT I INTRODUCTION 9

Machine Learning - Machine Learning Foundations –Overview – Applications - Types of Machine Learning - Basic Concepts in Machine Learning - Examples of Machine Learning - Applications - Linear Models for Regression - Linear Basis Function Models - The Bias-Variance Decomposition - Bayesian Linear Regression - Bayesian Model Comparison.

UNIT II SUPERVISED LEARNING 9

Linear Models for Classification - Discriminant Functions - Probabilistic Generative Models - Probabilistic Discriminative Models - Bayesian Logistic Regression - Decision Trees -Classification Trees - Regression Trees – Pruning - Neural Networks - Feed-Forward Network Functions - Error Back-Propagation - Regularization - Mixture Density and Bayesian Neural Networks - Kernel Methods - Dual Representations - Radial Basis Function Networks - Ensemble methods - Bagging - Boosting.

UNIT III UNSUPERVISED LEARNING 9

Clustering- K-means - EM - Mixtures of Gaussians - The EM Algorithm in General -Model Selection for Latent Variable Models - High-Dimensional Spaces -- The Curse of Dimensionality - Dimensionality Reduction - Factor Analysis - Principal Component Analysis - Probabilistic PCA Independent Components Analysis.

UNIT IV PROBABILISTIC GRAPHICAL MODELS 9

Directed Graphical Models - Bayesian Networks - Exploiting Independence Properties – From Distributions to Graphs - Examples - Markov Random Fields - Inference in Graphical Models - Learning –Naive Bayes Classifiers - Markov Models – Hidden Markov Models – Inference – Learning- Generalization – Undirected graphical models - Markov Random Fields- Conditional Independence Properties - Parameterization of MRFs - Examples - Learning – Conditional Random Fields (CRFs) - Structural SVMs.

UNIT V ADVANCED LEARNING 9

Sampling – Basic sampling methods – Monte Carlo - Reinforcement Learning - K-Armed Bandit-Elements - Model-Based Learning - Value Iteration- Policy Iteration - Temporal Difference Learning- Exploration Strategies- Deterministic and Non-deterministic Rewards and Actions- Eligibility Traces- Generalization- Partially Observable States- The Setting- Example - Semi-Supervised Learning - Computational Learning Theory - Mistake Bound Analysis – Sample Complexity Analysis - VC Dimension - Occam Learning - Accuracy and Confidence Boosting.

TOTAL: 45 PERIODS

OUTCOMES:

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

- To implement a neural network for an application of your choice using an available tool.
- To implement probabilistic discriminative and generative algorithms for an application of your choice and analyze the results.
- To use a tool to implement typical clustering algorithms for different types of applications.
- To design and implement an HMM for a sequence model type of application
- To identify applications suitable for different types of machine learning with suitable justification.

REFERENCES:

1. Christopher Bishop, “Pattern Recognition and Machine Learning” Springer, 2006
2. Kevin P. Murphy, “Machine Learning: A Probabilistic Perspective”, MIT Press, 2012
3. Ethem Alpaydin, “Introduction to Machine Learning”, Prentice Hall of India, 2005
4. Tom Mitchell, "Machine Learning", McGraw-Hill, 1997.
5. Hastie, Tibshirani, Friedman, “The Elements of Statistical Learning” (2nd ed)., Springer, 2008
6. Stephen Marsland, “Machine Learning –An Algorithmic Perspective”, CRC Press, 2009

IF 7017 SOCIAL NETWORK ANALYSIS L T P C
3 0 0 3

OBJECTIVES:

The student should be made to:

- Understand the concept of semantic web and related applications.
- Learn knowledge representation using ontology.
- Understand human behavior in social web and related communities.
- Learn visualization of social networks.

UNIT I THE SEMANTIC WEB AND SOCIAL NETWORKS 9

Introduction to Semantic Web: Limitations of current Web – Development of Semantic Web - Emergence of the Social Web – Social Network analysis: Development of Social Network Analysis - Key concepts and measures in network analysis.

UNIT II SEMANTIC TECHNOLOGY FOR SOCIAL NETWORK ANALYSIS 9

Electronic sources for network analysis: Electronic discussion networks, Blogs and online communities – Web-based networks-Ontology-based knowledge Representation –Resource Description Framework – Web Ontology Language-Modeling and aggregating social network data: State-of-the-art in network data representation - Ontological representation of social individuals – Ontological representation of social relationships - Aggregating and reasoning with social network data

UNIT III EXTRACTION AND MINING COMMUNITIES IN WEB SOCIAL NETWORKS 9

Detecting communities in social networks – Definition of community – Evaluating communities – Methods for community detection and mining – Applications of community mining algorithms – Tools for detecting communities - social network infrastructures and communities – Decentralized online social networks – Challenges of DOSN's - General Purpose DOSNs

UNIT IV PREDICTING HUMAN BEHAVIOUR AND PRIVACY ISSUES 9

Understanding and predicting human behaviour for social communities – User data management, Inference and Distribution – Enabling new human experiences – The Technologies - Privacy in online social networks – Trust in online environment – Trust models based on subjective logic – Trust network analysis – Trust transitivity analysis – Combining trust and reputation – Trust derivation based on trust comparisons.

UNIT V VISUALIZATION AND APPLICATIONS OF SOCIAL NETWORKS 9

Graph theory – Centrality – Clustering – Node-Edge Diagrams – Matrix representation – Visualizing online social networks, Visualizing social networks with matrix-based representations – Matrix and Node-Link Diagrams – Hybrid representations – Applications – Cover networks – Community welfare -Collaboration networks – Co-Citation networks.

TOTAL: 45 PERIODS

OUTCOMES:

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

- Develop semantic web related applications.
- Represent knowledge using ontology.
- Predict human behaviour in social web and related communities.
- Visualize social networks.

REFERENCES:

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

IF 7003 ARTIFICIAL INTELLIGENCE L T P C

3 0 0 3

OBJECTIVES:

- To provide a strong foundation of fundamental concepts in Artificial Intelligence.
- To enable Problem-solving through various searching techniques.
- To enable the student to apply these techniques in applications which involve perception, reasoning and learning.
- To apply AI techniques primarily for machine learning, vision, and robotics.

UNIT I INTRODUCTION 9

Introduction to Artificial Intelligence – Intelligent Agents – Agents and Environments - Good behavior – The Nature of Environments – Structure of Agents - Problem Solving - Problem Solving Agents – Agent Architectures and Hierarchical Control - Agents - Agent Systems – Hierarchical Control - Embedded and Simulated Agents - Acting with Reasoning

UNIT II SEARCHING TECHNIQUES 9

Searching For Solutions – Uniformed Search Strategies - Avoiding Repeated States – Searching with Partial Information - Informed Search and Exploration – Informed Search Strategies – Heuristic Function – Local Search Algorithms and Optimistic Problems – Local Search in Continuous Spaces – Online Search Agents and Unknown Environments – Constraint Satisfaction Problems (CSP) – Backtracking Search and Local Search for CSPs – Structure of Problems - Adversarial Search – Games – Optimal Decisions in Games – Alpha-Beta Pruning – Imperfect Real-Time Decisions – Games that include an element of chance.

UNIT III KNOWLEDGE AND REASONING 9

Proposition Logic - First Order Predicate Logic – Unification – Forward Chaining -Backward Chaining - Resolution – Knowledge Representation - Ontological Engineering - Categories and Objects – Events - Mental Events and Mental Objects - Reasoning Systems for Categories - Reasoning with Default Information - Prolog Programming.

UNIT IV LEARNING 9

Probability basics - Bayes Rule and its Applications - Bayesian Networks – Exact and Approximate Inference in Bayesian Networks - Hidden Markov Models - Forms of Learning - Supervised Learning - Learning Decision Trees – Regression and Classification with Linear Models - Artificial Neural Networks – Nonparametric Models - Support Vector Machines - Statistical Learning - Learning with Complete Data - Learning with Hidden Variables- The EM Algorithm – Reinforcement Learning

UNIT V AI PLANNING AND APPLICATIONS 9

AI Planning – Planning with State - Space Search – Partial-Order Planning – Planning Graphs – Planning with Propositional Logic- Hierarchical Task Network Planning – Conditional Planning - AII applications – Language Models - Information Retrieval – Information Extraction - Machine Translation – Machine Learning - Symbol-Based – Machine Learning: Connectionist – Machine Learning - Social and Emergent –Robots

TOTAL: 45 PERIODS

OUTCOMES:

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

- Provides a basic exposition to the goals and methods of Artificial Intelligence.
- Study of the design of intelligent computational agents.
- The knowledge acquired through learning can be used both for problem solving and for reasoning
- Improves problem solving, reasoning, planning, natural language understanding, computer vision, automatic programming and machine learning.

REFERENCES:

1. Stuart Russell, Peter Norvig, “Artificial Intelligence: A Modern Approach”, Third Edition, Pearson Education / Prentice Hall of India, 2010.
2. Elaine Rich and Kevin Knight, “Artificial Intelligence”, Third Edition, Tata McGraw-Hill, 2010.
3. Bratko I, “Prolog Programming for Artificial Intelligence”, Addison-Wesley Educational Publishers Inc; Fourth Edition, 2011.
4. David L. Poole, Alan K. Mackworth, “Artificial Intelligence: Foundations of Computational Agents”, Cambridge University Press, 2010.
5. Ethem Alpaydin, “Introduction to Machine Learning (Adaptive Computation and Machine Learning series)”, The MIT Press; Second edition, 2009.
6. Patrick H. Winston. ''Artificial Intelligence'', Third edition, Pearson Edition, 2006.
7. Dan W.Patterson, “Introduction to Artificial Intelligence and Expert Systems”, PHI, 2006.
8. Nils J. Nilsson, “Artificial Intelligence: A new Synthesis”, Harcourt Asia Pvt. Ltd., 2000.

IF 7005 **COMPILER DESIGN** **L T P C**
3 0 0 3

OBJECTIVES:

- To learn the fundamentals of a translator
- To study about intermediate code generation
- To understand the memory handling
- To explore code optimization techniques

UNIT I FRONT END ANALYSIS 9

Modules and interfaces- Tools and software-Data structures for tree languages -Lexical Analysis - Parsing- Abstract Syntax-Semantic Analysis-Overview

UNIT II INTERMEDIATE CODE AND INSTRUCTION SELECTION 9

Activation Records -Stack frames -Translation to Intermediate Code -Intermediate representation trees-Translation into trees-Declarations - Basic Blocks and Traces-Canonical trees-Taming conditional branches-Instruction Selection- Algorithms for instruction selection

UNIT III LIVENESS ANALYSIS AND REGISTER ALLOCATION 9

Liveness Analysis-Solution of dataflow equations- Register Allocation-Coloring by simplification-Coalescing-Precolored nodes-Graph-coloring implementation-Register allocation for trees

UNIT IV DATAFLOW ANALYSIS AND LOOP OPTIMIZATIONS 9

Dataflow Analysis - Intermediate representation for flow analysis - Various dataflow analyses - Transformations using dataflow analysis - Speeding up dataflow analysis - Alias analysis - Loop Optimizations - Dominators - Loop-invariant computations - Induction variables - Array-bounds checks - Loop unrolling - Static Single-Assignment Form

UNIT V PIPELINING AND SCHEDULING 9

Converting to SSA form - Efficient computation of the dominator tree - Optimization algorithms using SSA - Arrays, pointers, and memory - The control-dependence graph - Converting back from SSA form - A functional intermediate form - Pipelining and Scheduling - Loop scheduling without resource bounds - Resource-bounded loop pipelining - Branch prediction

TOTAL : 45 PERIODS

OUTCOMES:

At the end of the course, students will be able

- To explain the fundamentals of a translator
- To implement intermediate code generation
- To devise the memory handling techniques
- To design code optimization techniques

REFERENCES:

1. Andrew W. Appel and Jens Palsberg, "Modern Compiler implementation in Java", Cambridge University Press, 2004.
2. Alfred V. Aho, Monica S. Lam, Ravi Sethi, Jeffrey D. Ullman, "Compilers. Principles, Techniques, and Tools", Second Edition, Pearson Education,2008.
3. Keith Cooper and Linda Torczon, " Engineering a Compiler", Second Edition, Morgan Kaufmann Publishers, 2012.
4. Steven S. Muchnick," Advanced Compiler Design and Implementation", Morgan Kaufmann Publishers - Elsevier Science, India, Indian Reprint 2003.
5. Charles N. Fischer, Ron K. Cytron and Richard J. LeBlanc Jr. "Crafting A Compiler", Pearson Education, 2009.
6. Randy Allen and Ken Kennedy, "Optimizing compilers for modern architectures", Morgan Kaufmann Publishers, 2002.

IF 7072 **COMPUTER VISION** **L T P C**
3 0 0 3

OBJECTIVES:

- To provide knowledge about computer vision algorithms
- To understand the basic concepts of camera calibration, stereoscopic imaging and higher level image processing operations
- To familiarize the student with the image processing facilities in Matlab and its equivalent open source tools like OpenCV
- To appreciate the use of compute vision in Industrial applications and to understand the role of computer vision
- To understand and implement more advanced topics in current research literature

UNIT I FUNDAMENTALS OF VISION 9

Image Formation and Representation, Intensity and Range Images – Camera models – Camera parameters – Camera models – Light and colour – Image Noise – Image Filtering (spatial domain) - Mask-based filtering - Image Smoothing , Sharpening.

UNIT II IMAGE FEATURES 9

Image Features – Point and Line Detection – Hough Transform – Edge Detection – Corner Detection – Harris Detector – Textures - Deformable Contours – Features Reduction – Principal Component analysis – Feature Descriptors – SIFT and SURF.

UNIT III CAMERA CALIBRATION AND STEREO GEOMETRY 9

Camera Parameters – Intrinsic and Extrinsic parameters – Direct Parameter Calibration – Extraction from Projection matrix, Stereopsis – Correspondence Problem –RANSAC and Alignment - Epipolar Geometry

UNIT IV MOTION DETECTION AND SHAPE FROM CUES 9

Motion field of rigid objects – Notation of Optical flow – Estimating motion field – Estimation Motion Field – Horn and Schunck algorithm – Lucas and Kanade Algorithm – Using and Evaluation of Motion field – Shape from Shading and shape from Texture Modelbased Vision, smooth surfaces and their outlines, Aspect graphs and Range data**.**

UNIT V HIGH LEVEL VISION 9

Interpretation trees, Invariants – Appearance and Shape based Classification – 3D object modeling – Matching from Intensity Data – Matching from Range Data – Visual Recognition – AdaBoost and Random Decision Forests.

TOTAL : 45 PERIODS

OUTCOMES:

Upon Completion of the course, the students should be able to

- Implement basic computer vision algorithms
- Familiar with the use of MATLAB and OpenCV environment
- Design and implement industrial applications that incorporates different concepts of medical Image Processing
- Critically analyze different approaches to implement mini projects in industrial environment.

REFERENCES:

1.Introductory Techniques for 3-D Computer Vision, Prentice Hall, 1998.
2.Concise Computer Vision: An Introduction into Theory and Algorithms, ReinhardKlette, 2014, Springer-Verlag London
3.Computer Vision: Algorithms and Applications Richard Szeliski, Springer International, 2011.
4.Computer Vision: a Modern Approach , David Forsyth and Jean Ponce, Prentice Hall, 2009.
5.Multiple View Geometry in Computer Vision, Richard Hartley and Andrew Zisserman, Cambridge, 2001.
6.E.R.Davies,"Computer and Machine Vision",Elserier,4th edition, 2012

IF 7007 DATA WAREHOUSING AND DATA MINING L T P C
3 0 0 3

OBJECTIVES:

- To Understand Data mining principles and techniques and Introduce DM as a cutting edge
- business intelligence.
- To expose the students to the concepts of Data warehousing Architecture and Implementation.
- To study the overview of developing areas – Web mining, Text mining and ethical aspects of Data mining.
- To identify Business applications and Trends of Data mining.

UNIT I DATA WAREHOUSE 8

Data Warehousing - Operational Database Systems vs Data Warehouses - Multidimensional Data Model - Schemas for Multidimensional Databases – OLAP operations – Data Warehouse Architecture – Indexing – OLAP queries & Tools.

UNIT II DATA MINING & DATA PREPROCESSING 9

Introduction to KDD process – Knowledge Discovery from Databases - Need for Data Preprocessing – Data Cleaning – Data Integration and Transformation – Data Reduction – Data Discretization and Concept Hierarchy Generation.

UNIT III ASSOCIATION RULE MINING 8

Introduction - Data Mining Functionalities - Association Rule Mining - Mining Frequent Itemsets with and without Candidate Generation - Mining Various Kinds of Association Rules - Constraint – Based Association Mining.

UNIT IV CLASSIFICATION & PREDICTION 10

Classification vs Prediction – Data preparation for 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 V CLUSTERING 10

Cluster Analysis - Types of Data in Cluster Analysis – A Categorization of Major Clustering Methods – Partitioning Methods – Hierarchical methods – Density-Based Methods – Grid-Based Methods – Model-Based Clustering Methods – Clustering High- Dimensional Data – Constraint-Based Cluster Analysis – Outlier Analysis.

TOTAL: 45 PERIODS

OUTCOMES:

Upon Completion of the course, the students should be able to:

- Evolve Multidimensional Intelligent model from typical system.
- Discover the knowledge imbibed in the high dimensional system.
- Evaluate various mining techniques on complex data objects.

REFERENCES:

1 Jiawei Han and Micheline Kamber, “Data Mining Concepts and Techniques”,Second Edition, Elsevier, Reprinted 2011.
2 K.P. Soman, Shyam Diwakar and V. Ajay, “Insight into Data mining Theory and Practice”, Easter Economy Edition, Prentice Hall of India, 2006.
3 G. K. Gupta, “Introduction to Data Mining with Case Studies”, Easter Economy Edition

IF 7009 **DIGITAL SIGNAL PROCESSING** **L T P C**
3 0 0 3

OBJECTIVES:

- To understand the basics of signals and systems.
- To analyze various frequency transforms and to determine their use to DSP.
- To design and analyze various digital filters.
- To give exposure on musical sound processing and image processing.

UNIT I SIGNALS AND SYSTEMS **9**

Basic Elements of DSP – Concepts of Frequency in Analog and Digital Signals – Sampling Theorem – Discrete – Time Signals, Systems – Analysis of Discrete Time LTI Systems – Z Transform – Convolution (Linear And Circular) – Correlation.

UNIT II DISCRETE FOURIER TRANSFORMS **9**

Introduction to DFT – Properties of DFT – Filtering Methods based on DFT – FFT Algorithms - Decimation in Time Algorithms, Decimation in Frequency Algorithms – Use of FFT in Linear Filtering.

UNIT III IIR FILTER DESIGN **9**

Structures of IIR – Analog Filter Design – Discrete Time IIR Filter from Analog Filter – IIR Filter Design by Impulse Invariance, Bilinear Transformation, Approximation of Derivatives – (HPF, BPF, BRF) Filter Design using Frequency Translation.

UNIT IV FIR FILTER DESIGN **9**

Structures of FIR – Linear Phase FIR Filter – Filter Design using Windowing Techniques, Frequency Sampling Techniques – Finite Word Length Effects in Digital Filters.

UNIT V SIGNAL PROCESSING **9**

Multirate Signal Processing – Adaptive Filter – Compression - Musical Sound Processing – Image Enhancement

TOTAL : 45 PERIODS

OUTCOMES:

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

- Explain the basics of signals and systems.
- Analyze various frequency transforms and to determine their use to DSP.
- Design and analyze various digital filters.
- Exposure on signal processing like musical sound processing and image processing.

REFERENCES:

1. John G. Proakis & Dimitris G.Manolakis, “Digital Signal Processing – Principles, Algorithms & Applications”, Fourth edition, Pearson education / Prentice Hall, 2007.
2. Emmanuel C..Ifeachor, & Barrie.W.Jervis, “Digital Signal Processing”, Second edition, Pearson Education / Prentice Hall, 2002.
3. Sanjit K. Mitra, “Digital Signal Processing – A Computer Based Approach”,Tata McGraw Hill, fourth Edition, 2010.

IF 7015 **OPEN SOURCE TECHNOLOGIES** **L T P C**
3 0 0 3

OBJECTIVES:

- To introduce open technologies
- To develop applications using python
- To provide an exposure to open hardware

UNIT I INTRODUCTION **9**

Need for free and open source software – Overview of linux – Distributions Development environment tools and systems - using collaborative version control system - FOSS practices - programming guidelines

UNIT II SYSTEM ADMINISTRATION **9**

GNU andlinux installation – Boot process, Commands Using bash features, The man pages - files and file systems - Partitions - Processes - Graphical environment - Installing software - git commands

UNIT III PYTHON **9**

Conditionals/Loops - Functions - List - Strings - Recursion - tuples - Classes - Inheritance

UNIT IV DJANGO **9**

Introduction to Django - templates - models - forms - deploying django - caching - Integrating with legacy databases and applications – security

UNIT V OPEN SOURCE HARDWARE **9**

Raspberry pi - Arduino – building embedded applications with raspberry pi and arduino- open source 3-d printing

TOTAL : 45 PERIODS

OUTCOMES:

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

- Explain the internal structure of linux
- Write desktop and web applications using python
- Design for extendibility and code reuse
- To develop applications for open source hardware

REFERENCES:

1. Jesús M. González-Barahona, JoaquínSeoanePascual, Gregorio Robles, Introduction to Free Software, Free Technology Academy, Europe, 2009 (http://ftacademy.org/materials/fsm/1#1).
2. Introduction to Linux – A Hands on Guide, URL:http://tldp.org/guides.html
3. Rute's User tutorial and exposition, URL:http://rute.2038bug.com/index.html.gz
4. Allen B. Downey, Think Python, O'Reilly Publications, 2011.
5. Adrian Holovaty, Jacob Kaplan–Moss, The Definitive Guide to Django: Web Development Done Right, Apress, 2009
6. http://sixrevisions.com/resources/git-tutorials-beginners/
7. Charles Bell, Beginning Sensor Networks with Arduino and Raspberry Pi, Apress, 2013.
8. J Pearce, Open-Source Lab - How to Build Your Own Hardware and Reduce Research Costs, Elsevier, 2014.

Attested

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IF 7074 **HUMAN COMPUTER INTERACTION** **L T P C**
3 0 0 3

OBJECTIVES:

- To learn the principles and fundamentals of human computer interaction (HCI)
- To analyze HCI theories, as they relate to collaborative or social software.
- To Establish target users, functional requirements, and interface requirements for a given computer application.
- To understand user interface design principles, and apply them to designing an interface.
- To learn user interface designs through usability inspection and user models
- To know the applications of multimedia on HCI.

UNIT I DESIGN PROCESS **9**

Humans – Information process – Computer – Information Process – Differences and Similarities between them – Need for Interaction – Models – Ergonomics – Style – Context – Paradigms – Designing of Interactive systems – Usability – Paradigm shift – Interaction design basics – Design Process – Scenarios – Users need –Complexity of design

UNIT II DESIGN AND EVALUATION OF INTERACTIVE SYSTEMS **9**

Software Process – Usability engineering – Issue based Information systems – Iterative design practices – Design rules – maximum usability – Principles – Standards and guidelines – design patterns – Programming Tools – Windowing systems – Interaction tool kit – User Interface management system – Evaluation techniques – evaluation design – Evaluating implementations – Observational Methods

UNIT III MODELS **9**

Universal design principles – Multimodal systems – User Support – Presentation and Implementation Issues – types – requirements – approaches – Cognitive model – Hierarchical model – Linguistic model – physical and device models – Sociotechnical models – Communication and Collaboration models – Task models – Task analysis and design

UNIT IV EXPERIMENTAL DESIGN AND STATISTICAL ANALYSIS OF HCI **9**

Basic Design structure – Single independent variable – multiple independent variable – factorial design – split-plot design – random errors – experimental procedure – Statistical analysis – T tests – Analysis of Variance test – Regression – Chi-Square test – Survey – Probabilistic sampling – Non-probabilistic sampling – developing survey questions

UNIT V THEORIES **9**

Dialogue notations and design – Dialogue need – dialogue design notations – Graphical – Textual - representing dialogue – formal descriptions – Dialogue analysis – System models – Interaction models – relationship with dialogue – Formalisms – Formal notations – Interstitial behavior – Virtual reality – Modeling rich interaction – Status Event analysis – Properties – Rich contexts – Sensor-based systems – Groupware – Applications – Ubiquitous computing – Virtual reality

TOTAL: 45 PERIODS

OUTCOMES:

Upon Completion of the course, the students will be able to

- Interpret the contributions of human factors and technical constraints on human– computer interaction.
- Evaluate the role of current HCI theories in the design of software.
- Apply HCI techniques and methods to the design of software.
- Categorize and carefully differentiate various aspects of multimedia interfaces.
- Design and develop issues related to HCI for real application.

REFERENCES:

1. Human Computer Interaction, 3rd Edition Alan Dix, Janet Finlay, Gregory Abowd, Russell Beale Prentice Hall, 2004.
2. Research Methods in Human-Computer Interaction , Jonathan Lazar Jinjuan Heidi Feng, Harry Hochheiser, Wiley, 2010.
3. Ben Shneiderman and Catherine Plaisant Designing the User Interface: Strategies for Effective Human-Computer Interaction (5th Edition, pp. 672, ISBN 0-321-53735-1, March 2009), Reading, MA: Addison-Wesley Publishing Co.

MM 7152 DIGITAL IMAGE PROCESSING AND PATTERN RECOGNITION **L T P C 3 0 0 3**

OBJECTIVES:

- To understand the basic concepts and algorithms of digital processing
- To familiarize the student with the image processing environments like Matlab and its equivalent open source Image processing environments.
- To expose the students to a broad range of image processing techniques and issues and their applications, and to provide the student with practical experiences using them.
- To appreciate the use of image processing in current technologies and to expose the students to real-world applications of the image processing

UNIT I FUNDAMENTALS OF IMAGE PROCESSING **9**

Introduction – Elements of visual perception, Steps in Image Processing Systems – Digital Imaging System - Image Acquisition – Sampling and Quantization – Pixel Relationships – File Formats – colour images and models - Image Operations – Arithmetic, logical, statistical and spatial operations.

UNIT II IMAGE ENHANCEMENT AND RESTORATION **9**

Image Transforms -Discrete and Fast Fourier Transform and Discrete Cosine Transform ,Spatial Domain - Gray level Transformations Histogram Processing Spatial Filtering – Smoothing and Sharpening. Frequency Domain: Filtering in Frequency Domain – Smoothing and Sharpening filters – Homomorphic Filtering., Noise models, Constrained and Unconstrained restoration models.

UNIT III IMAGE SEGMENTATION AND MORPHOLOGY **9**

Detection of Discontinuities – Edge Operators – Edge Linking and Boundary Detection – Thresholding – Region Based Segmentation – Motion Segmentation, Image Morphology: Binary and Gray level morphology operations - Erosion, Dilation, Opening and Closing Operations- Distance Transforms- Basic morphological Algorithms. Features – Textures - Boundary representations and Descriptions- Component Labeling – Regional descriptors and Feature Selection Techniques.

UNIT IV INTRODUCTION TO PATTERN RECOGNITION **9**

Component Labeling - Image Features - Textures - Boundary representations and descriptions - Regional descriptors - Feature selection and Feature dimensionality reduction. Image Classification and Recognition- Statistical Classifiers _ Clustering Algorithms - Hierarchical and Partitional clustering

UNIT V IMAGE PATTERN RECOGNITION CASE STUDIES 9

Image Understanding – Case Studies in Biometrics, Video Processing, Image Fusion - Image Security - Steganography and Watermarking - Stereo vision - Visual Effects - Image compositing

TOTAL: 45 PERIODS

OUTCOMES:

Upon completion of the course

- The students should be able to implement basic image processing algorithms using MATLAB tools
- Design an application that incorporates different concepts of Image processing
- Apply and explore new techniques in the areas of image enhancement, restoration, segmentation, compression, wavelet processing and image morphology
- critically analyze different approaches to implements mini projects
- Explore the possibility of Appling image processing concepts in various domains

REFERENCES:

1. S.Sridhar, “Digital Image Processing”, Oxford University Press, 2011, New Delhi.
2. Rafael C.Gonzalez and Richard E.Woods, “Digital Image Processing”, Third Edition, Pearson Education, 2008, New Delhi.
3. Alasdair McAndrew, “Introduction to Digital Image Processing with Matlab”, Cengage Learning 2011, India.
4. Anil J Jain, “Fundamentals of Digital Image Processing”, PHI, 2011.
5. Wilhelm Burger, Mark J Berge, “ Digital Image Processing: An algorithmic Introduction using Java”, Springer International Edition,2008.

IF 7012 INFORMATION RETRIEVAL L T P C

3 0 0 3

OBJECTIVES:

- To understand the basics of Information Retrieval with pertinence to modeling, Query operations and indexing.
- To get an understanding of machine learning techniques for text classification and clustering.
- To understand the various applications of Information Retrieval giving emphasis to Multimedia IR, Web Search.
- To understand the concepts of digital libraries.

UNIT I INTRODUCTION 9

Introduction - Goals and history of IR - The impact of the web on IR - The role of artificial intelligence (AI) in IR – Basic IR Models Boolean and vector space retrieval models – Ranked Retrieval – Text similarity metrics –TF IDF (term frequency/inverse document frequency) weighting - Cosine Similarity.

UNIT II PREPROCESSING 9

Basic Tokenizing - Indexing and Implementation of Vector Space Retrieval - Simple tokenizing – stop word removal and stemming – Inverted Indices –Efficient processing with sparse vectors – Query Operations and Languages - Relevance feedback – Query expansion – Query languages.

UNIT III METRICS **9**

Experimental Evaluation of IR Performance metrics Recall, Precision and F measure – Evaluations on benchmark text collections - Text Representation - Word statistics – Zipf's law – Porter stemmer - Morphology – Index term Selection using thesauri -Metadata and markup languages- Web Search engines – spidering – metacrawlers – Directed spidering – Link analysis shopping agents.

UNIT IV CATEGORIZATION AND CLUSTERING **9**

Text Categorization and Clustering - Categorization algorithms - Naive Bayes – Decision trees and nearest neighbor- Clustering algorithms - Agglomerative clustering – k Means – Expectation Maximization (EM) - Applications to information filtering – Organization and relevance feedback.

UNIT V EXTRACTION AND INTEGRATION **9**

Recommender Systems - Collaborative filtering - Content based recommendation of documents and products - Information Extraction and Integration - Extracting data from text – XML – semantic web – Collecting and integrating specialized information on the web.

TOTAL : 45 PERIODS

OUTCOMES:

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

- Build an Information Retrieval system using the available tools.
- Identify and design the various components of an Information Retrieval system.
- Apply machine learning techniques to text classification and clustering which is used for efficient Information Retrieval.
- Analyze the Web content structure.
- Design an efficient search engine.

REFERENCES:

1. Christopher D. Manning, Prabhakar Raghavan and Hinrich Schütze," Introduction to Information Retrieval" , Cambridge University Press, 2008.
2. Ricci, F. Rokach, L. Shapira, B. Kantor, P.B. "Recommender Systems Handbook" 1st Edition, 2011.
3. Brusilovsky, Peter, "The Adaptive Web Methods and Strategies of Web Personalization", Springer, 2007.

IF 7077 SERVICE ORIENTED ARCHITECTURE **L T P C**
3 0 0 3

OBJECTIVES:

- To learn SOA fundamentals
- To understand SOAD
- To study about service composition
- To explore RESTful services and SOA security

UNIT I SOA FUNDAMENTALS **9**

SOA – Services – Loose Coupling – The Enterprise service bus – Service Classification – Business process management – SOA and the organization – SOA and the organization - SOA in context – Message exchange patterns – SOA life cycle – Versioning – Web services

UNIT II SERVICE-ORIENTED ANALYSIS AND DESIGN 9

SOA Terminology and Concepts - REST Design Constraints and Goals - RESTful Service-Orientation - Service Contracts with REST - Service-Orientation and REST Service-Oriented Analysis and Design with REST - Mainstream SOA Methodology - Analysis and Service Modeling with REST - Service-Oriented Design with REST

UNIT III SERVICE COMPOSITION 9

Service Composition with REST - Fundamental Service Composition with REST - Advanced Service Composition with REST - Service Composition with REST Case Study - Design Patterns for SOA with REST - Service Versioning with REST - Uniform Contract Profiles

UNIT IV RESTFUL SERVICES AND THE RESOURCE-ORIENTED ARCHITECTURE 9

Introducing the Simple Storage Service - Object-Oriented Design of S3 - URIs - Addressability - Statelessness - Representations - Links and Connectedness - The Uniform Interface - Resource Design - Turning Requirements into Read-Only Resources - Service Implementation - Web service case studies - Connect Resources to Each Other - Controller Code - Model Code

UNIT V SOA TRANSACTION AND SECURITY 9

SOA and performance - SOA and security – Service Management - Model driven service deployment – Establishing SOA and SOA governance

TOTAL : 45 PERIODS

OUTCOMES:

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

- To appreciate SOA fundamentals
- To implement SOAD
- To compose the web services
- To deploy RESTful services and SOA security

REFERENCES

1. Nicolai M.Josuttis, SOA in design - The art of distributed system design, O'REILLY publication, 2007.
2. Raj Balasubramanian, Benjamin Carlyle, Thomas Erl, Cesare Pautasso, "SOA with REST - Principles, Patterns & Constraints for building Enterprise solutions with REST" , Prentice Hall/PearsonPTR , 2012.
3. Leonard Richardson and Sam Ruby, RESTful Web Services, O'REILLY publication,2007.

IF 7018 SOFT COMPUTING AND APPLICATION L T P C

3 0 0 3

OBJECTIVES:

- To understand the concept and applications of fuzzy logic, neural networks, genetic algorithms and hybrid systems.

UNIT I INTRODUCTION AND FUZZY LOGIC 9

Introduction to Soft Computing - Components of Soft Computing - Importance of Soft Computing - Fuzzy Set Theory - Different types of fuzzy set Membership Functions - Fuzzy Set theoretic operations - Fuzzy Rules and Fuzzy Reasoning - Fuzzy Inference Systems.

UNIT II NEURAL NETWORKS 9

Basic concepts of neural networks - Supervised Learning, Unsupervised Learning - Neural network architectures - Learning methods - Architecture of a back propagation network.

UNIT III GENETIC ALGORITHMS 9

Basic concepts of genetic algorithms - encoding - genetic modeling -Evolutionary Strategies - Optimization techniques

UNIT IV HYBRID SYSTEMS 9

Adaptive Neuro-Fuzzy Inference Systems – Coactive Neuro-Fuzzy Modeling - Integration of neural networks, fuzzy logic and genetic algorithms.

UNIT V APPLICATIONS 9

Applications of Fuzzy Logic - Applications of Neural Network - Application of Genetic Algorithm - Applications in Image processing- Applications in Data mining - Applications in other domains.

TOTAL: 45 PERIODS

OUTCOMES:

Upon completion of the course, the student should be able

- To implement the concept and applications of fuzzy logic, neural networks, genetic algorithms and hybrid systems.

REFERENCES:

1. Jyh-Shing Roger Jang, Chuen-Tsai Sun, Eiji Mizutani, “Neuro-Fuzzy and Soft
2. Computing”, Prentice-Hall of India, 2003.
3. George J. Klir and Bo Yuan, “Fuzzy Sets and Fuzzy Logic-Theory and Applications”,
4. Prentice Hall, 1995.
5. James A. Freeman and David M. Skapura, “Neural Networks Algorithms,
6. Applications, and Programming Techniques”, Pearson Edn., 2003.
7. Mitchell Melanie, “An Introduction to Genetic Algorithm”, Prentice Hall, 1998.
8. David E. Goldberg, “Genetic Algorithms in Search, Optimization and Machine Learning”, Addison Wesley, 1997.

IF 7019 SOFTWARE QUALITY ASSURANCE AND TESTING L T P C
3 0 0 3

OBJECTIVES:

- To give a clear picture on quality management, documentation and controlling for software quality
- Provide knowledge on standards, models and tools used for quality management
- How to perform measurement and assessment of software quality
- To introduce the basics and necessity of Software testing
- To introduce various testing techniques along with software production
- To introduce the concepts of Software bugs and its impact

UNIT I BASICS OF SOFTWARE QUALITY and CONTROLLING 9

Introduction to Software Quality -Establishment of a Software Quality Program - Software Quality Assurance Planning -Software Quality Assurance Management - Documentation - Reviews and Audits - Problem Reporting and Corrective Action – Defect prevention and removal - Code Control - Media Control - Supplier Control – Records -Collection, Maintenance.

UNIT II QUALITY STANDARDS 9

Need for standards – ISO 9000 Series – ISO 9000-3 for software development – CMM and CMMI – Comparison of the ISO 9000 Model with SEI Vs CMM - Six Sigma concepts. Integration Pattern - The PTR Submodel - The PTR Arrival and Backlog Projection Model - Reliability Growth Models - Criteria for Model Evaluation - In-Process Metrics and Reports - Orthogonal Defect Classification – Applying Seven Basic Quality Tools in Software Development.

UNIT III QUALITY METRICS AND ASSESMENT 9

Fundamentals of Measurement Theory - Software quality Metrics overview – Availability Metrics – Conducting In-Process quality assessment - Conducting software project Assessments.

UNIT IV SOFTWARE TESTING CONCEPTS 9

Software Testing Background – Software Bugs- Cost of Bugs-Software Testing Realities- Testing Axioms – Precision and Accuracy-Verification and Validation- Quality and Reliability-Testing and Quality Assurance. Functional Testing- Structural Testing – Static and Dynamic Testing – Low Level Specification Test Techniques – Equivalence Partitioning – Data Testing – State Testing – Formal Reviews – Coding Standards and Guidelines – Code Review Checklist – Data Coverage-Code Coverage.

UNIT V SOFTWARE TESTING TECHNIQUES and TOOLS 9

Configuration Testing – Compatibility Testing – Foreign Language Testing – Usability Testing – Testing the Documentation - Testing for Software Security – Website Testing - Benefits of Automation and Tools – Viewers and Monitors – Drivers – Stubs – Stress and Load Tools – Analysis Tools- Software Test Automation – Random Testing – Beta Testing – Testing documentation – Test case writing.

TOTAL: 45 PERIODS

OUTCOMES:

Upon Completion of the course, the students should be able to:

- Learned how to document, control and manage software quality with the aid of tools and standards.
- The process of measurement and assessment would be practiced to ensure Software Quality
- Perform automated testing using test tools
- Document the testing procedures

REFERENCES:

1. Stephen H. Kan, “Metrics and Models in Software Quality Engineering”, Pearson Education (Singapore) Pte Ltd., 2002
2. Mordechai Ben – Menachem and Garry S.Marliss, “Software Quality”, CL EMEA, 2009.
3. Allan C. Gillies, “Software Quality: Theory and Management”, Thomson Learning, 2003
4. Mary Beth Chrissis, Mike Konrad and Sandy Shrum, “CMMI”, Pearson Education (Singapore) Pte Ltd, 2003.
5. Glenford J.Myers, Tom Badgett, Corey Sandler, “The Art of Software Testing”,3rd edition, John Wiley & Sons publication, 2012.
6. Ron Patton, “Software testing” , second edition, Pearson education, 2009.
7. Boris Beizer, “Software testing techniques”,DreamTech Press,2009.
8. Srinivasan Desikan, Gopalaswamy Ramesh, “Software testing- Principles and Practices”, Pearson education, 2009.

IF 7451 **UNIX INTERNALS** **L T P C**
3 0 0 3

OBJECTIVES:

- To understand the design of the UNIX operating system.
- To become familiar with the various data structures used.
- To learn the various low-level algorithms used in UNIX.

UNIT I OVERVIEW **9**

General Overview of the System - History – System structure – User perspective –Operating system services – Assumptions about hardware - Introduction to the Kernel - Architecture of the UNIX operating system – Introduction to system concepts - The Buffer Cache - Buffer headers – Structure of the buffer pool – Scenarios for retrieval of a buffer– Reading and writing disk blocks – Advantages and disadvantages of the buffer cache.

UNIT II FILE SUBSYSTEM **9**

Internal representation of files - Inodes – Structure of a regular file – Directories –Conversion of a path name to an Inode – Super block – Inode assignment to a new file – Allocation of disk blocks.

UNIT III SYSTEM CALLS FOR THE FILE SYSTEM **9**

Open – Read – Write – File and record locking – Adjusting the position of file I/O – Lseek – Close – File creation – Creation of special files – Changing directory – root – owner - mode – stat and fstat – Pipes – Dup – Mounting and unmounting file systems – link – unlink.

UNIT IV PROCESSES **9**

Process states and transitions – Layout of system memory – The context of a process –Saving the context of a process – Manipulation of the process address space – Sleep - Process Control - Process creation – Signals – Process termination – Awaiting process termination – Invoking other programs – user id of a process – Changing the size of a process - Shell – System boot and the INIT process– Process Scheduling.

UNIT V MEMORY MANAGEMENT AND I/O **9**

Memory Management Policies - Swapping – Demand paging - The I/O Subsystem -Driver Interface – Disk Drivers – Terminal Drivers**.**

TOTAL:45 PERIODS

OUTCOMES:

Upon completion of the course, the student should be able

- To analyze the internals of the unix operating system.
- To make use of the various data structures
- To implement various low-level algorithms used in UNIX.

REFERENCES:

1. Maurice J. Bach, “The Design of the Unix Operating System”, First Edition,Pearson Education, 1999.
2. B. Goodheart, J. Cox, “The Magic Garden Explained”, Prentice Hall of India,1986.
3. S. J. Leffler, M. K. Mckusick, M. J. .Karels and J. S. Quarterman., “The Design and Implementation of the 4.3 BSD Unix Operating System”, Addison Wesley, 1998.

IF 7002 ADHOC MOBILE WIRELESS NETWORKS L T P C
3 0 0 3

OBJECTIVES:

- To learn about the issues in the design of ad hoc and wireless sensor networks
- To understand the working of protocols in different layers of ad hoc and sensor networks
- To expose the students to different aspects in ad hoc and sensor networks
- To understand various standards and applications in ad hoc and sensor networks

UNIT I FUNDAMENTALS 9

Introduction to ad hoc networks- Differences between cellular and ad hoc wireless networks-Challenges and issues in ad hoc networks-Introduction to WSN-Single node architecture-Network architecture- Localization and positioning-Operating systems for WSN.

UNIT II MAC AND LINK MANAGEMENT 9

Fundamentals of wireless MAC protocols- Classification of MAC protocols for ad hoc networks-MAC for WSN-Low duty cycle protocols and wakeup concepts- Contention and schedule based protocols-WSN link layer-Error control-Framing-Link management.

UNIT III ROUTING 9

Design issues of routing protocols for ad hoc networks- Classification of routing protocols-Proactive, Reactive and Hybrid routing protocols-Routing in WSN-Naming and addressing-Gossiping and agentbased unicast forwarding- Energy efficient unicast- Broadcast and multicast-Geographic routing-Data-centric and content-based networking.

UNIT IV TRANSPORT LAYER AND QoS 9

Challenges of transport layer protocol in wireless environments- TCP's challenges and design issues in ad hoc networks-Transport protocols for ad hoc networks-Transport control protocols for WSNs-Issues and challenges in providing QoS in ad hoc networks-Network layer QoS solutions-QoS Model-QoS in wireless sensor networks-Congestion control in network processing.

UNIT V STANDARDS AND APPLICATIONS 9

Wireless sensor network standards-Standards on wireless mesh networks-Applications of ad hoc and WSNs-Case study: Building military border area surveillance system, Forest fire detection system and tsunami early warning system with wireless sensor networks.

TOTAL : 45 PERIODS

OUTCOMES:

Upon completion of this course students should be able to

- Identify different issues in wireless ad hoc and sensor networks
- To analyze the protocols developed for ad hoc and sensor networks
- To identify and discuss the standards and applications of ad hoc and sensor networks

REFERENCES:

1. SubirKumarSarkar, TGBasavaraju, C Puttamadappa,"Ad Hoc Mobile Wireless Networks", Auerbach Publications, 2008.
2. C.Siva Ram Murthy, B.S.Manoj, "Ad Hoc Wireless Networks- Architectures and Protocols", Pearson Education, 2004.
3. KazemSohraby, Daniel Minoli, TaiebZnati, "Wireless Sensor Networks-Technology, Protocols, and Applications", John Wiley & Sons, 2007.
4. WaltenegusDargie,Christian Poellabauer, "Fundamentals of Wireless SensorNetworks", John Wiley & Sons, 2010.
5. Holger Karl, Andreas Willig, "Protocols and Architectures for Wireless Sensor Networks", John Wiley & Sons, 2005.

IF 7073 GPU ARCHITECTURE AND PROGRAMMING L T P C
3 0 0 3

OBJECTIVES:

- To understand the architecture of GPUs in order to program them effectively.
- To program using GPU programming frameworks.
- To optimize multimedia applications to run on GPUs.

UNIT I GPU ARCHITECTURES 9

Parallel Processors – Classification – Performance – Multimedia SIMD Architectures. GPU – NVIDIA Case Study – GPU Computational Structures – ISA – Memory Structures.

UNIT II GPU COMPUTING AND CUDA 9

Introduction – Parallel Programming Languages and models – Evolution of Graphic pipelines – GPGPUs - CUDA Program Structure – Device memories – Data Transfer – Kernel Functions

UNIT III CUDA DETAILS 9

CUDA Threads – Thread Organization – Synchronization & Scalability – CUDA memories – Performance – Imaging Case study

UNIT IV OPENCL BASICS 9

OpenCL Standard – Kernels – Host Device Interaction – Execution Environment – Memory Model – Basic OpenCL Examples.

UNIT V OPENCL CONCURRENCY & EXECUTION MODEL 9

OpenCL Synchronization – Kernels – Fences – Barriers – Queueing – Global Synchronization – Memory Consistency – Events – Host side memory model – Device Side memory Model – Case study

TOTAL:45 PERIODS

OUTCOMES:

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

- Design multimedia applications using GPUs.
- Write Programs for GPUs using CUDA / OpenCL.
- Optimize programs to run on massively parallel architectures.

REFERENCES:

1. David B. Kirk, Wen-mei W. Hwu, “Programming massively parallel processors”,Morgan Kauffman, 2010.
2. B.R. Gaster, L. Howes, D.R. Kaeli, P. Mistry, D. Schaa, “ Heterogeneous computing with OpenCL”, Morgan Kauffman, 2012.
3. John L. Hennessey and David A. Patterson, “Computer Architecture – A quantitative approach”, Morgan Kaufmann / Elsevier, 5th edition, 2012.
4. J. Sanders and E. Kandrot**,** “CUDA by Example: An Introduction to General-Purpose GPU Programming”, Addison Wesley, 2010.
5. Wen–mei W. Hwu, “GPU Computing Gems”, Morgan Kaufmann / Elsevier, 2011

IF 7020 **VIRTUALIZATION** **L T P C**
3 0 0 3

OBJECTIVES:

- To understand the concept of virtualization.
- To understand the various issues in virtualization.
- To familiarize themselves with the types of virtualization.
- To compare and analyze various virtual machines products.

UNIT I OVERVIEW OF VIRTUALIZATION 10

Basics of Virtualization - Virtualization Types – Desktop Virtualization – Network Virtualization – Server and Machine Virtualization – Storage Virtualization – System-level of Operating Virtualization – Application Virtualization-Virtualization Advantages - Virtual Machine Basics – Taxonomy of Virtual Machines - Process Virtual Machines - System Virtual Machines – Hypervisor - Key Concepts.

UNIT II SERVER CONSOLIDATION 8

Hardware Virtualization – Virtual Hardware Overview - Sever Virtualization – Physical and Logical Partitioning - Types of Server Virtualization – Business cases for Sever Virtualization – Uses of Virtual server Consolidation – Planning for Development –Selecting server Virtualization Platform.

UNIT III NETWORK VIRTUALIZATION 10

Design of Scalable Enterprise Networks - Virtualizing the Campus WAN Design – WAN Architecture - WAN Virtualization - Virtual Enterprise Transport Virtualization–VLANs and Scalability - Theory Network Device Virtualization Layer 2 - VLANs Layer 3 VRF Instances Layer 2 - VFIs Virtual Firewall Contexts Network Device Virtualization – DataPath Virtualization Layer 2: 802.1q - Trunking Generic Routing Encapsulation - IPsec L2TPv3 Label Switched Paths - Control-Plane Virtualization–Routing Protocols- VRF - Aware Routing Multi-Topology Routing.

UNIT IV VIRTUALIZING STORAGE 8

SCSI- Speaking SCSI- Using SCSI buses – Fiber Channel – Fiber Channel Cables –Fiber Channel Hardware Devices – iSCSI Architecture – Securing iSCSI – SAN backup and recovery techniques – RAID – SNIA Shared Storage Model – Classical Storage Model – SNIA Shared Storage Model – Host based Architecture – Storage based architecture – Network based Architecture – Fault tolerance to SAN – Performing Backups – Virtual tape libraries.

UNIT V VIRTUAL MACHINES PRODUCTS 9

Xen Virtual machine monitors- Xen API – VMware – VMware products - VMware Features – Microsoft Virtual Server – Features of Microsoft Virtual Server.

TOTAL:45 PERIODS

OUTCOMES:

Upon Completion of the course, the students should be able to

- Create a virtual machine and to extend it to a virtual network.
- Discuss on various virtual machine products.
- Compile all types of virtualization techniques and utilize them in design of virtual machines.

REFERENCES:

1. William von Hagen, “Professional Xen Virtualization”, Wrox Publications, January, 2008.
2. Chris Wolf , Erick M. Halter, “Virtualization: From the Desktop to the Enterprise”, APress 2005.
3. Kumar Reddy, Victor Moreno, “Network virtualization”, Cisco Press, July, 2006.
4. James E. Smith, Ravi Nair, “Virtual Machines: Versatile Platforms for Systems and Processes”, Elsevier/Morgan Kaufmann, 2005.
5. David Marshall, Wade A. Reynolds, “Advanced Server Virtualization: VMware and Microsoft Platform in the Virtual Data Center”, Auerbach Publications, 2006.

IF 7076 **OPERATIONS RESEARCH** **LT P C**
3 0 0 3

OBJECTIVES:

The student should be able to

This course aims at providing the necessary basic concepts of a few deterministic optimization techniques, queuing theory, simulation and applies them to various engineering problems.

UNIT I QUEUEING MODELS 9

Markovian Queues - Steady state analysis of Single and Multi-server Models - Little's Formula - Finite and Infinite Capacity Models - Machine Interference Model - Self-Service Queue.

UNIT II LINEAR PROGRAMMING 9

Formulation - Graphical Solution - Simplex Method - Two-Phase Method - Transportation and Assignment Models.

UNIT III NON-LINEAR PROGRAMMING 9

Constrained Problems - Equality Constraints - Lagrangean Method - Inequality Constraints - Karush – Kuhn -Tucker (KKT) Conditions - Quadratic Programming.

UNIT IV DYNAMIC PROGRAMMING 9

Dynamic Programming - Principle of Optimality - Forward and Backward Recursion – Applications of Dynamic Programming - Problem of Dimensionality.

UNIT V SIMULATION MODELLING 9

Monte Carlo Simulation - Types of Simulation - Elements of Discrete Event Simulation - Generation of Random Numbers - Applications to Queueing systems.

TOTAL:45 PERIODS

OUTCOMES :

Upon completion of this course, the student will:

- Have a clear perception of the power of mathematical programming tools and acquire skills to analyze queuing models.
- Demonstrate the application of the operations research techniques to problems drawn from industry, management and other engineering fields.

REFERENCES:

1. Taha H.A, "Operations Research: An Introduction", Pearson Education, New Delhi, Ninth Edition, 2010.
2. Gupta P.K. and Hira, D.S., "Operations Research", S.Chand & Company Ltd., Revised Edition, 2012.
3. Ravindran A., Don T. Phillips and James J. Solberg, "Operations Research", Wiley-India Edition, Second Edition, 2006.
4. Sharma J. K., "Operations Research", Macmillan Publishers India Ltd., Third Edition, 2009.

MM 7071 **DIGITAL VIDEO PROCESSING** **L T P C**
3 0 0 3

OBJECTIVES:

To provide an introduction to the fundamental principles and techniques in

- Video processing.
- To provide an overview of video enhancement and restoration algorithms
- To provide details about video Tracking
- To review latest trends and future technologies in video computing.

UNIT I FUNDAMENTALS OF VIDEO PROCESSING 9

Video Formation, Perception and Representation - Video Capture and Display – Principles of Color Video - Video Cameras – Video Display and Composite versus Component Models and Gamma Correction – Analog Video Raster – Progressive vs Interlaced scans - – Digital Video – Notation – ITU– R.BT.601Digital Video Format and Other Digital Video Formats and Applications

UNIT II DIGITAL VIDEO ENHANCEMENT AND SEGMENTATION 9

Video Sampling – Basics of the Lattice Theory – Sampling of Video Signals over Lattices –Filtering Operations in Cameras and Display Devices – Video Segmentation Algorithms – Median Cut, Graph Cut and EM Algorithms – Active Contour models.

UNIT III VIDEO ANALYSIS AND TRACKING 9

Typical Tracker – Localization – Optical Flow - Object Tracking and analysis – Kalman Filtering – Video Tracking – Bayesian Approach – Particle Filter – Trackers – Evaluation – Video Inpainting – restoration –Video Mining – Video Search Engines and retrieval – Visual Event Detection – Video Surveillance and Security.

UNIT IV MOTION ESTIMATION 9

Two-Dimensional Motion Estimation - Optical Flow. General Methodologies - Motion Representation, Motion Estimation Criteria, Optimization Methods. Pixel-Based Motion Estimation - Block-Matching Algorithm - Exhaustive Block-Matching Algorithm - Phase Correlation Method and Multiresolution Motion Estimation.

UNIT V VIDEO CLASSIFICATION AND RECOGITION 9

Video Classification – Classification and Clustering models – Video Annotation – Video Summarization – Action Recognition - Visual Event Detection.

TOTAL: 45 PERIODS

OUTCOMES:

Upon Completion of the course, the students should be able to

- Implement basic algorithms related to digital video.
- Familiarize with the MATLAB and its equivalent open source tools for processing video.
- Design and implement some basic video related applications in domains like biometrics, object
- traction and in Industrial environment.
- Critically analyze the role of video in modern technologies.

REFERENCES:

1. A. Murat Tekalp ,"Digital Video Processing", Pearson, 2010.
2. Maggio E., Cavallaro A., Video Tracking, Wiley , 2011.
3. Alan Bovik C “The Essential Guide to Video Processing”, Academic Press Inc, 2009.
4. Oge Marques ‘Practical Image and Video processing using Matlab”, IEEE Press, 2011.
5. Niels NielsHaering, Niels Da Vitoria Lobo, Visual Event Detection, The International Series in Video Computing, Springer US, 2001.
6. Michael A. Smith, Takeo Kanade, Multimodal Video Characterization and Summarization, The Kluwer International Series in Video Computing, 2005.

MM 7252 VIDEO PROCESSING AND ANALYTICS L T P C
3 0 0 3

OBJECTIVES:

- To have a better knowledge about videos
- To enrich students with data analytics
- To understand the video content analysis
- To expose the student to various applications and case studies of Video analytics.

UNIT I VIDEO FUNDAMENTALS 9

Basic concepts and Terminology-Monochrome Analog video – Color in Video – Anlog video standards – Digital video basics – Analog-to Digital conversion – Color representation and chroma sub sampling – Digital video formats and standards Video sampling rate and standards conversion.

UNIT II VIDEO SEGMENTATION AND VIDEO FEATURES 9

Fundamentals of Motion Estimation – Optical flow - Pixel Video Features - colour, shape features, Textural features - Feature selection and Dimensionality Reduction .

UNIT III INTRODUCTION TO ANALYTICS 9

Big-Data - Descriptive data analysis - Analytic Processes and Tools - Regression - Classification - Clustering algorithms - Validation - Multimodal approach to Image and Video data mining - Probabilistic semantic mode - Model based annotation and video mining.

UNIT IV VIDEO CONTENT ANALYSIS AND ANALYTICS 9

Introduction- Detecting Shot Boundaries in Video – Parsing a Video into Semantic Segments – Video Indexing and Abstraction for Retrievals – Affective Video Content Analysis - Automatic Video Trailer Generation - Video database - Video categorization - Video query categorization

UNIT V EMERGING TRENDS 9

Object Segmentation and Tracking in the Presence of Complex Background – Video Inpainting – Video Summarization – Forensic video analysis

TOTAL:45 PERIODS

OUTCOMES:

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

- Discuss video processing fundamentals
- Analyze video features
- Formulate various application of video processing

REFERENCES:

1. Oges Marques, Practical Image and Video Processing Using MATLAB, Wiley-IEEE Press, 2011.
2. Michael Berthold, David J.Hand, Intelligent Data Analysis, Springer, 2007.
3. Anand Rajaraman and Jeffrey David Ullman, Mining of Massive Datasets, Cambridge University Press, 2012.

SW 7151 SOFTWARE ARCHITECTURE L T P C
3 0 0 3

OBJECTIVES:

The student should be able to

- Understand the fundamentals of software architecture.
- Study the various software development methodologies.
- Learn the various software architecture design components.
- Relate software architecture and software quality.

UNIT I INTRODUCTION 9

Basic Concepts of Software Architecture - Architecture business cycle - architectural patterns - reference models - architectural structures, views - Introduction to Styles - Simple Styles - Distributed and Networked Architectures-Architecture for network based applications - Decentralized Architectures

UNIT II DESIGN METHODOLOGIES 9

Structured Design - Design Practices – Stepwise Refinement – Incremental Design – Structured System Analysis and Design – Jackson Structured Programming – Jackson System Development

UNIT III ARCHITECTURE DESCRIPTION DOCUMENTATION AND EVALUATION 9

Early Architecture Description Languages –Domain and Style Specific ADLs –Extensible ADLs - Documenting Software architecture -Architecture Evaluation –ATAM

UNIT IV ARCHITECTURE DESIGN 9

Typical Architectural Design - Data Flow - Independent Components - Call and Return - Using Styles in Design – choices of styles – Architectural design space – Theory of Design Spaces – Design space of Architectural Elements – Design space of Architectural styles.

UNIT V CREATING AN ARCHITECTURE 9

Understanding Quality Attributes - Functionality and Architecture –Architecture and Quality Attributes-System Quality Attributes –Quality attribute Scenarios in Practice - Introducing Tactics - Availability Tactics –Modifiability Tactics –Performance Tactics -Security Tactics –Testability Tactics –Usability Tactics –Relationship of Tactics to Architectural Patterns –Architectural Patterns and Styles.

TOTAL : 45 PERIODS

OUTCOMES:

At the end the student will be able to

- Develop Software applications starting from software architecture and design.
- Learn and evaluate existing software architectures.
- Design methods for improving software quality from the perspective of software architecture.

REFERENCES:

1. Len Bass, Paul Clements, Rick Kazman, “Software Architecture inPractice, Third Edition, Addison,Wesley, 2012.
2. David Budgen, "Software Design", Second Edition, Pearson Education, 2004.
3. Richard N.Taylor, NenadMedvidovic and Eric M.Dashofy, “Software Architecture, Foundations, Theory and Practice”, Wiley 2010.
4. Hong Zhu, “Software Design Methodology from Principles to Architectural Styles”, Elsevier, 2005.
5. Mary shaw and David Garlan, Software Architecture –Perspectives on anemerging discipline, Pearson education, 2008.

IF 7075 **MOBILE APPLICATION DEVELOPMENT** **L T P C**
3 0 0 3

OBJECTIVES:

- To learn the characteristics of mobile applications.
- To understand the intricacies of UI required by mobile applications.
- To study about the design aspects of mobile application.
- To learn development of mobile applications.

UNIT I INTRODUCTION **9**

Mobile Applications – Characteristics and Benefits – Application Model – Infrastructure and Managing Resources – Mobile Software Engineering – Frameworks and Tools – Mobile devices Profiles.

UNIT II USER INTERFACE **9**

Generic UI Development – VUIs and Mobile Applications – Text to Speech techniques – Designing the right UI – Multimodal and Multichannel UI – Gesture based UIs – Screen Elements and Layouts – Voice XML – Java API.

UNIT III APPLICATION DESIGN **9**

Memory Management – Design patterns for limited memory – Work flow for Application Development – Techniques for composing Applications – Dynamic Linking – Plug ins and rules of thumb for using DLLs – Concurrency and Resource Management – Look and feel.

UNIT IV APPLICATION DEVELOPMENT **9**

Intents and Services – Storing and Retrieving data – Communication via the Web – Notification and Alarms – Graphics and Multimedia – Telephony – Location based services – Packaging and Deployment – Security and Hacking.

UNIT V TOOLS **9**

Google Android Platform – Eclipse Simulator – Android Application Architecture – Event based programming – Apple iPhone Platform – UI tool kit interfaces – Event handling and Graphics services – Layer Animation.

TOTAL:45 PERIODS

OUTCOMES:

Upon Completion of the course, the students should be able

- To design and implement the user interfaces for mobile applications.
- To design the mobile applications that is aware of the resource constraints of mobile devices.
- To develop advanced mobile applications that accesses the databases and the web.
- To develop useful mobile applications in the current scenario using Google Android and Eclipse simulator.

REFERENCES:

1. Zigurd Mednieks, Laird Dornin, G, Blake Meike and Masumi Nakamura, “Programming Android”, O‟Reilly, 2011.
2. Reto Meier, Wrox Wiley, “Professional Android 2 Application Development”, 2010.
3. Alasdair Allan, “iPhone Programming”, O‟Reilly, 2010.
4. Wei-Meng Lee, “Beginning iPhone SDK Programming with Objective-C”, Wrox Wiley, 2010.
5. Stefan Poslad, “Ubiquitous Computing: Smart Devices, Environments and interactions”, Wiley, 2009.