ANNA UNIVERSITY, CHENNAI
UNIVERSITY DEPARTMENTS
M.C.A
REGULATIONS – 2015
CHOICE BASED CREDIT SYSTEM

PROGRAMME EDUCATIONAL OBJECTIVES (PEOs) :

I. To prepare students to excel in computer applications to succeed in industry/ technical profession.

II. To provide students with solid foundation in mathematical and computing fundamentals and techniques required to solve related problems and also to pursue higher studies and research.

III. To train students with good computing breadth so as to comprehend, analyze, design and create computing solutions for the real life problems.

IV. To inculcate students in professional and ethical attitude, effective communication skills, multidisciplinary approach and an ability to relate computing issues to broader social context.

V. To provide students with an academic environment aware of excellence, leadership and continuous learning, on technology and trends needed for a successful career.

PROGRAMME OUTCOMES (POs):
On successful completion of the programme,

1. Graduates will acquire knowledge of basic mathematics, computing fundamentals, programming concepts and other core computer subjects.

2. Graduates will have an ability to identify, formulate and implement computing solutions.

3. Graduates will have an ability to design and conduct experiments, analyze and interpret data.

4. Graduates will be able to design a system, component or process as per needs and specification.

5. Graduates will have the skill to work on multidisciplinary tasks and will be aware of the new and emerging disciplines.

6. Graduates will demonstrate skills to use modern tools, software and equipments to analyze problems.

7. Graduates will exhibit the knowledge of professional and ethical responsibilities.

8. Graduates will be able to communicate effectively in both verbal and written form.

9. Graduates will demonstrate effects of computing solutions on the society.

10. Graduates will have a confidence for self education and ability for continuous learning on trends and technologies

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

Year	Sem	Course	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
YEAR 1	SEM 1	Mathematical Foundations of Computer Science	✓	✓			✓					
		Problem Solving and C Programming	✓	✓	✓	✓					✓	
		Database Management Systems	✓	✓	✓		✓				✓	
		Data Structures	✓	✓	✓	✓						
		Computer Organization and Design	✓	✓		✓						
		Data Structures and Programming Laboratory		✓	✓	✓	✓	✓				
		Database Management Systems Laboratory		✓	✓		✓	✓			✓	
	SEM 2	Computer Communication and Networks	✓	✓		✓	✓					
		Operating System Concepts	✓	✓		✓						
		Software Engineering Methodologies	✓	✓		✓	✓	✓	✓	✓	✓	
		Design and Analysis of Algorithms	✓	✓	✓	✓	✓					
		Object Oriented Programming Paradigm	✓	✓	✓	✓					✓	
		OOP and Algorithms Lab.		✓	✓	✓	✓	✓			✓	
		OS and Network Programming Laboratory					✓	✓				
YEAR 2	SEM 3	Embedded Systems			✓	✓	✓	✓			✓	✓
		Data Warehousing and Mining		✓	✓	✓	✓				✓	✓
		Object Oriented Analysis and Design		✓	✓	✓	✓					
		Web Programming	✓	✓	✓	✓	✓	✓				✓
		Elective I										
		Web Programming Lab.		✓	✓		✓	✓				✓
		Case Tools Laboratory		✓	✓		✓	✓				
		Soft Skills Development Lab							✓	✓	✓	✓
	SEM 4	Advanced Java Programming	✓	✓	✓	✓	✓	✓				
		Unix Internals	✓	✓								
		Mobile Computing		✓		✓	✓	✓				✓
		Elective- II										
		Elective – III										
		Advanced Java Programming Laboratory		✓	✓	✓	✓	✓				
		Mobile Application Development Laboratory			✓	✓	✓	✓				✓
		Technical Seminar and Report Writing							✓	✓	✓	✓

YEAR 3	SEM	Course										
	SEM 5	Software Testing	✓		✓	✓		✓				
		Distributes Cloud Computing					✓	✓			✓	✓
		Cryptography and Network Security	✓	✓	✓	✓	✓					
		Elective – IV										
		Elective – V										
		Software Testing laboratory		✓		✓	✓	✓				
		Cloud Computing and Security Laboratory				✓	✓	✓			✓	✓
		Report Writing Practice Lab.							✓	✓	✓	✓
	SEM 6	Project Work	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓

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CURRICULA AND SYLLABI

SEMESTER - I

SL. NO.	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
THEORY								
1.	MA7104	Mathematical Foundations of Computer Science	FC	4	4	0	0	4
2.	CA 7104	Problem Solving and C Programming	FC	3	3	0	0	3
3.	CA7103	Database Management Systems	PC	3	3	0	0	3
4.	CA7102	Data Structures	PC	3	3	0	0	3
5.	CA7101	Computer Organization and Design	PC	3	3	0	0	3
PRACTICALS								
6.	CA7111	Data Structures and Programming Laboratory	PC	4	0	0	4	2
7.	CA7112	Database Management Systems Laboratory	PC	4	0	0	4	2
			TOTAL	**24**	**16**	**0**	**8**	**20**

II SEMESTER

SL. NO.	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
THEORY								
1.	CA7201	Computer Communication and Networks	PC	4	4	0	0	4
2.	CA7204	Operating System Concepts	PC	3	3	0	0	3
3.	CA7205	Software Engineering Methodologies	PC	3	3	0	0	3
4.	CA7202	Design and Analysis of Algorithms	PC	3	3	0	0	3
5.	CA7203	Object Oriented Programming Paradigm	PC	3	3	0	0	3
PRACTICALS								
6.	CA7211	OOP and Algorithms Laboratory	PC	4	0	0	4	2
7.	CA7212	OS and Network Programming Laboratory	PC	4	0	0	4	2
			TOTAL	**24**	**16**	**0**	**8**	**20**

III SEMESTER

SL. NO	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
THEORY								
1.	CA7302	Embedded Systems	PC	3	3	0	0	3
2.	CA7301	Data Warehousing and Mining	PC	3	3	0	0	3
3.	CA7303	Object Oriented Analysis and Design	PC	3	3	0	0	3
4.	CA7304	Web Programming	PC	3	3	0	0	3
5.		Elective – I	PE	3	3	0	0	3
PRACTICALS								
6.	CA7313	Web Programming Laboratory	PC	4	0	0	4	2
7.	CA7311	Case Tools Laboratory	PC	4	0	0	4	2
8.	CA7312	Soft Skills Development Lab	EEC	2	0	0	2	1
			TOTAL	25	15	0	10	20

IV SEMESTER

SL. NO.	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
THEORY								
1.	CA7401	Advanced Java Programming	PC	4	4	0	0	4
2.	IF7451	Unix Internals	PC	3	3	0	0	3
3.	CA7402	Mobile Computing	PC	3	3	0	0	3
4.		Elective- II	PE	3	3	0	0	3
5.		Elective – III	PE	3	3	0	0	3
PRACTICALS								
6.	CA7411	Advanced Java Programming Laboratory	PC	4	0	0	4	2
7.	CA7412	Mobile Application Development Laboratory	PC	4	0	0	4	2
8.	CA7413	Technical Seminar and Report Writing	EEC	2	0	0	2	1
			TOTAL	26	16	0	10	21

V SEMESTER

SL. NO	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
THEORY								
1.	CA7503	Software Testing	PC	3	3	0	0	3
2.	CA7502	Distributed and Cloud Computing	PC	3	3	0	0	3
3.	CA7501	Cryptography and Network Security	PC	3	3	0	0	3
4.		Elective – IV	PE	3	3	0	0	3
5.		Elective – V	PE	3	3	0	0	3
PRACTICALS								
6.	CA7513	Software Testing Laboratory	PC	4	0	0	4	2
7.	CA7511	Cloud Computing and Security Laboratory	PC	4	0	0	4	2
8.	CA7512	Report Writing Practice Laboratory	EEC	2	0	0	2	1
			TOTAL	25	15	0	10	20

VI SEMESTER

SL. NO	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
PRACTICALS								
1.	CA7611	Project Work	EEC	24	0	0	24	12
			TOTAL	24	0	0	24	12

TOTAL NO. OF CREDITS: 113

FOUNDATION COURSES (FC)

SL. NO	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
1.		Mathematical Foundations of Computer Science	FC	4	4	0	0	4
2.		Problem Solving and C Programming	FC	3	3	0	0	3

PROFESSIONAL CORE (PC)

SL. NO	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
1.		Database Management Systems	PC	3	3	0	0	3
2.		Data Structures	PC	3	3	0	0	3
3.		Computer Organization and Design	PC	3	3	0	0	3
4.		Data structures and Programming Laboratory	PC	4	0	0	4	2
5.		Database Management Systems Laboratory	PC	4	0	0	4	2
6.		Computer Communication and Networks	PC	4	4	0	0	4
7.		Operating System Concepts	PC	3	3	0	0	3
8.		Software Engineering Methodologies	PC	3	3	0	0	3
9.		Design and Analysis of Algorithms	PC	3	3	0	0	3
10.		Object Oriented Paradigm and Programming	PC	3	3	0	0	3
11.		OOP and Algorithms Laboratory	PC	4	0	0	4	2
12.		OS and Network Programming Laboratory	PC	4	0	0	4	2
13.		Embedded Systems	PC	3	3	0	0	3
14.		Data warehousing and Mining	PC	3	3	0	0	3
15.		Object Oriented Analysis and Design	PC	3	3	0	0	3
16.		Web Programming	PC	3	3	0	0	3
17.		Web Programming Laboratory	PC	4	0	0	4	2
18.		Case Tools Laboratory	PC	4	0	0	4	2
19.		Advanced Java Programming	PC	4	4	0	0	4
20.		Unix Internals	PC	3	3	0	0	3
21.		Mobile Computing	PC	3	3	0	0	3
22.		Advanced Java Programming Laboratory	PC	4	0	0	4	2
23.		Mobile Application Development Laboratory	PC	4	0	0	4	2

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24.		Software Testing	PC	3	3	0	0	3
25.		Distributed and Cloud Computing	PC	3	3	0	0	3
26.		Cryptography and Network Security	PC	3	3	0	0	3
27.		Cloud Computing and Security Laboratory	PC	4	0	0	4	2
28.		Software Testing Laboratory	PC	4	0	0	4	2

PROFESSIONAL ELECTIVES (PE)

SL. NO	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
1.	CA7005	Distributed Systems	PE	3	3	0	0	3
2.	CA7014	High Speed Networks	PE	3	3	0	0	3
3.	CA7025	TCP/IP Design and Implementation	PE	3	3	0	0	3
4.	CA7001	Computer Graphics and Animation	PE	3	3	0	0	3
5.	CA7003	Database Tuning	PE	3	3	0	0	3
6.	CA7023	Software Quality Management	PE	3	3	0	0	3
7.	CA7022	Real Time Systems	PE	3	3	0	0	3
8.	CA7009	Fundamental of Digital Image Processing	PE	3	3	0	0	3
9.	CA7026	User Interface Design	PE	3	3	0	0	3
10.	CA7012	Grid Computing	PE	3	3	0	0	3
11.	CA7018	Internet of Things	PE	3	3	0	0	3
12.	CA7028	XML and Web Services	PE	3	3	0	0	3
13.	CA7011	Geographical Information Systems	PE	3	3	0	0	3
14.	CA7013	Healthcare Information Systems	PE	3	3	0	0	3
15.	CA7006	E-Learning Techniques	PE	3	3	0	0	3
16.	IF7076	Operations Research	PE	3	3	0	0	3
17.	CA7007	Enterprise Resource Planning	PE	3	3	0	0	3
18.	CA7020	Multimedia	PE	3	3	0	0	3
19.	CA7016	Information Management System	PE	3	3	0	0	3
20.	CA7019	M-Commerce	PE	3	3	0	0	3
21.	CA7024	Software Reliability and Metrics	PE	3	3	0	0	3
22.	MM7072	Visualisation Techniques	PE	3	3	0	0	3
23.	IF7071	Bio Informatics	PE	3	3	0	0	3
24.	CA7017	Intelligent Data Analysis	PE	3	3	0	0	3
25.	CA7008	Financial Accounting and Management	PE	3	3	0	0	3
26.	CA7015	Human Resources Management	PE	3	3	0	0	3
27.	CA7002	Customer Relationship Management	PE	3	3	0	0	3
28.	CA7027	Virtualization Techniques	PE	3	3	0	0	3
29.	CA7010	Game Programming	PE	3	3	0	0	3
30.	CA7021	Professional Practice and Ethics	PE	3	3	0	0	3
31.	CA7004	Development Frameworks and Virtual Machines	PE	3	3	0	0	3
32.	IF7077	Service Oriented Architecture	PE	3	3	0	0	3

EMPLOYABILITY ENHANCEMENT COURSES (EEC)

SL. NO	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
1.		Soft Skills Development Laboratory	EEC	2	0	0	2	1
2.		Technical Seminar and Report Writing	EEC	2	0	0	2	1
3.		Report Writing Practice Laboratory	EEC	2	0	0	2	1
4.		Project Work	EEC	24	0	0	24	12

MA 7104	MATHEMATICAL FOUNDATIONS OF COMPUTER SCIENCE	L	T	P	C
		4	0	0	4

OBJECTIVES:
To introduce mathematical logic, combinatorial and counting techniques, Algebraic structures, Finite state system and grammar as Mathematical Foundation of computer Science so as to understand algorithms, computability and other theoretical aspects of Computer science.

UNIT I   LOGIC   9+3
Statements - Connectives - Truth Tables - Normal Forms - Predicate Calculus – Inference - Theory for Statement Calculus**.**

UNIT II   COMBINATORICS   9+3
Permutations and Combinations - Mathematical Induction - Pigeonhole principle - Principle of Inclusion and Exclusion - Recurrence relations - Solution by generating functions and characteristics equations.

UNIT III   ALGEBRAIC STRUCTURES   9+3
Groups - Cyclic group - Permutation group (Sn and Dn) - Substructures - Homomorphism - Cosets and Lagrange's Theorem - Normal Subgroups - Rings and Fields (definition and examples).

UNIT IV   LATTICES   9+3
Partial order relation – Posets - Hasse diagram - Lattices - Special Lattices - Boolean Algebra.

UNIT V   FINITE STATE AUTOMATA AND GRAMMARS   9+3
Finite state automata - Deterministic and non-deterministic model - languages accepted by Finite State Automata - Regular expressions - Context-free grammars - Derivation trees.

L: 45 +T: 15 TOTAL: 60 PERIODS

OUTCOMES :
Upon completion of this course, the student will:
- Apply mathematical logic and develop analytical solutions for logical problems and they will be equipped with counting techniques to solve combinatorial problems.
- Comprehend the algebraic structure and formal languages with their applications to handle
- Abstract generalizations and computability.

REFERENCES :
1. Trembley.J.P. and Manohar R., "Discrete Mathematical Structures with Applications to Computer Science", Tata McGraw – Hill Publishing Company Limited, New Delhi. Reprinted in 2007.
2. Grimaldi R.P. and Ramana B.V., "Discrete and Combinatorial Mathematics", 5th Edition, Pearson Education, Reprinted in 2006.
3. Hopcroft J.E. and Ullman J.D., "Introduction to Automata, Languages and Computation", Narosa Publishing House, 1987.

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	L	**T**	**P**	**C**
CA 7104 **PROBLEM SOLVING AND C PROGRAMMING**	**3**	**0**	**0**	**3**

OBJECTIVES:
The student
- To understand the various problem solving techniques.
- To understand the usage of top down design technique in problem solving.
- To learn the syntax of C.
- To get exposed to the file processing techniques of C.
- To get familiarized with the pre-processor directives.

UNIT I   PROBLEM SOLVING   9
Introduction – The Problem–Solving Aspect – Top-Down Design – Implementation of Algorithms – Program Verification – The Efficiency of Algorithms – The Analysis of Algorithms.

UNIT II   BASICS OF C PROGRAMMING   9
Introduction– Keywords – Identifiers – Basic Data Types in C – Variables – Constants – Input/Output Statements in C – Operators in C – Conditional Branching Statements – Iterative Statements – Nested Loops – The Break and Continue Statements -Goto Statement.

UNIT III   FUNCTIONS, ARRAYS AND STRINGS   9
Functions-Definitions - Prototypes – Passing Parameters to the Function – Scope of Variables – Storage Classes – Recursive Functions - Arrays – Declaration – Usage – Passing Arrays to Functions – Reading and Writing Strings – String Operations.

UNIT IV   POINTERS AND AGGREGATE DATA TYPES   9
Pointer Variable Declarations and Initialization – Operators – Uses - Pointer Expressions and Pointer Arithmetic – Relationship between Pointers and Arrays – Arrays of Pointers – Pointers to Functions -Structures-Definition – Initialization – Unions – Bitwise Operators – Enumeration Constants.

UNIT V   FILES AND PREPROCESSOR DIRECTIVES   9
Introduction to Files – Using Files in C – Read and Write Data with Files - Random Access Files – Types of Pre-processor Directives –#define - #include- Conditional Directives.

TOTAL : 45 PERIODS

OUTCOMES :
Upon completion of this course, the student will:
- Design and implement C programs for a given problem.
- Work with existing programs and modify it as per the requirements.
- Identify the errors in a C program.
- Identify the output of a C program without actually executing it.

REFERENCES :
1. R.G.Dromey, "How to Solve it by Computer", Pearson Education, 2007.
2. ReemaThareja, "Programming in C", OXFORD Higher Education, 2011.
3. Kernigan Brian W., and Dennis M. Ritchie, "The C Programming Language", Second Edition, Prentice Hall, 1988.
4. Brian W. Kernighan and Rob Pike, "The UNIX Programming Environment", Prentice Hall, 1984.

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CA 7103	DATABASE MANAGEMENT SYSTEMS	L	T	P	C
		3	0	0	3

OBJECTIVES:

The student
- To learn the fundamentals of data models and to conceptualize and depict a database system using ER diagram.
- To make a study of SQL and relational database design.
- To understand the internal storage structures using different file and indexing techniques which will help in physical DB design.
- To know the fundamental concepts of transaction processing - concurrency control techniques and recovery procedure.
- To have an introductory knowledge about the Storage and Query processing Techniques.

UNIT I   RELATIONAL DATABASES   9

Purpose of Database System – Views of data – Data Models – Database System Architecture – Entity Relationship model – E-R Diagrams - Introduction to relational databases - The relational Model – Keys - Relational Algebra – Relational Calculus – SQL fundamentals - Advanced SQL features – Embedded SQL – Dynamic SQL.

UNIT II   DATABASE DESIGN   9

Functional Dependencies – Non-loss Decomposition – Functional Dependencies – First – Second - Third Normal Forms - Dependency Preservation – Boyce/Codd Normal Form - Multi-valued Dependencies and Fourth Normal Form – Join Dependencies and Fifth Normal Form.

UNIT III   DATASTORAGE AND QUERYING   9

Overview of Physical Storage Media – RAID – File Organization – Organization of Records in Files – Indexing and Hashing –Ordered Indices – B+ tree Index Files – B tree Index Files – Static Hashing – Dynamic Hashing – Query Processing Overview – Measures of Query Cost- Selection Operation, Sorting, Join Operation.

UNIT IV   TRANSACTION MANAGEMENT   9

Transaction Concepts - Transaction State – Implementation of Atomicity and Durability – Concurrent Executions- Serializability- Recoverability- Implementation of Isolation- Testing for Serializability- Lock Based Protocols- Time-Stamp based Protocols- Deadlock Handling-Failure Classification- Storage Structure-Recovery and Atomicity-Log-Based Recovery-Recovery with Concurrent Transactions.

UNIT V   ADVANCED TOPICS   9

Data Analysis and Mining – Decision Support System- Data Analysis and OLAP- Data warehousing – Data Mining – Distributed Databases – Homogenous and Heterogeneous Databases – Distributed Data storage – Distributed Transactions – Commit Protocols- OO Databases – XML Databases.

TOTAL : 45 PERIODS

OUTCOMES :

Upon completion of this course, the student will:
- Design and create tables in relational database and query them.
- Know how transaction processing and concurrency control is done.
- Compare different types of databases.

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REFERENCES :
1. Abraham Silberschatz, Henry F. Korth, S. Sudharshan, "Database System Concepts", Sixth Edition, Tata McGraw Hill, 2011
2. C.J.Date, A.Kannan, S.Swamynathan, "An Introduction to Database Systems", Eighth Edition, Pearson Education, 2006.
3. Ramez Elmasri, Shamkant B. Navathe, "Fundamentals of Database Systems", Fifth Edition, Pearson, 2008.
4. Raghu Ramakrishnan, "Database Management Systems", Fourth Edition, Tata McGraw Hill, 2010.
5. G.K.Gupta,"Database Management Systems", Tata McGraw Hill, 2011.

CA7102	**DATA STRUCTURES**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

OBJECTIVES: The student should be able to
- To gain comprehensive introduction of common data structures
- To master the linear and hierarchical data structures and its applications
- To learn about sorting techniques and disjoint set ADT

UNIT I   LINEAR DATA STRUCTURES – LIST, STACK AND QUEUE   9
1. Abstract Data Types (ADTs) – List ADT – Array-Based Implementation – Linked List Implementation – Doubly-Linked Lists – Circular Linked Lists – Applications – Cursor-Based Implementation of Linked Lists – Stack ADT: Implementation of Stacks – Applications - Queue ADT: Implementation of Queues – Applications of Queues

UNIT II   HIERARCHICAL DATA STRUCTURES   9
Trees: Preliminaries – Implementation of Trees – Tree Traversals with an Application - Binary Trees: Implementation – Expression Trees – Search Tree ADT: Binary Search Trees –AVL Trees – B-Trees

UNIT III   HASHING   9
Hashing: General Idea – Hash Function – Separate Chaining – Open Addressing – Linear Probing – Quadratic Probing – Double Hashing – Rehashing – Extendible Hashing

UNIT IV   PRIORITY QUEUES   9
Priority Queues: Model – Implementations – Binary Heap – Applications of Priority Queues –   d-Heaps – Leftist Heaps –   Skew Heaps – Binomial Queues

UNIT V   SORTING AND DISJOINT SET ADT   9
Sorting Algorithms: Insertion Sort – A Lower Bound for Simple Sorting Algorithms – Shell Sort – Heap Sort – Sorting Large Structures – A General Lower Bound for Sorting – Bucket Sort – External Sorting – Disjoint Set ADT: Equivalence Relations – Dynamic Equivalence Problem Basic Data Structure – Smart Union Algorithms – Path Compression – Worst Case for Union-By-Rank and Path Compression

TOTAL : 45 PERIODS

OUTCOMES :
Upon completion of this course, the student will:
- Describe, explain and use abstract data types including stacks, queues and lists
- Design and Implement Tree data structures and Sets
- Implement hashing techniques and heaps for applications
- Implement a variety of algorithms for sorting

REFERENCES :
1. Mark Allen Weiss, "Data Structures and Algorithm Analysis in C", 2nd edition, Pearson Education, 1997.
2. Y. Langsam, M. J. Augenstein and A. M. Tenenbaum, "Data Structures using C", Pearson Education Asia, 2004.
3. Aho, J. E. Hopcroft and J. D. Ullman, "Data Structures and Algorithms", Pearson education Asia, 1983.
4. Robert Kruse & Bruce Leung: Data Structures & Program Design in C, Pearson Education, 2007.

CA 7101	COMPUTER ORGANIZATION AND DESIGN	L	T	P	C
		3	0	0	3

OBJECTIVES:
The student should be able to
- To understand the fundamentals of Boolean logic and functions.
- To have a thorough understanding of the basic structure and operation of a digital computer.
- To design and realize digital systems with basic gates and other components using combinational and sequential circuits
- To discuss in detail about the operation of the arithmetic and logic unit.
- To study the instruction sets and operation of a processor.
- To study the different ways of communication with I/O devices and standard I/O Interfaces.
- To study the hierarchical memory system including cache memories and virtual memory

UNIT I   DIGITAL FUNDAMENTALS   9
Digital systems - Binary numbers – Octal - Hexadecimal conversions - Signed binary numbers – Complements - Logic gates - Boolean algebra- K-maps-Standard forms - NAND-NOR implementation.

UNIT II   COMBINATIONAL AND SEQUENTIAL CIRCUITS   9
Combinational circuits - Adder- Subtractor - ALU design – Decoder - Encoder – Multiplexers - Sequential circuits – Latches - Flip-flops – Registers – Memories – Up-down Counters.

UNIT III   PROCESSOR FUNDAMENTALS   9
Von-Neumann architecture- Processor – Definition – Structure – Category – Technology - ALU concept - Stored programs - Fetch execute cycle - Instruction formats - Clock rate instruction rate – Pipeline - Current processors - Multi core processors.

UNIT IV   MEMORY   9
Physical memory – Addressing - Virtual memory - Address translation – Paging – Cache - L1-L2-L3 cache memories - Cache mapping – LRU replacement.

UNIT V   DATA TRANSFER   9
Data transfer - Serial and Parallel data transfer - Full duplex - Half duplex interaction - Bus interface - Programmed I/O – Polling - Interrupt driven I/O - Hardware interrupt mechanism - Interrupt vectors - Multi level of interrupts – DMA - Buffer chaining - Operation chaining.

TOTAL : 45 PERIODS

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OUTCOMES :
- Master the binary and hexadecimal number systems including computer arithmetic.
- Design and implement digital systems with basic gates and other components using
- combinational and sequential circuits.
- Familiarize the Von Neumann architecture.
- Familiarize the functional units of the processor and addressing modes, instruction sets.
- Familiarize the memories and cache subsystem.

REFERENCES :
1. Marris Mano, "Digital design", Fourth edition, PHI/Pearson, 2006.
2. Douglas E.Comer, "Essentials of Computer Architecture", Sixth Edition, Pearson Education, 2012.
3. Carl Hamacher, Zvonko Vranesic, Safwat Zaky, "Computer Organization", Fifth Edition, Tata McGraw Hill , 2002.
4. William Stallings, "Computer Organization and Architecture – Designing for Performance", Seventh Edition, Pearson Education, 2006.
5. David A Patterson and John L. Hennessy, "Computer Organization and Design, The Hardware/Software Interface", Third Edition, Morgan Kaufmann / Elsevier, 2005

CA 7111	DATA STRUCTURES AND PROGRAMMING LABORATORY	L	T	P	C
		0	0	4	2

OBJECTIVES:

The student should be able to
- To develop skills in design and implementation of data structures and their applications.
- To learn and implement linear, non linear and tree data structures.
- To learn Set ADT and Graph data structures and its applications.
- To study, implement and analyze the different sorting techniques.

EXPERIMENTS
1. Writing Simple C Programs.
2. Conditional and Iterative Structures.
3. Arrays, Functions and Strings.
4. Structures and Unions.
5. Pointers.
6. File Handling.
7. List ADT implementation with arrays and linked lists.
8. Stack ADT implementation with arrays and linked lists.
9. Queue ADT implementation with arrays and linked lists.
10. BST implementation.
11. AVL implementation.
12. Hashing implementation – Separate Chaining algorithm.
13. Heap implementation – Priority Queues.
14. Sorting Algorithms – Insertion sort, Shell sort

TOTAL : 45 PERIODS

OUTCOMES :

Upon completion of this course, the student will:
- Work with basic data structures that are suitable for the problems to be solved efficiently.
- Design and implement linear, tree, and graph structures and its applications.
- Design various sorting techniques, its algorithm design and analysis.

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CA 7112   DATABASE MANAGEMENT SYSTEMS LABORATORY

L	T	P	C
0	0	4	2

OBJECTIVES:
The student should be able to
- To understand the concepts of DBMS.
- To familiarize with SQL queries.
- To write stored procedures in DBMS.
- To learn front end tools to integrate with databases.

EXERCISES :
1. Data Definition - Manipulation of Tables and Views.
2. Database Querying – Simple queries - Nested queries - Sub queries and Joins.
3. Triggers.
4. Transaction Control.
5. Embedded SQL.
6. Database Connectivity with Front End Tools.
7. Front End Tools / Programming Languages.
8. High level language extensions - PL/SQL Basics.
9. Procedures and Functions.
10. Database Design and Implementation (Case Study).

TOTAL : 45 PERIODS

OUTCOMES :
Upon completion of this course, the student will:
- Design and Implement databases.
- Formulate complex queries using SQL.
- Design and Implement applications that have GUI and access databases for backend connectivity

CA7201   COMPUTER COMMUNICATIONS AND NETWORKS

L	T	P	C
4	0	0	4

Learning Objectives:

- To explore various data communication techniques.
- To know Network Fundamentals and Protocols.
- To understand Network addressing and routing concepts.
- To understand the requirement of reliable and unreliable communication.
- To understand the functionality and concepts of various application layer protocols.

UNIT I   INTRODUCTION
Communication model – Data communications and Networking – Data transmission concepts and terminology – Transmission media – Data Encoding Techniques – Digital Data communication Techniques –Multiplexing- FDM-TDM-Statistical TDM.

UNIT II   NETWORK FUNDAMENTALS
Network Architecture – OSI – TCP/IP –Framing – Error detection and Correction –Reliable Transmission– LAN Technologies –802.3 Ethernet- CSMA/CD– Fast Ethernet-Gigabit Ethernet - Token ring – FDDI - Wireless LANS - 802.11 Standards.

UNIT III   NETWORK LAYER
Network layer functions – Switching and Bridging – Circuit switching – Packet Switching –Internet Protocol – IPv4 -Subnetting and Classless Addressing - IPv6 –ARP-Routing Algorithms– Static - Dynamic Routing-Multicast - ICMP- ICMPv6.

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UNIT IV   TRANSPORT LAYER
Transport layer Services –Multiplexing and Demultiplexing –Connectionless Transport –Principles of Reliable Data Transfer- Connection Oriented Transport – Flow Control – Congestion Control – Queuing disciplines – Congestion Avoidance.

UNIT V   APPLICATIONS
Application layer Protocols- Web and HTTP- FTP - Domain Name System– Telnet – rlogin – Electronic Mail Protocols –SNMP-Building a web server.

TOTAL: 60 PERIODS

Learning Outcomes :
Upon completion of this course, the student will be able to:
- Explain how communication works in data networks and the Internet
- Explain the role of protocols in data networks
- Describe the importance of addressing and naming schemes at various layers of data networks
- Describe the protocols and services provided by the application layer in the OSI model and describe how this layer operates in sample networks

REFERENCES :
1. Larry L. Peterson and Bruce S. Davie, "Computer Networks: A Systems Approach", Fifth Edition, Morgan Kaufmann Publishers, 2012.
2. William Stallings, "Data and Computer Communications", Tenth Edition, Pearson, 2013.
3. James F. Kurose, Keith W. Ross, "Computer Networking: A Top-DownApproach",FifthEdition,Pearson Education,2012

CA 7204	OPERATING SYSTEM CONCEPTS	L	T	P	C
		3	0	0	3

OBJECTIVES:
The student should be able to
- To Learn the Operating System basics.
- To Study the process management of Operating system.
- To Gain knowledge in storage management and I/O systems of Operating system.
- To Explore the case studies with various operating systems.

UNIT I   OPERATING SYSTEMS OVERVIEW   9
Operating system – Types of Computer Systems - Computer-system operation – I/O structure – Hardware Protection - System components – System calls – System programs – System structure – Process concept – Process scheduling – Operations on processes – Cooperating processes – Inter-process communication – Communication in client-server systems - Threads-Multithreading Models-Thread Libraries-Threading Issues.

UNIT II   PROCESS MANAGEMENT   10
Scheduling criteria – Scheduling algorithms – Multiple-processor scheduling – Real time scheduling –Thread Scheduling- Algorithm Evaluation – Process Scheduling Models - The critical-section problem – Synchronization hardware – Semaphores – Classic problems of Synchronization – Critical regions – Monitors-Usage-Dining philosopher solution using monitor-Atomic Transactions-Deadlock – Deadlock characterization – Methods for handling deadlocks – Recovery from deadlock.

UNIT III   STORAGE MANAGEMENT

Memory Management – Swapping – Contiguous memory allocation – Paging – Segmentation – Segmentation with paging- Virtual Memory - Background – Demand paging – Process creation – Page replacement – Allocation of frames – Thrashing.

UNIT IV   FILE AND I/O SYSTEMS   9

File concept – Access methods – Directory structure – File-system mounting – Protection - Directory implementation – Allocation methods – Free-space management -Secondary Storage Structure-Mass Storage-Disk Storage and Attachment- Disk scheduling – Disk management – Swap-space management-I/O Hardware-Application I/O Interface-Kernel I/O Subsystem-Life cycle of an I/O request.

UNIT V   CASE STUDY   8

The Linux System - History – Design Principles – Kernel Modules – Process Management – Scheduling – Memory management – File systems – Input and Output – Inter-process Communication – Network Structure – Security – Windows 7 - History – Design Principles – System Components – Environmental subsystems – File system – Networking.

TOTAL : 45 PERIODS

OUTCOMES :

Upon completion of this course, the student will:
- Discuss on the basics of OS.
- Familiarize the In depth knowledge in process management, memory management and I/O management of various operating systems.

REFERENCES :

1. Abraham Silberschatz, Peter B. Galvin and Greg Gagne, "Operating System Concepts", Ninth Edition, John Wiley and Sons Inc, 2012.
2. Andrew S. Tanenbaum, "Modern Operating Systems", Second Edition, Addison Wesley, 2001.
3. Gary Nutt, "Operating Systems", Second Edition, Addison Wesley, 2001.
4. H M Deital, P J Deital and D R Choffnes, "Operating Systems", Pearson Education, 2004.
5. Andrew S.Tanenbaum "Operating Systems Design and implementation"Third edition Prentice hall, 2006.
6. William Stallings "Operating Systems: Internals and Design Principles" 7th Edition, Prentice hall - 2011.

		L	T	P	C
CA7205	**SOFTWARE ENGINEERING METHODOLOGIES**	3	0	0	3

OBJECTIVES:

 The student should be able to
- To provide information about wider engineering issues that form the background to develop 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.

UNIT I   INTRODUCTION   9

Software Engineering – Product and process – process models - Waterfall Life cycle model – Spiral Model – Prototype Model – fourth Generation Techniques – Agile methods.

UNIT II   REQUIREMENT ANALYSIS   9
Software Requirements Analysis and Specification – Software Requirements – Problem Analysis – Requirements Specification – Validation – Metrics – Summary.

UNIT III   SOFTWARE TESTING   9
Abstraction – Modularity – Software Architecture – Cohesion – Coupling – Various Design Concepts and notations – Real time and Distributed System Design – Documentation – Dataflow Oriented design – Designing for reuse – Programming standards.

UNIT IV   SOFTWARE TESTING   9
Coding – Programming Practice – Top-down and Bottom-up - structured programming – Information Hiding – Programming style – Internal Documentation Verification – Code Reading – Static Analysis – Symbolic Execution – Code Inspection or Reviews – Unit Testing – Fundamentals – Functional Testing versus structural Testing Coding.

UNIT V   SOFTWARE MAINTENANCE AND SOFTWARE METRICS   9
Need for Software maintenance – Maintenance models - SCM – Version Control – SCM process – Software Configuration Items – Taxonomy – Basics of Case tools - Scope of Software Metrics – Classification of metrics – Measuring Process and Product attributes – Direct and Indirect measures – Reliability – Software Quality Assurance – Standards.

TOTAL : 45 PERIODS

OUTCOMES :
Upon completion of this course, the student will:
* Familiarize the basic concepts of Software design and implementation. Perform software testing on various applications.
* Apply various software metrics on software quality products.

REFERENCES :
1. Pankaj Jalote, "An Integrated Approach to Software Engineering", Third Edition, Narosa publications, 2011.
2. Ian Sommerville, "Software engineering", Ninth Edition, Pearson Education Asia, 2010.
3. Roger S. Pressman, "Software Engineering – A Practitioner's Approach", Seventh Edition, Tata McGraw-Hill International Edition, 2009.

CA 7202	DESIGN AND ANALYSIS OF ALGORITHMS	L 3	T 0	P 0	C 3

OBJECTIVES:
The student should be able to
* To understand the problem solving process and writing algorithms
* To use algorithm design paradigms for algorithm design
* To analyze the algorithms for time/space complexity

UNIT I   ALGORITHM ANALYSIS   9
The Role of Algorithms in Computing – Insertion sort – Analyzing algorithms – Designing Algorithms – Growth of Functions – Asymptotic Notation – Standard Notations and Common Functions

UNIT II   HEAP SORT AND QUICK SORT   9
Heap Sort: Heaps – Maintaining the Heap Property – Building a Heap – Heap Sort Algorithm – Priority Queues – Quick Sort: Description – Performance – Randomized Version – Analysis

UNIT III   DESIGN AND ANALYSIS TECHNIQUES   9
Introduction to Dynamic Programming – Matrix Chain Multiplication – Longest Common Subsequence – Greedy Algorithms – Activity Selection Problem – Huffman Codes

UNIT IV   GRAPH ALGORITHMS   9
Representation of Graphs – Representing Attributes – Breadth-First Search – Breadth-First Trees – Depth-First Search – Topological Sort – Strongly Connected Components – Minimum Spanning Trees: Growing a Minimum Spanning Trees – Algorithms of Kruskal and Prim – Single Source Shortest Path – Bellman-Ford Algorithm – Single Source Shortest Path in Directed Acyclic Graphs – Dijkstra's Algorithm

UNIT V   NP PROBLEMS   9
Polynomial Time – Polynomial-time Verification – NP-completeness and Reducibility – NP-Completeness Proofs – NP-complete Problems – Approximation Algorithms – Vertex Cover Problem

TOTAL : 45 PERIODS

OUTCOMES :
Upon completion of this course, the student will:
- Analyze the algorithms for time/space complexity
- Implement heap sort and quick sort
- Design algorithms using dynamic programming and Greedy approaches
- Design algorithms using graph structure to solve real-life problems
- Analyze problems in terms of polynomial time .

REFERENCES
1. Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest, Clifford Stein, "Introduction to Algorithms", Third Edition, PHI Learning, 2002.
2. Aho, Hopcroft and Ullman, "Data Structures and Algorithms", Pearson Education,1983.
3. Anany Levitin, "Introduction to Design and Analysis of Algorithms", Third, Pearson Education, 2012.
4. Robert Sedgewick and Kevin Wayne, "Algorithms", Fourth Edition, Pearson Education, 2011.
5. S.Sridhar,"Design and Analysis of Algorithms", First Edition, Oxford University Press,2014.

CA 7203	OBJECT ORIENTED PROGRAMMING PARADIGM	L 3	T 0	P 0	C 3

OBJECTIVES:
The student should be able to
- To understand the OO paradigm.
- To be aware of the OO design technique.
- To learn the syntax of C++.
- To be exposed to the file processing and exception handling techniques of C++.
- To be familiarized with the Standard Template Library.

UNIT I   INTRODUCTION   9
Introduction - Object-oriented Design - Object-oriented Features-   –Types and Declaration – Pointers –Arrays -Structures–Expressions and Statements –Functions –Namespaces and Exceptions.

UNIT II   ABSTRACT DATA TYPES   9
Classes – Constructors – Destructors – Function Overloading - Operator Overloading – Conversions.

UNIT III   INHERITANCE   9
Derived Class – Virtual Functions –Polymorphism - Abstract Base Class – Multiple Inheritance.

UNIT IV   GENERIC PROGRAMMING   9
Templates – Generic Functions – Generic Classes –Standard Template Library –Containers –
Iterators Function Objects –Allocators.
UNIT V   I/O AND EXCEPTION HANDLING   9
Streams - Ostream – Istream –Files –Throwing Exceptions – Try Blocks – Handlers- OOP using
C++.

TOTAL : 45 PERIODS

OUTCOMES :
Upon completion of this course, the student will:
- Design and implement C++ programs for any given problem. Understand an existing program and modify it as per the requirements.
- Identify the errors in a C++ program.
- Identify the output of a C++ program without actually executing it.
- Write generic programs using STL.

REFERENCES :
1. Ira Pohl, "Object - Oriented Programming using C++",   Second Edition , Pearson Education, 2003.
2. Bjarne Stroustrup, "The C++ Programming Language", Fourth Edition , Addison Wesley, 2013.
3. Herbert Schildt, "C++:The Complete Reference", Fifth Edition, McGraw Hill, 2015.
4. Stanley B. Lippman , Josée Lajoie , C++ Primer, Fifth Edition , Barbara E. Moo ,Pearson Education,   2012.

CA7211	OOP AND ALGORITHMS LABORATORY	L	T	P	C
		0	0	4	2

OBJECTIVES:
The student should be able to
- To develop skills in object oriented programming.
- To learn and implement linear, non linear and tree data structures.
- To learn Set ADT and Graph data structures and its applications.
- To study, implement and analyze the different sorting techniques.

EXPERIMENTS
The following experiments should be practiced
1. Classes, Constructors, Destructors, Function overloading and Operator overloading.
2. Implementation of Derived classes, Abstract classes, Multiple inheritance, Static and Dynamic Polymorphism.
3. Implementation of IO Stream classes and Exception Handling.
4. Working with function template and class template.
5. Usage of standard template library and implementation of container and iterators.
6. Divide and Conquer Strategy – Merge Sort and Quick Sort Analysis.
7. Graph Implementation – Traversals
8. Shortest path using Dijkstra's Algorithm
9. Minimum Spanning Tree using Prim's Algorithm.
10. Matrix Chain Multiplication and LCS.
11. Activity Selection and Huffman Coding.

TOTAL : 45 PERIODS

OUTCOMES :
Upon completion of this course, the student will:
- Develop programs in object oriented paradigm.
- Develop applications using various design techniques
- Design and implement various graph algorithms.

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CA 7212   OS AND NETWORK PROGRAMMING LABORATORY

L	T	P	C
0	0	4	2

OBJECTIVES:
The student should be able to
- To know about various Process scheduling algorithms
- To realize the differences between OS and Distributed OS
- To learn Socket programming
- To study about Networking Tools

EXPERIMENTS
1. Client-server programming (Sockets)
2. Network analyzer -Tool
3. Traffic Analysis -Tool
4. Protocol Analysis - Tool
5. Study of Software Defined Networking tools
6. Implementation of Process scheduling algorithms (FCFS and SJF)
7. Implementation of Process scheduling algorithms (Round Robin and Priority)
8. Implementation of deadlock detection algorithm
9. Implementation of deadlock prevention and recovery process
10. Implementation of deadlock avoidance algorithm
11. Implementation of Page replacement algorithms
12. Implementation of Disk scheduling algorithms
13. Implementation of Distributed OS Resource Scheduling algorithms
14. Two-Phase Commit Protocol in Distributed OS.

TOTAL : 45 PERIODS

OUTCOMES :
Upon completion of this course, the student will:
- At the end of the course the student should be able to Implement process scheduling and deadlock detection, prevention algorithms
- Write programs for distributed process management.
- Write Socket programs with TCP/UDP Develop networking applications

CA7302   EMBEDDED SYSTEMS

L	T	P	C
3	0	0	3

OBJECTIVES:
The student should be able to
- To understand the architecture of embedded processor, microcontroller and peripheral devices.
- To appreciate the nuance of programming micro controllers in assembly language for embedded systems.
- To understand challenges in Real time operating systems.
- To learn programming the embedded systems in high level languages such as C.

UNIT I   INTRODUCTION TO EMBEDDED SYSTEM   **9**
Introduction to Embedded system - Microprocessor V/s Micro-controller - 8051 Microcontroller -

General architecture - Instruction set and Assembly programs - Embedded C programs.

UNIT II   MEMORY AND INTERFACE   9
Memory organization and interfacing - I/O devices and interfacing Counters and Timers - Serial data communication – Interrupts.

UNIT III   INTERFACING PERIPHERALS   9
Interfacing LCD Display – Keypad Interfacing – Generation of Gate signals for Converters and Inverters – Motor Control – Controlling AC appliances –Measurement of frequency — Stand alone Data Acquisition System.

UNIT IV   ADVANCED CONTROLLER AND PROCESSORS   9
Advanced Microcontrollers - PIC - ARM - ATOM processor - Architecture-Instruction set.

UNIT V   DESIGNING AND DEVELOPMENT OF APPLICATIONS   9
Design methodologies and tools - designing hardware and software components - system analysis and architecture design - system integration – debugging - case studies

TOTAL : 45 PERIODS

OUTCOMES :
Upon completion of this course, the student will:
- Have the ability to analyze architecture of embedded processors and microcontroller.
- Have the ability to use Assembly language to develop embedded software.
- Have the ability to use ANSI C to develop embedded software.
- Interface to peripherals, and have the knowledge of typical interfacing standards.
- Design and Develop the prototype of Embedded system (including interfacing to microcontroller, and control from software).

REFERENCES :
1. Muhammad Ali Mazidi, Janice Gillispie Mazidi., "The 8051 Microcontroller and Embedded systems", Second Edition, Pearson Education, 2011.
2. Lyla B.Das "Embedded systems an integrated approach", Pearson Education, 2013.
3. Wayne wolf "Computers as components", Second edition, Elsevier, 2011.
4. Muhammad Ali Mazidi, Rolin D. Mckinlay, Danny Causey, "PIC Microcontroller an Embedded Systems using Assembly and C for PIC18", Pearson Education, 2008.
5. Andrew N Sloss, D. Symes, C. Wright, " Arm system developers guide", Morgann Kauffman / Elsevier, 2006.
6. Peter Bary Patrick Crowley "Modern Embedded computing", Elsevier, 2012.

CA 7301	DATA WAREHOUSING AND MINING	L	T	P	C
		3	0	0	3

OBJECTIVES:
The student should be able to
- 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.

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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 this course, the student will:
- 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.
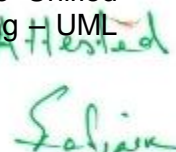3. G. K. Gupta, "Introduction to Data Mining with Case Studies", Easter Economy Edition

CA 7303	OBJECT ORIENTED ANALYSIS AND DESIGN	L	T	P	C
		3	0	0	3

OBJECTIVES:

The student should be able to
Gives and understanding of OOAD basics, UML diagrams, system modeling, design based on requirements, converting design to code, and design patterns.

UNIT I   OOAD BASICS   10

Introduction – Overview of object oriented system development – Object basics-The Unified Process – Modeling concepts – Modeling as a design technique – Analysis and modeling – UML diagrams – Use case Modeling – Class modeling – State modeling – Interaction Modeling

UNIT II REQUIREMENTS & MORE MODELING 7

Object Constraint Language - Inception – Evolutionary Requirements– Domain Models – System Sequence Diagrams – Operation Contracts

UNIT III DESIGN AND PRINCIPLES OF DESIGN 10

Requirements to Design –Design Patterns – Logical Architecture – Package diagram – Design patterns – Model, View, Control pattern – Detailed design – Object design with GRASP pattern – Detailed class diagram with Visibility.

UNIT IV MAPPING TO CODE 8

Mapping designs to code – Test Driven development and refactoring – UML Tools and UML as blueprint

UNIT V MORE PATTERNS 10

More Patterns – Analysis update – Objects with responsibilities – Applying design patterns – Architectural Analysis – Logical Architecture Refinement – Package Design – Persistence framework with patterns.

TOTAL : 45 PERIODS

OUTCOMES :
Upon completion of this course, the student will:
- Familiarize with the topics of object oriented System designs.
- Design Patterns using UML.
- Apply design patterns to various applications.

REFERENCES :
1. Michael Blaha and James Rumbaugh, "Object-oriented modeling and design with UML", Prentice-Hall of India, 2005.
2. Craig Larman. "Applying UML and Patterns – An introduction to Object-Oriented Analysis and Design and Iterative Development", 3rd ed, Pearson Education, 2005.
3. Ali Bahrami, "Object Oriented Systems Development", McGraw-Hill, 1999.
4. Booch, Grady. Object Oriented Analysis and Design. 2nd ed. Pearson Education 2000.
5. Fowler, Martin. UML Distilled. 3rd ed. Pearson Education. 2004.
6. Lunn, Ken. Software development with UML. Palgrave Macmillan. 2003.
7. O'Docherty, Mike. Object-Oriented Analysis & Design. Wiley. 2005.
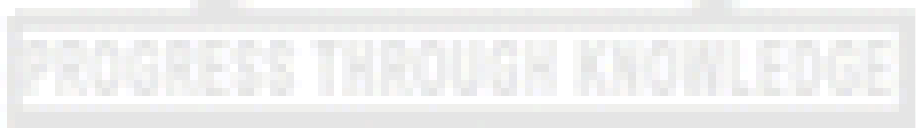
CA 7304	WEB PROGRAMMING	L	T	P	C
		3	0	0	3

OBJECTIVES:
The student should be able to
- To understand the basics of web forms and validation.
- To learn the concepts of XML related technologies.
- To learn the fundamentals of java.
- To understand the importance of server side programming and web development.

UNIT I HTML AND JAVA SCRIPT 9

World Wide Web – XHTML - Cascading Style Sheet - JavaScript – Java script objects - Date – Array – pattern matching using regular expressions – Dynamic documents with Java script – HTML 5 – New features. UNIT II 9 UNIT III 9 UNIT IV 9 Generic classes – Generic methods – Applets – Applet life cycle methods – Applets based GUI – GUI components – Basic of Swings – Accessing database with JDBC – basi

UNIT II   XML TECHNOLOGIES   9

XML – Validating XML - DTD – XML schema – XPath – XLink – parsing XML using DOM – parsing XML using SAX – Transforming XML with XSL – Integrating XML with database – AJAX – RSS – JSON.

UNIT III   JAVA BASICS   9

Overview of Java – Java Fundamentals – Classes - Objects and Methods – Arrays and Array Lists – String – String Builder – Regular expressions – class pattern – class matcher - Packages and Interfaces – Exception Handling.

UNIT IV   JAVA GUI AND DATABASE CONNECTIVITY   9

Generic classes – Generic methods – Applets – Applet life cycle methods – Applets based GUI – GUI components – Basic of Swings – Accessing database with JDBC – basics.

UNIT V   SERVER SIDE SCRIPT   9

Overview of servlets – Servlet API – Servlet life cycle – Servlet configuration – Running Servlet with database connectivity - Servlet support for cookies – Session tracking – Basics of PHP - JSP/PHPCase study/ Applications – Developing Dynamic - Data driven web sites.

TOTAL : 45 PERIODS

OUTCOMES :

Upon completion of this course, the student will:

- Design and implement web forms and client side validation. Work with XML authoring, Parsing, and related technologies.
- Develop object oriented programming using Java.
- Design and develop GUI based applications using Swing components.
- Design and develop servlet and JSP application with database connectivity.

REFERENCES :

1. Robert W. Sebesta, "Programming with World Wide Web", Pearson Education, 2008.
2. Paul Deitel and Harvey Deitel, "Java – How to program", Ninth Edition, PHI, 2012.
3. Kogent Solutions, "Java 6 Programming Black book", Dreamtech Press, 2007 .

CA 7313	WEB PROGRAMMING LABORATORY	L	T	P	C
		0	0	4	2

OBJECTIVES:

The student should be able to

- To learn web page creation.
- To understand the real time requirements of web page such as validation, use of DOM, role of XML.
- To understand OOP concepts and basics of Java language.
- To learn and use client server architecture based applications.
- To explore server side functionalities of an application.

EXPERIMENTS :

1. Creation of web pages having dynamic contents and validation using Java script.
2. Creation of XML file and validation using XML schema and generation of XML using tools.
3. Simple xml based applications using DOM, SAX and XSL.
4. Basic Java programming covering objects, inheritance, polymorphism, interfaces, packages and exception handling.
5. String handling programs and regular expression programs.
6. Creation of applet based GUI's. 7. Application involving applet based GUI, JDBC, Servlet, JSP/PHP, cookies and session tracking.

TOTAL : 45 PERIODS

OUTCOMES :
Upon completion of this course, the student will:
- Make Web site creation and validation.
- Work with XML based technologies.
- Develop simple console application using Java.
- Develop GUI application using Swing and Applet.
- Build web based applications using JDBC, Servlet / JSP.

		L	T	P	C
CA 7311	CASE TOOLS LABORATORY	0	0	4	2

OBJECTIVES:
The student should be able to
- To understand the software engineering methodologies for project development.
- To gain knowledge about open source tools for Computer Aided Software Engineering.
- To develop an efficient software using case tools.

EXPERIMENTS :
1. Open source Tools: StarUML / UMLGraph / Topcased Prepare the following documents for each experiment and develop the software using software engineering methodology.
2. Problem Analysis and Project Planning -Thorough study of the problem – Identify Project scope - Objectives and Infrastructure.
3. Software Requirement Analysis - Describe the individual Phases/modules of the project and Identify deliverables.
4. Data Modelling - Use work products – data dictionary - use case diagrams and activity diagrams - build and test class diagrams - sequence diagrams and add interface to class diagrams.
5. Software Development and Debugging – implement the design by coding
6. Software Testing - Prepare test plan - perform validation testing - coverage analysis - memory leaks - develop test case hierarchy - Site check and site monitor.

Sample Experiments:
Academic domain
1. Course Registration System
2. Student marks analysing system

Railway domain
1. Online ticket reservation system
2. Platform assignment system for the trains in a railway station

Medicine domain
1. Expert system to prescribe the medicines for the given symptoms
2. Remote computer monitoring Finance domain
3. ATM system
4. Stock maintenance Human Resource management
5. Quiz System
6. E-mail Client system.

TOTAL : 45 PERIODS

OUTCOMES :
Upon completion of this course, the student will:
- Use open source CASE tools to develop software.
- Analyze and design software requirements in an efficient manner.

CA7312	SOFT SKILLS DEVELOPMENT LAB	L T P C
		0 0 2 1

OBJECTIVES: The student should be able to
- Develop broad career plans, evaluate the employment market, identify the organizations to get good placement, match the job requirements and skill sets. Take part effectively in various selection procedures adopted by the recruiters.

EXPERIMENTS
- Practice on phonetics.
- Grammar and writing style.
- Natural language processing.
- Arithmetic skills.
- Communication skills.
- Use of software tools for presentation – Word, Excel, Power point.
- Database connectivity.
- Report writing.
- Project design and implementation.
- Presentation skills on projects.
- Group discussion.
- Interview preparation.

TOTAL : 30 PERIODS

OUTCOMES :
Upon completion of this course, the student should be able to :
- Develop effective communication skills (spoken and written).
- Develop effective presentation skills.
- Conduct effective business correspondence and prepare business reports which produce results.
- Become self-confident individuals by mastering inter-personal skills, team management skills, and leadership skills

CA 7401	ADVANCED JAVA PROGRAMMING	L T P C
		4 0 0 4

OBJECTIVES:
The student should be able to
- To understand the advanced concepts of java.
- To learn the concepts of web applications and MVC architecture.
- To learn the concept of distributed objects including web services.
- To understand the importance of advanced frameworks.

UNIT I   JAVA BASICS   12
Review of java basics - Java String Handling – Recursion - Files – streams – Working with Streams - File and I/O Handling - Threads – multithreading - object serialization – Swing components – Graphics and Java 2D.

UNIT II   JAVA NETWORK PROGRAMMING   12
Generic collections – Classes – Methods – Manipulating databases with JDBC - Networking – Manipulating URLs – Reading web pages – Using stream sockets – Datagrams - Broadcasting – Multicasting – Chat application.

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UNIT III   WEB APPLICATION DEVELOPMENT   12

 Overview of servlets – Servlet API – Servlet life cycle – Servlet configuration – Running Servlet with database connectivity - Servlet support for cookies – Session tracking – Basics of JSP -Java Server Faces – Multitier application Architecture – MVC architecture of JSF Apps – common JSF components – Session tracking – Cookies – Accessing databases in Web Apps – Java Beans component.

UNIT IV   SOFTWARE COMPONENTS   12

Distributed objects – RMI programming model – Parameters and return values in remote methods – Remote object activation - Web services and JAX-WS - Publishing and consuming SOAP based web services – REST-based web services – REST-based JSON web services.

UNIT V   ADVANCED FRAMEWORK   12

Advanced Frameworks – Understanding Struts – MVC framework – Struts control flow – Building model view controller component - Hibernate – Architecture – Understanding O/R mapping – Query language - Spring framework – Architecture - Case studies.

TOTAL : 60 PERIODS

OUTCOMES :

Upon completion of this course, the student will:
- Work with Java I/O streams, networking and GUI based application development.
- Work with Web application development using Java Server Faces.
- Develop web services using REST/SOAP/JSON.
- Design and develop applications using advanced frameworks.

REFERENCES :

1. Kogent Solution Inc, "Java 6 Programming Black Book", Dreamtech Press, 2007.
2. Paul Deitel and Harvey Deitel, "Java How to Program", 9th Edition, Prentice Hal, 2012.
3. Cay S.Horstmann and Gary Cornell, "Core Java Volume II – Advanced Features", Eighth edition, PHI, 2008.
4. Herbert Schildt , "Java The Complete Reference", 8th Edition, Tata McGraw Hill.

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

OBJECTIVES:
The student should be able to

- 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 students should be able to:
- Design and implement any subsystem of an operating system.
- Modify the existing data structures of Linux kernel.
- Modify the existing subsystem of Linux kernel and rebuild it.
- Design and implement new data structures and algorithms for the kernel of an operating system.
- Critically analyze different data structures and algorithms used in the building of a kernel.

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

	L	T	P	C
CA7402 MOBILE COMPUTING	3	0	0	3

OBJECTIVES:
The student should be able to
- To study the need and nature of mobile applications
- To learn about the tools and platforms required for mobile application development
- To understand the design issues in the development of mobile applications
- To learn mobile application development
- To become familiar with the popular cellular network and wireless data network

UNIT I   INTRODUCTION   9

Aspects of Mobility – Mobile Device Profiles – Device Portability – Mobile Applications – Characteristics and Benefits – Application Model – Infrastructure and Managing Resources – Frameworks and Tools – Generic UI Development – Visual UI – Text to Speech Techniques – Multiodal and Multichannel UI

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UNIT II   TOOLS   9

Google Android Platform – Eclipse Simulator – Android Application Architecture – Event based programming – Apple iPhone Platform – UI and Toolkit Interfaces – Event handling – Graphical Services – Animation Techniques

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 rule 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   CELLULAR NETWORKS AND WIRELESS LANS   9

Cellular Network Structure and Operation - Principles - Tessellation, Frequency Reuse, Hand off - GSM - System Architecture, Elements, Interfaces, Frame Structure, Protocol Stack, Types of Handover - IEEE 802.11 WLAN - Architecture, Reference Model - Physical layer - MAC Layer - CSMA/CA- Interference Spacing – Security – WEP,802.1x Authentication

TOTAL : 45 PERIODS

OUTCOMES :

Upon completion of this course, the student will:
* To appreciate the need for rapid progress in mobile application development
* To use the various tools and developments for mobile application development
* To design and implement effective mobile applications in popular mobile development platform
* To deploy GSM network and IEEE 802.11 WLAN

REFERENCES :

1. Reza B'Far, "Mobile Computing Principles: Designing and Developing Mobile Applications with UML and XML", Cambridge Press University, 2009
2. Asoke K Talukder, Hasan Ahmed, Roopa R Yavagal, "Mobile Computing Technology, Applications and Service Creation", 2nd ed, Tata McGraw Hill, 2010.
3. Reto Meier, "Professional Android 2 Application Development", Wrox Wiley,2010.
4. Neil Smyth, "iPhone iOS 4 Development Essentials – Xcode", 4 Edition, Payload media, 2011.
5. Ben Shneiderman and Catherine Plaisant, "Designing the User Interface: strategies for Effective Human Computer Interaction", Addison– Wesley, 5th Edition, 2009.
6. Zigurd Mednieks, Laird Dornin, G, Blake Meike and Masumi Nakamura, "Programming Android", O"Reilly, 2011
7. Reto Meier, Wrox Wiley, "Professional Android 2 Application Development", 2010
8. Alasdair Allan, "iPhone Programming", O"Reilly, 2010
9. Wei-Meng Lee, "Beginning iPhone SDK Programming with Objective-C", Wrox Wiley, 2010
10. Stefan Poslad, "Ubiquitous Computing: Smart Devices, Environments and interactions", Wiley, 2009.

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	0	0	4	2

CA 7411   ADVANCED JAVA PROGRAMMING LABORATORY

OBJECTIVES:

The student should be able to

- To learn Java and Enterprise Java intensively.
- To understand many advanced technologies of Java such as Multithreading, Streaming, Networking, Generic collections, RMI.
- To learn and use MVC architecture for application development.
- To learn and use web services and advanced frameworks for web application development.

EXPERIMENTS

1. Design and Implement java programs that deals with the following:
   a. Classes and Objects and Interfaces.
   b. Exception Handling with user defined Exceptions.
   c. String Handling (String Class objects - String Manipulation functions).
   d. Streaming (Image File Handling using Byte Streams - Text File Manipulation using Character Streams).
   e. Implementation of Thread Synchronization using any application.
   f. Reading and Writing Objects using Serialization.
   g. Creation of User Interfaces using SWING.
   h. Creation of Smileys – Drawings – Cartoons – Symbols - Simple animations using Java Graphics.
   i. Usage of Recursion.
   j. Creation and Manipulation of generic objects.
   k. Reading websites using URL class.
   l. File Transfer using UDP.
   m. Chat Application using TCP.

2. Implementation of any Information System using JDBC.
3. Web Application development using Servlet and JSP.
4. Development of a Web application using JSF.
5. Session Management and Implementation of Cookies using JSF.
6. Database Connectivity using Java Bean.
7. Remote Method Access using RMI Implementation.
8. Creation of Web Services using JAX-WS.
9. Creation of REST based web services and its access using JSON.
10. Database access using Hibernate.
11. Web application development using Struts Framework & Spring Framework.

TOTAL : 45 PERIODS

OUTCOMES :

Upon completion of this course, the student will:

- Become an intermediate or advanced developer of Java.
- Write programs on advanced technologies of Java such as Streaming, Networking, Multithreading and Generic collections.
- Develop chat and file transfer applications.
- Implement Server Side Programming and dynamic software components.
- Design and Develop GUI based components and Animations.
- Design and implementation of interactive web sites.
- Create distributed applications using RMI, JAX-WS, and REST based services.
- Create MVC applications using advanced frameworks.

CA7412   **MOBILE APPLICATION DEVELOPMENT LABORATORY**

L	T	P	C
0	0	4	2

OBJECTIVES:
The student should be able to
- To know about various platforms and tools available for developing mobile applications.
- To realize the differences between the development of conventional applications and mobile
- applications.
- To learn programming skills in J2ME and Android SDK
- To study about micro browser based applications to access the Internet using Sun Java Toolkit.

EXPERIMENTS
The following experiments to be practiced
1. Survey of Mobile Application Development Tools.
2. Form design for mobile applications.
3. Applications using controls.
4. Graphical and Multimedia applications.
5. Data retrieval applications.
6. Networking applications.
7. Gaming applications. (Perform the experiments from 2 to 7 in J2ME and Android SDK framework)
8. Micro browser based applications using WAP, WML and WML scripts. (Perform experiments in 8 using Sun Java Wireless toolkit)

TOTAL : 45 PERIODS

OUTCOMES
Upon completion of this course, the student will:
- Be able to develop useful mobile applications for the current scenario in mobile computing and pervasive computing.

CA7413   **TECHNICAL SEMINAR AND REPORT WRITING**

L	T	P	C
0	0	2	1

OBJECTIVES:
- To help students develop listening skills for academic and professional purposes.
- To help students acquire the ability to speak effectively in English in real-life situations.
- To inculcate reading habit and to develop effective reading skills.

SEMINAR ON:
- Literature survey methods and literature study methods for projects.
- Good programming practices.
- System software development.
- Application design.
- Operating system design.
- Compiler design.
- Network design.
- Soft computing.
- Implementation using languages and packages.
- Report and thesis writing.

TOTAL : 30 PERIODS

OUTCOMES
Upon completion of this course, the student will be able to:
- Gain confidence in facing the placement interview.
- Develop effective communication skills (spoken and written).
- Interact with each other and face a wide variety of issues, topics, and situations that they are likely to come across as entry level professionals.

CA7503	SOFTWARE TESTING	L	T	P	C
		3	0	0	3

OBJECTIVES: The student should be able to
- 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   INTRODUCTION   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.

UNIT II   SOFTWARE TESTING METHODOLOGY   9
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 III   SOFTWARE TESTING TECHNIQUES   9
Configuration Testing – Compatibility Testing – Foreign Language Testing – Usability Testing – Testing the Documentation - Testing for Software Security – Website Testing - Testing Internet Applications - Mobile Application Testing.

UNIT IV   AUTOMATED TESTING AND TEST TOOLS   9
Benefits of Automation and Tools – Viewers and Monitors – Drivers – Stubs – Stress and Load Tools – Analysis Tools - Software Test Automation – Random Testing – Beta Testing.

UNIT V   TEST DOCUMENTATION   9
Goal of Test Planning – Test Phases – Test Strategy – Resource Requirements – Test Schedule – Writing and Tracking Test Cases - Bug Tracking Systems – Metrics and Statistics - Risks and Issues.

TOTAL : 45 PERIODS

OUTCOMES :
Upon completion of this course, the student will:
- Perform automated testing using test tools.
- Document the testing procedures.

REFERENCES:
1. Glenford J.Myers, Tom Badgett, Corey Sandler, "The Art of Software Testing",3rd edition, John Wiley & Sons publication, 2012.
2. Srinivasan Desikan, Gopalaswamy Ramesh, "Software testing- Principles and Practices", Pearson education, 2009.
3. Ron Patton, "Software testing", second edition, Pearson education, 2009.
4. Boris Beizer, "Software testing techniques", Dream Tech Press, 2009.

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DISTRIBUTED AND CLOUD COMPUTING   **L   T   P   C**
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OBJECTIVES:
The student should be able to
- To understand the concept of cloud and utility computing and its various issues.
- To appreciate the emergence of cloud as the next generation computing paradigm.
- To be able to set up a private cloud.

UNIT I   INTRODUCTION TO CLOUD COMPUTING   9
Cloud Computing Basics – Overview, Cloud Components: Clients, Datacenters and Distributed Servers, Applications, Benefits :Scalability simplicity, Limitations Historical Developments - Essential characteristics Cloud Computing and Service Models- Cloud Ecosystem and Enabling Technologies – Infrastructure-as-a-Service (IaaS) – Platform-as-a-Service (PaaS) – Software-as-a-Service (SaaS) – Architectural Design of Compute and Storage Clouds – Data-Center Design and Interconnection Networks.

UNIT II   DISTRIBUTED SYSTEMS   9
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 – Map Reduce – Hadoop.

UNIT III   VIRTUALIZATION   9
Introduction to Virtual Machines – Emulation – Interpretation and Binary Translation– Implementation Levels of Virtualization – Virtualization Structures/Tools and Mechanisms– Binary Translation with Full Virtualization – Para-Virtualization with Compiler Support –   Virtualization of CPU, Memory, and I/O Devices.

UNIT IV   CLOUD SECURITY   9
Cloud Security and Trust Management– Cloud Security Challenges – Cloud Security Defense Strategies– Distributed Intrusion/Anomaly Detection – Data and Software Protection Techniques– Reputation Guided Protection of Data Centers– Data Security– Network Security – Host Security – SaaS Security.

UNIT V   CASE STUDIES   9
Google App Engine – Google File System (GFS) – Big Table – Google's NOSQL System– Chubby – Google's Distributed Lock Service, Amazon AWS - Amazon EC2, Amazon Simple Storage Service (S3) – Eucalyptus – Open Stack.
                                                                  TOTAL : 45 PERIODS
OUTCOMES :
Upon completion of this course, the student will:
- Articulate the main concepts, key technologies, strengths and limitations of cloud computing.
- Identify the architecture, infrastructure and delivery models of cloud computing.
- Explain the core issues of cloud computing such as security, privacy and interoperability.

REFERENCES :
1. Kai Hwang, Geofrey C. Fox and Jack J. Dongarra, Distributed and Cloud Computing, Morgan Kaufmann, 2012.
2. Cloud Computing: A Practical Approach, Anthony T.Velte, Toby J. Velte, Robert Elsenpeter, Tata-McGraw- Hill, New Delhi – 2010.
3. George Coulouris, Jean Dollimore, Tim Kindberg, Distributed Systems Concepts and Design, Fifth Edition, Pearson Education Asia, 2012.

4. Distributed Systems - Principles and Paradigms, Andrew S. Tanenbaum,Maarten Van Steen, Second Edition, Pearson Prentice Hall, 2006.
5. James E. Smith and Ravi Nair, Virtual Machines, Morgan Kaufman, 2005.
6. Boris Lublinsky, Kevin T. Smith, Alexey Yakubovich, Professional Hadoop Solutions, Wrox, Wiley, 2013.
7. RajkumarBuyya,Christian Vecchiola,S.ThamaraiSelvi,Mastering Cloud Computing, Tata Mcgraw Hill, 2013.
8. George Reese, Cloud Application Architectures: Building Applications and Infrastructure in the Cloud, O'Reilly, 2009.
9. John W.Rittinghouse and James F.Ransome, "Cloud Computing: Implementation, Management, and Security", CRC Press, 2010.

CA 7501	CRYPTOGRAPHY AND NETWORK SECURITY	L	T	P	C
		3	0	0	3

OBJECTIVES:
The student should be able to
- 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
Data Encryption Standard – Advanced Encryption Standard – Confidentiality using Symmetric Encryption - Public-Key Cryptography and RSA – Key Management - Diffie-Hellman Key Exchange – Elliptic Curve Cryptography – Symmetric Key Distribution – Kerberos - X.509 Authentication Service.

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   NETWORK SECURITY   9
Security at the application layer - E-Mail - Pretty Good Privacy – S/MIME – Security at the transport layer - SSL Architecture – Protocols – Message Formats - TLS – Security at the Network Layer - IPSec – Two modes - Authentication Header (AH) – Encapsulating Security Payload (ESP) – Security Policy – Security Association – Internet Key Exchange.

UNIT V   SYSTEM SECURITY   9
Intruders – Intrusion Detection – Password Management – Malwares and Related Threats – DOS Attacks - Distributed Denial of Service Attacks - Firewalls – Firewall Types-Configuration and Implementation - Demilitarized Zone - Firewall Forensics -Services and Limitations - Intrusion Prevention System.

TOTAL : 45 PERIODS

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OUTCOMES :
Upon completion of this course, the student will:
- Analyze the basic security algorithms required by any computing system.
- Predict the vulnerabilities across any computing system.
- Design a security solution for any computing system.

REFERENCES :
1. William Stallings, "Cryptography And Network Security – Principles and Practices", Sixth Edition, Pearson Education, 2013
2. Behrouz A. Forouzan, Debdeep Mukhopadhyay, "Cryptography and Network Security", Second Edition, Tata Mc Graw Hill, 2010.
3. Atul Kahate, "Cryptography and Network Security", Tata McGraw Hill, 2003.
4. Joseph Migga Kizza, "A Guide to Computer Network Security", Springer International Edition, 2010.
5. Charles B. Pfleeger, Shari Lawrence Pfleeger, "Security in Computing", Fourth Edition, Pearson Education, 2007.

		L	**T**	**P**	**C**
CA 7513	**SOFTWARE TESTING LABORATORY**	**0**	**0**	**4**	**2**

OBJECTIVES:
The student should be able to
- To study various testing tools.
- To implement various testing techniques.
- The following experiments should be practiced:

EXPERIMENTS
1. Study of software testing tools such as WinRunner, LoadRunner, Rational Rose Test Suite, QTP, Selenium

2. Implementation of testing techniques using tools:
   - (1) Function testing
   - (2) System testing
   - (3) Acceptance testing
   - (4) Usability testing
   - (5) Agile testing
   - (6) Configuration testing
   - (7) Compatibility testing
   - (8) Foreign language testing
   - (9) Security testing

3. Mini-project: developing automated test case generation tool

TOTAL : 45 PERIODS

OUTCOMES :
Upon completion of this course, the student will:
- Perform automated testing on applications using open source testing tools.
- Design and develop automated test case generation tools.

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CA 7511	CLOUD COMPUTING AND SECURITY LABORATORY	L T P C
		0 0 4 2

OBJECTIVES:

The student should be able to

- To understand the concept of Number Theory.
- To learn the cryptographic algorithms used to provide confidentiality, integrity and authenticity.
- To configure and study about wireless security.
- To develop web applications in the cloud.
- To learn the design and development process involved in creating a cloud based application.

EXPERIMENTS

Part I   Cryptographic Algorithms
(using Java)

1. Implementation of classical cryptographic algorithms.
2. Euclidean algorithm and Extended Euclidean algorithm.
3. Implementation of modular arithmetic.
4. Implementation of symmetric key cryptography using DES, AES, RC4 algorithms.
5. Implementation of Euler's Theorem, Fermat Theorem and Chinese Remainder Theorem.
6. Implementation of algorithms for generating and checking prime numbers.
7. Implementation of discrete logarithm problem.
8. Implementation of Asymmetric key cryptography using RSA, ElGamal and Deffie-Hellman Key - exchange algorithms.
9. Implementation of hashing algorithms: MD5, SHA and Message Authentication Code.

Part II   Configuration and study exercise

10. Wireless   Security: AAA protocol, WEP,WPA/PSK ,WPA2/PSK, RADIUS server
11. Wire shark tool for packet analysis.
12. VPN Configuration.
13. Firewall configuration for packet filtering and access control

Part III

Any 4 of the following experiments can be implemented:

1. 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
2. Install Virtual box with different flavours of linux or windows OS on top of windows7 or 8.
3. Install GAE and run a quick sort using python.
4. Install and run Eucalyptus Fast start.
5. Create two nodes in Eucalyptus and exchange data.
   Mini Project
6. Simulate a cloud scenario using Cloud Sim and run a scheduling algorithm not present in CloudSim or Install Hadoop and manipulate a large dataset and run on Hadoop

TOTAL : 45 PERIODS

OUTCOMES:

Upon completion of this course, the student will:

- Have a detailed overview of the design and development process involved in creating a cloud based application.
- Apply the security algorithms for web based and cloud based applications.
- Analyze and mitigate vulnerabilities across any computing system and hence be able to design a secure environment.

CA7512	REPORT WRITING PRACTICE LABORATORY	L T P C
		0 0 2 1

OBJECTIVES:

The student should be able to

- Construct workplace documents that demonstrate understanding of management communication contexts, genres, and contemporary business topics.
- Analyze and use quantitative data in professional documents.
- Recognize, explain, and use the formal elements of specific genres of organizational communication: white papers, recommendation and analytical reports, proposals, memorandums, web pages, wikis, blogs, business letters, and promotional document.

EXPERIMENTS

1. Use of MS Word and Latex for Report preparation.
2. Use of Excel for graphs.
3. Use of report writing tools – Oracle Report Builder, Crystal Reports –Visual Basic.
4. Report writing for an application project on any one of the following:
   - Student Information System.
   - Banking Operation.
   - Admission system.
   - Railway reservation system.
5. Header, Body computation and Footer generation for Reports.
6. Thesis writing:
   - Introduction on problems.
   - Literature survey – Existing work.
   - Architecture Design.
   - Algorithms and Implementation.
   - Presentation and results.
   - Writing Conclusion.
   - Display of Reference.

TOTAL : 30 PERIODS

OUTCOMES

Upon completion of this course, the student will:

- Explain the ethical, international, social, and professional constraints of audience, style, and content for writing situations.
- Demonstrate effective use of secondary research resources (such as electronic databases) as well as primary data gathering strategies.
- Identify different format features in print, multimedia, and HTML documents, and develop document design skills.

Revise and effectively edit all assignments, including informal media (such as email messages to the instructor).

CA 7005	DISTRIBUTED SYSTEMS	L T P C
		3 0 0 3

OBJECTIVES:

The student should be able to

- To understand the concepts of distributed system.
- To learn about distributed system resource management.
- To understand various fault tolerant techniques.

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UNIT I COMMUNICATION IN DISTRIBUTED ENVIRONMENT 9

Introduction – Various Paradigms in Distributed Applications – Remote Procedure Call –Remote Object Invocation – Message-Oriented Communication – Unicasting - Multicasting and Broadcasting – Group Communication – Ordered Multicast.

UNIT II DISTRIBUTED OPERATING SYSTEMS 12

Issues in Distributed Operating System – Threads in Distributed Systems – Clock Synchronization – Causal Ordering – Global States – Election Algorithms – Distributed Mutual Exclusion – Distributed Deadlock.

UNIT III DISTRIBUTED RESOURCE MANAGEMENT 10

Replication Strategies – Data-Centric Consistency Models – Client-Centric Consistency Models – Distributed Scheduling – Distributed File Systems Architecture –Sun NFS – HDFS – Map Reduce.

UNIT IV FAULT TOLERANCE AND CONSENSUS 7

Introduction to Fault Tolerance – Distributed Transactions – Distributed Commit Protocols – Byzantine Fault Tolerance – Impossibilities in Fault Tolerance -- Agreement Protocols.

UNIT V CASE STUDIES 7

Distributed Object-Based System – CORBA –Haddop – Python Romote Objects - Distributed Ruby.

TOTAL : 45 PERIODS

OUTCOMES :
Upon completion of this course, the student will:
- Develop fault tolerant distributed applications.
- Work Compare various distributed operating system characteristics.
- Apply efficient Resource allocation methodologies in distributed applications

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. Hadoop in Practice, Second Edition, Alex Holmes
4. MukeshSinghal, "Advanced Concepts In Operating Systems", McGraw Hill Series in Computer Science, 1994.
5. M.L.Liu, "Distributed Computing Principles and Applications", Pearson Addison Wesley, 2004.

	L	T	P	C
CA 7014 HIGH SPEED NETWORKS	3	0	0	3

OBJECTIVES:
The student should be able to
- To provide an overview of high-speed networking technologies.
- To learn the enhanced set of functionalities for high-speed networking.
- To understand the underlying concept involved for high performance.

UNIT I HIGH SPEED LANS 9

Ethernet – Fast Ethernet - Gigabit Ethernet - 10 Gigabit Ethernet – Token Ring - Fibre Channel – Wireless LAN"s – IEEE802.11 architecture and services – IEEE802.11 MAC – IEEE802.11 a/b/g/n Physical layers - security considerations.

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UNIT II   IPV6   9

Overview of IPv6- Functionalities - Addressing- Router/Network configuration – DNS for IPv6 – Multicasting- Interoperability Issues - Scalability Issues - Performance of TCP over IPv6 – ICMPv6.

UNIT III   CONGESTION AND TRAFFIC MANAGEMENT   9

Queuing Analysis - Queuing Models – Single Server Queues – Effects of Congestion – Congestion Control – Traffic Management – Congestion Control in Packet Switching Networks

UNIT IV   INTEGRATED AND DIFFERENTIATED SERVICES   9

Integrated Services Architecture – Approach - Components – Services - Queuing Discipline - FQ - PS - BRFQ - GPS - WFQ – Random Early Detection - Differentiated Services - RSVP – Goals and Characteristics - Data Flow - RSVP operations - Protocol Mechanisms.

UNIT V   MPLS NETWORKS   9

Multiprotocol Label Switching – Operations - Label Stacking - Protocol Details –Congestion Control and Routing in MPLS networks – MPLS Virtual Private Networks - MPLS Traffic Engineering.

TOTAL : 45 PERIODS

OUTCOMES :
Upon completion of this course, the student will:
- A good appreciation of the building blocks and operation of high speed networking technology including the hardware and software components.

REFERENCES :
1. William Stallings, "Data and Computer Communications", Ninth Edition, Pearson Education,2011.
2. William Stallings, "High Speed Networks and Internet", Second Edition, Pearson Education,2002.
3. Warland, PravinVaraiya, "High Performance Communication Networks", Second Edition, JeanHarcourt Asia Pvt. Ltd., 2001.
4. IrvanPepelnjk, Jim Guichard, Jeff Apcar, "MPLS and VPN Architecture", Cisco Press, Volume 1 and 2, 2003.

CA 7025	TCP/IP DESIGN AND IMPLEMENTATION	L	T	P	C
		3	0	0	3

OBJECTIVES:
The student should be able to
- Understand the design of TCP/IP Protocol structure
- Understand the implementation of TCP and IP functionalities in the form of data structures
- Understand how TCP handles input and output with synchronization
- Understand the implementation of error processing strategies
- Understand the importance of timers and how it is managed in a TCP communication.

UNIT I   FUNDAMENTALS   9

Internetworking concepts - IP and datagram forwarding - TCP services - Interactive data flow - Timeout and retransmission - Bulk data flow - Persist timer – Keep-alive timer

UNIT II   ARP AND IP   9

Structure of TCP/IP in OS - Data structures for ARP - Cache design and management - IP software design and organization - Sending a datagram to IP

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UNIT III   IP ROUTING IMPLEMENTATION   9
Routing table - Routing algorithms - Fragmentation and reassembly - Error processing (ICMP) - Multicast Processing (IGMP)

UNIT IV   TCP I/O PROCESSING AND FSM   9
Data structure and input processing - Transmission control blocks - Segment format - Comparison - Finite state machine implementation - Output processing - Mutual exclusion - Computing TCP data length

UNIT V   TCP TIMER AND FLOW CONTROL   9
Timers - Events and messages - Timer process - Deleting and inserting timer event - Flow control and adaptive retransmission - Congestion avoidance and control - Urgent data processing and push function

TOTAL : 45 PERIODS

OUTCOMES :
Upon completion of this course, the student will:
- Design a sample protocol stack.
- Come up with more efficient data structures for the protocols.
- Embed the protocol suite in a better and secure way in the OS.
- Come up with the variants of TCP according to the applications.
- Modify IP according to the applications.

REFERENCES :
1. Douglas E. Comer, "Internetworking with TCP/IP Principles, Protocols and Architecture", Vol. 1 Sixth edition, Pearson Education Asia, 2014.
2. Douglas E. Comer, "Internetworking with TCP/IP - Design, Implementation and Internals", Vol. 2 Third edition, Pearson Education Asia, 1999.
3. W. Richard Stevens, "TCP/IP illustrated-The Protocols", Volume 1, Pearson Education, 2012.

CA 7001	COMPUTER GRAPHICS AND ANIMATION	L	T	P	C
		3	0	0	3

OBJECTIVES:
The student should be able to
- understand the foundation of graphics applications programming.
- understand the fundamental concepts and theory of computer graphics.
- understand the basics of application programming interface (API) implementation based on graphics pipeline approach and
- become proficient at graphics programming using OpenGL

UNIT I   INTRODUCTION   6
Basics, Scope and Applications, Graphics Hardware, Graphics Standards, Display systems, Image formation, Graphics Systems, Coordinate systems.

UNIT II   GRAPHICS PRIMITIVES   6
OpenGL Functions; Line-Drawing Algorithms, Parallel Line Algorithms, Circle drawing algorithms, Area Filling, Clipping Algorithms: Line and Polygon, Anti-aliasing.

UNIT III   TRANSFORMATIONS   12
Affine Transformations (2D & 3D): Translation, Rotation, Scaling, Reflection and Shearing; Hierarchical Modelling & viewing: The Camera Transformation – Perspective, orthographic and Stereographic views; Fractals.

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UNIT IV ADVANCED RENDERING TECHNIQUE 12

Curves and Surfaces: Bezier, B-Splines and NURBS; Color models; Hidden Surface Removal Algorithms; Photorealistic rendering; Global Illumination: Ray tracing - Radiosity; Texture Synthesis – Bump Mapping, Environmental mapping; Advanced Lighting and Shading.

UNIT V ANIMATION 9

Overview of Animation Techniques – Key framing, Computer Animation;Motion capture and editing; forward/Inverse Kinematics;Deformation models;Facial animation; Rigid body animation - collision detection – Graphicsfile 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.
- Identify the structure of modern computer graphics systems.
- Explain the basic principles of implementing computer graphics primitives.
- Be able to construct interactive computer graphics programs using OpenGL.

REFERENCES

1. Donald D. Hearn, M. Pauline Baker, Warren Carithers, "Computer Graphics with OpenGL", 4th Edition, By, 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.

			L	T	P	C
CA 7003	DATABASE TUNING		3	0	0	3

OBJECTIVES: The student should be able to
- To understand the basic principles of tuning.
- To learn about the performance criteria of choosing a DBMS.
- To understand and use suitable troubleshooting mechanisms for tuning databases.

UNIT I FUNDAMENTALS OF TUNING 8

Review of Relational Databases – Relational Algebra - Locking and Concurrency Control – Correctness Consideration – Lock Tuning – Logging and the Recovery Subsystem – Principles of Recovery – Tuning the Recovery Subsystem – Operating Systems Considerations – Hardware Tuning.

UNIT II INDEX TUNING 8

Types of Queries – Data Structures – B tree – B + Tree - Hash Structures – Bit Map Indexes – Clustering Indexes – Non Clustering Indexes – Composite Indexes – Hot Tables – Comparison of Indexing and Hashing Techniques.

UNIT III   QUERY OPTIMIZATION   10

Techniques - Tuning Relational Systems – Normalization – Tuning Denormalization – Clustering Two Tables – Aggregate Maintenance – Record Layout – Query Tuning – Triggers – Client Server Mechanisms – Objects - Application Tools and Performance – Tuning the Application Interface – Bulk Loading Data – Accessing Multiple Databases.

UNIT IV   TROUBLESHOOTING   10

Query Plan Explainers – Performance Monitors – Event Monitors – Finding Suspicious Queries – Analyzing a Query"s Access Plan – Profiling a Query Execution – DBMS Subsystems – Data Warehousing Tuning.

UNIT V   CASE STUDIES   9

Tuning E-Commerce Applications – E-Commerce Architecture – Tuning E-Commerce Architecture - Transaction Chopping – Time Series Databases – Understanding Access Plans – Configuration Parameters – Oracle - SQL Server - DB2UDB – Distributed Database - Implementation.

TOTAL : 45 PERIODS

OUTCOMES :
Upon completion of this course, the student will:
- Gain knowledge on the significance of database tuning.
- Optimize queries for tuning databases.
- Develop tuning based E-Commerce applications.

REFERENCES :
1. Dennis Shasha and Philippe Bonnet, "Database Tuning, Principles, Experiments, and Troubleshooting Techniques", Morgan Kaufmann, An Imprint of Elsevier, 2003.
2. Thomas Connoly and Carolyn Begg, "Database Systems, A Practical Approach to Design, Implementation and Management", Third Edition, Pearson Education, 2003.
3. M.Tamer Ozsu, Patrick Valduriez and S.Sridhar, "Principles of Distributed Database Systems", Pearson Education, 2007.

CA 7023	SOFTWARE QUALITY MANAGEMENT	L T P C
		3 0 0 3

OBJECTIVES:
The student should be able to

- To give a clear picture on quality management, documentation and control for software quality.
- To provide knowledge on standards, models and tools used for software quality management.
- To understand how to perform measurement and assessment of software quality.

UNIT I   BASICS OF SOFTWARE QUALITY   9

Introduction to Software Quality - Establishment of a Software Quality Program - Software Quality Assurance Planning - Software Quality Assurance Management.

UNIT II   CONTROLLING AND DOCUMENTING   9

Documentation - Reviews and Audits - Problem Reporting and Corrective Action – Defect prevention and removal - Code Control - Media Control - Supplier Control – Records - Collection - Maintenance and Retention - Training - Risk Management.

UNIT III   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

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UNIT IV QUALITY TOOLS 9

Hierarchical models of software quality – software quality metrics –function points - Software product quality – software maintenance quality – effect of case tools – software quality infrastructure – procedures – certifications – configuration management – documentation control.

UNIT V QUALITY METRICS AND ASSESMENT 9

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

TOTAL : 45 PERIODS

OUTCOMES :
Upon completion of this course, the student will:
- Prepare document, control and manage software quality with the aid of tools and standards.
- Practice the process of measurement and assessment to ensure Software Quality.

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) Pvt. Ltd, 2003.

CA 7022	REAL TIME SYSTEMS	L T P C
		3 0 0 3

OBJECTIVES:
The student should be able to
- To learn the fundamentals of real time computing systems.
- To understand real time databases.
- To familiarize with real time reliability techniques.

UNIT I INTRODUCTION 9

Introduction - Issues in Real Time Computing - Structure of a Real Time System - Task Classes - Performance Measures for Real Time Systems - Estimating Program Runtimes - Task Assignment and Scheduling - Classical Uniprocessor Scheduling Algorithms - Uniprocessor Scheduling of IRIS Tasks - Task Assignment - Mode Changes - and Fault Tolerant Scheduling.

UNIT II PROGRAMMING LANGUAGES AND TOOLS 9

Programming Language and Tools – Desired Language characteristics - Data Typing- Control structures - Facilitating Hierarchical Decomposition - Packages - Run-time (Exception) Error handling - Overloading and Generics - Multitasking - Low Level Programming - Task scheduling - Timing Specifications - Programming Environments - Run-time Support.

UNIT III REAL TIME DATABASES 9

Real time Databases - Basic Definition - Real time Vs General Purpose Databases - Main Memory Databases - Transaction priorities - Transaction Aborts - Concurrency Control Issues - Disk Scheduling Algorithms - Two-Phase Approach to improve Predictability - Maintaining Serialization Consistency - Databases for Hard Real Time systems.

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UNIT IV COMMUNICATION 9

Real-Time Communication - Communications Media - Network Topologies Protocols - Fault Tolerant Routing - Fault Tolerance Techniques - Fault Types - Fault Detection - Fault Error containment Redundancy - Data Diversity - Reversal Checks - Integrated Failure handling.

UNIT V EVALUATION TECHNIQUES 9

Reliability Evaluation Techniques - Obtaining Parameter Values - Reliability Models for Hardware Redundancy - Software Error Models - Clock Synchronization - Clock - A Nonfault -Tolerant Synchronization Algorithm - Impact of Faults - Fault Tolerant Synchronization in Hardware - Fault Tolerant Synchronization in Software.

TOTAL : 45 PERIODS

OUTCOMES :
Upon completion of this course, the student will:
- Design and Implement real time applications.
- Apply real time communication techniques in networks.
- Evaluate reliability in real time applications.

REFERENCES :
1. C.M. Krishna, Kang G. Shin, "Real-Time Systems", McGraw-Hill International Editions, 1997.
2. Stuart Bennett, "Real Time Computer Control-An Introduction", Second edition, Prentice Hall PTR, 1994.
3. Peter D. Lawrence, "Real time Micro Computer System Design – An Introduction", McGraw Hill, 1988.
4. S.T. Allworth and R.N. Zobel, "Introduction to real time software design", II Edition, Macmillan, 1987.
5. R.J.A Buhur, D.L.Bailey, "An Introduction to Real-Time Systems", Prentice-Hall International, 1999.
6. Philip.A.Laplante "Real Time System Design and Analysis", III Edition, PHI, April 2004.

CA 7009	FUNDAMENTAL OF DIGITAL IMAGE PROCESSING	L	T	P	C
		3	0	0	3

OBJECTIVES:
The student should be able to
- To understand the basic concepts and algorithms of digital image processing.
- To familiarize the students 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 students with practical experience using them.
- To appreciate the use of image processing in current technologies and to expose the students to real-world applications of 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

Spatial Domain - Gray level Transformations Histogram Processing Spatial Filtering – Smoothing and Sharpening. Frequency Domain: Filtering in Frequency Domain – DFT, FFT, DCT, Smoothing and Sharpening filters – Homomorphic Filtering., Noise models, Constrained and Unconstrained restoration models.

UNIT III   IMAGE SEGMENTATION AND IMAGE FEATURE ANALYSIS   9
Detection of Discontinuities – Edge Operators – Edge Linking and Boundary Detection – Thresholding – Region Based Segmentation – Motion Segmentation, Image Features – Textures - Boundary representations and Descriptions- Component Labeling – Regional descriptors and Feature Selection Techniques.

UNIT IV   MULTI RESOLUTION ANALYSIS AND MORPHOLOGICAL PROCESSING   9
Multi Resolution Analysis: Image Pyramids – Multi resolution expansion – Wavelet Transforms, Fast Wavelet transforms, Wavelet Packets. Image Morphology: Binary and Gray level morphology operations – Erosion, Dilation, Opening and closing operations – Distance transforms – Basic morphological operations.

UNIT V   IMAGE PATTERN RECOGNITION AND CASE STUDIES   9
Statistical Classifiers – Clustering Algorithms – Hierarchical and Partitional clustering – Image classification and Recognition- Image Understanding – Case Studies in Biometrics, Video - Image Fusion – Steganography

TOTAL : 45 PERIODS

OUTCOMES :
Upon completion of this course, the student will:
- 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 implement mini projects.
- Explore the possibility of applying 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.

CA 7026	USER INTERFACE DESIGN	L	T	P	C
		3	0	0	3

OBJECTIVES: The student should be able to

- To know about the user.
- To learn the importance of best interface.
- To know about object oriented user interface (OOUI).
- To know about the merging of PC interface with Internet Web browser interfaces.

UNIT I   FOUNDATIONS OF USER INTERFACE DESIGN   9
Designing quality software user interface – user experiences and expectations – software user interface – user interface models – psychology of humans and computer – golden rules of user interface design

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UNIT II   USER INTERFACE EVOLUTION   9
Computer standards and user interface guidelines – software usability testing – command lines and menus – graphical user interface.

UNIT III   OBJECT- ORIENTED USER INTERFACE   9
Introduction – basic of OOUIs – core skills needed for OOUIs – user interface architecture behind OOUIs – OOUIs and the user's model – User's Memory load – Semantics of OOUIs – migrating from GUI to OOUIs.

UNIT IV   USER INTERFACE DESIGN PROCESS   9
An iterative user interface design process – Design Team approach – User involved and learner – Centered design – Four-phase Interface design process – Iterative nature of interface design – Case Study – Gather and analyze user information – Design the user interface – Construct the user interface – Validate the user interface – Testing – evaluation

UNIT V   ADVANCED USER INTERFACE TECHNIQUES AND TECHNOLOGIES   9
Interface Designer's Tool kit – Uses of color – Audio and animation in the user interface - top ten usability – Problems with GUI and OOUIs – Help - advisors - wizards and multimedia – Social user interface and intelligent agents – The new worlds of PC – internet user interfaces.

TOTAL : 45 PERIODS

OUTCOMES
Upon completion of this course, the student will:
- Design an efficient User interface with required information.
- Analyze user requirements thoroughly.
- Implement Object oriented approach in interface design

REFERENCES :
1. Theo Mandel; "The Elements of user Interface Design" John wiley & sons, Inc 1997
2. Wilbent. O. Galitz, " The Essential Guide To User Interface Design", John Wiley & Sons, 2001.
3. Deborah Mayhew, "The Usability Engineering Lifecycle", Morgan Kaufmann, 1999.
4. Alan Cooper, "The Essential Of User Interface Design", Wiley, 2002.
5. Alan Dix, Janet Finlay, Gregory D. Abowd, Russell Beale, "Human – Computer Interaction", Third Edition, Pearson, 2004.
6. Jonathan Lazar Jinjuan Heidi Feng, Harry Hochheiser, "Research Methods in Human Computer Interaction," Wiley, 2010.
7. Ben Shneiderman and Catherine Plaisant, "Designing the User Interface: strategies for Effective Human Computer Interaction", Addison– Wesley, 5th Edition, 2009.

CA 7012	GRID COMPUTING	L 3	T 0	P 0	C 3

OBJECTIVES:
The student should be able to
- To understand Grid Architecture.
- To understand different types of grids.
- To know Grid standards.
- To acquire the knowledge of Grid computing in various areas.

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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 EDUCATIONAL GRID 9
Global infrastructure-e-Science perspective of Grid-Meta computing-grid and virtual observatory-High energy physics Grid-Biology and Grid-Medical images and Grid-Chemistry and Grid-Education and Enterprise with the Grid

UNIT V APPLICATIONS 9
Scientific – Medical – Bioinformatics – Federated Computing – ERM – Multiplayer Games - Collaborative Science – Case Study.

TOTAL : 45 PERIODS

OUTCOMES :
Upon completion of this course, the student will:
- 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.

CA7018	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.

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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:
- 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.

CA 7028	XML AND WEB SERVICES	L	T	P	C
		3	0	0	3

OBJECTIVES:
The student should be able to
- To learn the basics of XML technology.
- To understand the background of distributed information system.
- To analyze and design a web service based application.
- To learn the security features of web services and service composition

UNIT I   XML FUNDAMENTALS   9
XML – structuring with schema DTD – XML Schema – XML Processing DOM – SAX – Presental XSL – Transformation XSLT – XPath – XQuery.

UNIT II   DISTRIBUTED INFORMATION SYSTEM   9
Distributed information system – Design of IB – Architecture of IB – Communication in an IS – Middleware RPC – TP monitors – Object brokers – Message oriented middleware – EAI – EAI Middleware – Workflow – Management – benefits and limitations – Web technologies for Application Integration.

UNIT III   WEB SERVICES   9
Web Services – Definition – Web Services and EAI – Web Services Technologies – Web services Architecture – SOAP – WSDL – UDDI – WS-Addressing – WS-Routing – WS-Security – WS-Policy – Web Service invocation framework - web services using java – WS using .NET - mobile web service.

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UNIT IV　　　XML SECURITY　　　　　　　　　　　　　　　　　　　9
XML Security and meta framework - XML signature – XML Encryption – SAML – XKMS – WSSecurity – RDF – semantic Web service.

UNIT V　　　SERVICE COMPOSITION　　　　　　　　　　　　　　　9
Service Coordination and Composition coordination protocols – WS-Coordination – WS-Transaction – RosttaNet – ebXML –WSCI – Service Composition – Service Composition Models – Dependencies between coordination and composition – BPEL – Current trends.

TOTAL : 45　PERIODS

OUTCOMES
Upon completion of this course, the student will:
* Create, validate, parse, and transform XML documents.
* Design a middleware solution based application.
* Develop web services using different technologies.
* Compose set of web services using BPEL.

REFERENCES :
1. Gystavo Alonso, Fabio casasi, Hareemi kuno, vijay machiraju, "Web Services – Concepts, Architecture and Applications", Springer, 2004.
2. Ron Schmelzer etal, "XML and Web Services", Pearson Education, 2002.
3. Sandeep Chatterjee and James Webber, "Developing Enterprise web services: An Architect's and Guide", Practice Hall, 2004.
4. Freunk p.coyle, "XML, web Services and the Data Revolution", Pearson, 2002.

CA 7011　　　**GEOGRAPHICAL INFORMATION SYSTEMS**　　　**L T P C**
　　　　　　　　　　　　　　　　　　　　　　　　　　　　　　　　3 0 0 3

OBJECTIVES:
The student should be able to
* To provide exposure to data models and data structure used in GIS and to introduce various Raster and Vector Analysis capabilities of GIS also expose the concept of quality and errors in GIS

UNIT I　　　BASICS　　　　　　　　　　　　　　　　　　　　　　8
Maps: Types – Characteristics – Coordinate systems – Map projections – Definition of GIS – Evolution – Components of GIS – Data : Spatial and Non-spatial – Spatial Data: Point, Line, Polygon/Area and Surface – Non-Spatial Data: Levels of measurement – Database Structures.

UNIT II　　　DATA MODEL AND INPUT　　　　　　　　　　　　　　9
Raster Data Model – Grid – Tessellations – Geometry of Tessellations –– Data Compression – Vector Data Model – Topology –Topological consistency – Vector data input– Raster Vs. Vector comparison – File Formats for Raster and Vector – Vector to Raster conversion- raster formats

UNIT III　　　DATA ANALYSIS AND OUTPUT　　　　　　　　　　　10
Raster Data Analysis: Local, Neighborhood and Regional Operations – Map Algebra – Vector Data Analysis: Non-topological analysis, Topological Analysis, Point-in-Polygon, Line-in-polygon, Polygon-in-polygon – Network Analysis – buffering – ODBC – Map Compilation.

UNIT IV   SPATIAL MODELING   9

Modeling in GIS – types – Digital Elevation Models: Generation, Representation, Applications – ALTM.

UNIT V   DATA QUALITY AND MISCELLANEOUS TOPICS   9

Data quality analysis – Sources of Error – Components of Data Quality – Meta Data – Open GIS consortium – Customisation in GIS – Object Oriented GIS – WebGIS-GIS system evaluation and bench marking.

TOTAL : 45 PERIODS

OUTCOMES :
Upon completion of this course, the student will:
- Apply the fundamental concepts and techniques related to the use of Geographic Information System.
- Apply this knowledge to a wide range of spatial/environmental problems.
- Describe GIS data models and spatial data collection.

REFERENCES :
1. Lo. C P and Yeung, Albert K W, "Concepts and Techniques of Geographic Information Systems", Prentice Hall of India, 200
2. Robert Laurini and Derek Thompson, "Fundamentals of Spatial Information Systems", Academic Press, 1996.
3. Peter A Burrough, Rachael A Mc.Donnell, "Principles of GIS", Oxford University Press, 2000.
4. Allan Brimicombe, GIS Environmental Modeling and Engineering, Taylor & Francis, 2003.

		L T P C
CA 7013	**HEALTHCARE INFORMATION SYSTEMS**	**3 0 0 3**

OBJECTIVES: The student should be able to
- To gain knowledge about medical informatics and healthcare informatics.
- To understand the case study of computerized patient record.
- To study and use different tools for clinical information system.
- To apply the knowledge of Bio informatics for systems.

UNIT I   MEDICAL INFORMATICS   9

Introduction - Structure of Medical Informatics –Internet and Medicine -Security Issues Computer based Medical Information Retrieval, Hospital Management and Information System - Functional Capabilities of a Computerized HIS - E-Health Services - Health Informatics – Medical Informatics – Bioinformatics.

UNIT II   HEALTHCARE INFORMATICS   9

Strategic Planning - Selecting a Health Care Information System - Systems Integration and Maintenance - Systems Integration - Regulatory and Accreditation Issues - Contingency Planning and Disaster Recovery.

UNIT III   COMPUTERISED PATIENT RECORD   9

Introduction - History taking by Computer, Dialogue with the Computer - Components and Functionality of CPR - Development Tools – Intranet - CPR in Radiology - Application Server Provider - Clinical Information System - Computerized Prescriptions for Patients.

UNIT IV   MEDICAL IMAGING   9

Automated Clinical Laboratories - Automated Methods in Hematology - Cytology and Histology - Intelligent Laboratory Information System - Computerized ECG, EEG And EMG - Computer Assisted Medical Imaging - Nuclear Medicine - Ultrasound Imaging Ultrasonography -Computed X-Ray Tomography - Radiation Therapy and Planning, Nuclear Magnetic Resonance.

UNIT V   BIO-INFORMATICS   9

Pair wise Sequence Alignment – Local Versus Global Alignment – Multiple Sequence Alignment – Computational Methods – Dot Matrix Analysis – Substitution Matrices – Dynamic Programming – Word Methods – Bayesian Methods – Multiple Sequence Alignment – Dynamic Programming – Progressive Strategies – Iterative Strategies – Tools – Nucleotide Pattern Matching – Polypeptide Pattern Matching – Utilities – Sequence Databases.

TOTAL : 45 PERIODS

OUTCOMES :
Upon completion of this course, the student will:
* To design and develop clinical and hospital management system on his own.
* To work with different medical imaging techniques.
* To apply the knowledge of bio informatics for biological databases.

REFERENCES :
1. R.D.Lele, "Computers in Medicine Progress in Medical Informatics", Tata Mcgraw Hill Publishing Computers, 2005.
2. Mohan Bansal, "Medical informatics", Tata McGraw Hill Publishing, 2003.
3. Burke, Lillian; Well, Barbara, "Information Technology for the Health Professions", Prentice Hall, 2006.
4. Bryan Bergeron, "Bio Informatics Computing", Second Edition, Pearson Education, 2003.

CA 7006	E-LEARNING TECHNIQUES	L	T	P	C
		3	0	0	3

OBJECTIVES:
The student should be able to
* To gain knowledge about modern technology for learning.
* To acquaint with the e-Learning Tools.
* To learn technologies involved in e-learning application development.
* To become aware of the current business potential of e-learning based business.

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

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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 :
Upon completion of this course, the student will:
- Work with technologies involved in e-Learning Applications.
- Design and Develop e-Learning Application and working with e-Learning tools.

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.
4. Madhuri Dubey,"Effective E-learning Design,Development and Delivery",University Press 2011.

IF 7076	OPERATIONS RESEARCH	L	T	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 Queuing systems.

TOTAL : 45 PERIODS

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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", Ninth Edition, Pearson Education, New Delhi, 2010.
2. Gupta P.K. and Hira, D.S., "Operations Research",Revise Edition, S.Chand & Company Ltd., 2012.
3. Ravindran A., Don T. Phillips and James J. Solberg, "Operations Research", Second Edition, Wile India Edition, 2006.
4. Sharma J. K., "Operations Research", Third Edition, Macmillan Publishers India Ltd., 2009.

CA 7007	ENTERPRISE RESOURCE PLANNING	L	T	P	C
		3	0	0	3

OBJECTIVES:
The student should be able to
To make the students aware of the enterprise resource planning using information technology.

UNIT I   INTRODUCTION TO ERP   9
ERP essentials – ERP evolution – ERP market – ERP tiers – information systems – Presentation tier – application tier – database tier.

UNIT II   ENTERPRISE SYSTEMS   9
Enterprise systems – stand alone mainframe systems – client server architecture – service oriented architecture – types of enterprise systems – types of data – SAP overview.

UNIT III   PROCESS IN ERP   9
Basic Procurement process – physical flow – document flow – information flow – financial impact - role of enterprise systems in the procurement process – fulfillment process – production process.

UNIT IV   INTEGRATION   9
Integrated processes – Integrated processes execution – additional intracompany processes – extended (intracompany) processes.

UNIT V   CASE STUDY   9
ERP for construction industry – ERP for a corrugated box manufacturing company – ERP for lens making company – ERP for furniture manufacturing company – ERP for toys manufacturing company - Mc Donald's story – Automobile enterprises.

TOTAL : 45 PERIODS

OUTCOMES :
Upon completion of this course, the student will:
- Explain the traditional ecosystem and the use of technology in enterprises.

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REFERENCES :
1. Simha R Magal, Jeff Word, "Essentials of Business Processes and Information Systems", Wiley Publications, 2009.
2. Marianne Bradford, "Modern ERP: Select, Implement and use Today's advanced business systems", Second Edition, Lulu Publishers, 2010.
3. Jyotindra Zaveri, "Enterprise Resource Planning", Second edition, Himalaya Publishing House, 2012.

CA 7020	MULTIMEDIA	L	T	P	C
		3	0	0	3

OBJECTIVES:

The student should be able to

- understand the foundation of Multimedia Elements.
- create a graphics presentation.
- understand the compression and communication techniques used in multimedia.
- understand the basic functionalities of multimedia tools and
- create an entire multimedia project

UNIT I INTRODUCTION 9

Multimedia; Multimedia Software Tools; Multimedia Authoring Tools; Graphics and Image Data Representation; Multimedia Architecture.

UNIT II IMAGE FORMATION 9

Basics of Image Formation: Camera and lenses, image formation, basic camera models and geometry. Standard image formats. Colors in images and videos, Fundamental Concepts of audio and video.

UNIT III MULTIMEDIA COMPRESSION TECHNIQUES 9

Basics of Information Theory; Lossless and Lossy Compression Algorithms – Image Compression Standards – Basic Audio and Video Compression Techniques – MPEG Audio and Video Coding.

UNIT IV MULTIMEDIA COMMUNICATION AND RETRIEVAL 9

Basics of Multimedia Networks; Multiplexing Technologies; Quality of Multimedia Data Transmission; Multimedia over IP; Media – on – Demand; Content based Retrieval; Relevance Feedback

UNIT V MULTIMEDIA TOOLS AND APPLICATION 9

Overview of Animation Techniques – Key framing, Computer Animation; Authoring tools – 3D modelling and animation tools – Image editing tools – sound editing tools – Digital movie tools; Multimedia application development - Authoring – Metaphors – Testing – Report writing – Documentation.

TOTAL : 45 PERIODS

OUTCOMES

Upon completion of this course, the student will:

- Use current trends in multimedia.
- Identify the basic components of a multimedia project
- Analyze meaning and media: the evolution of information across a variety of media types
- Assess the relationship between Interactive design and learning theories.
- Be proficient in digital imaging, interactive production, audio production.
- Have the ability to produce work in a team-based.

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REFERENCES :
1. Ze-Nian Li and Mark S.Drew, "Fundamentals of Multimedia" PHI, 2003
2. Ralf Steinmetz and KlaraNahrstedt "Multimedia Systems", Springer, 2004.
3. K.R. Rao, "Multimedia Communication Systems: Techniques, Standards, and Networks", TMH, 2002.
4. T.M. Savage and K.E. Vogel, "An Introduction to Digital Multimedia",Second Edition, jblearning, 2014.

CA 7016	**INFORMATION MANAGEMENT SYSTEM**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

OBJECTIVES:
The student should be able to
- To aware the significant of information in the business scenario
- To familiarize method of restoring, retrieving and presenting the information.

UNIT I   INTRODUCTION   9
Data, information, knowledge and wisdom; characteristics of information, quality of information, value of information in decision making in various levels of the organization - Role of information in Business scenario- functional and process approach in the organization; Source and supply of information and content to employees, shareholders and customers

UNIT II   INFORMATION CAPTURING AND MIGRATION MECHANISMS   9
Data management and system integration ;Content management – text, imaging , records, workflow, web content management; Distributed databases, OO databases-object life cycle modeling visual databases and knowledge based databases and business impacts, ETL on data ware house, Meta data and indexing

UNIT III   BUSINESS PROCESS MANAGEMENT   9
Practices of BPM, role of Information in BPM, Business Analysis-relationship between information and organization, Critical success factors, Enterprise analysis –framework and tools, Process design and modeling-process improvements, process modeling, business process reengineering, SOA, Six Sigma and continuous improvement, ERP.

UNIT IV   INFORMATION PRESENTATION   9
Enterprise wide search-DSS, EIS, ES,   Fact and entity extraction -OLAP, Data mining algorithm-classification and clustering of information, information governance, BI

UNIT V   INFORMATION IN BUSINESS SCENARIO AND BUSINESS TRENDS   9
Information in management application: Functional areas of management, roles and responsibilities of Information resource manager, E business models, Value of information in E-CRM - Social marketing – social and ethical issues in handling information management.

TOTAL : 45 PERIODS

OUTCOMES :
Upon completion of this course, the student will:
- Gains knowledge on effective applications of information systems in business

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REFERENCES:
1. Robert Schultheis and Mary Summer, Management Information Systems – The Managers View, Tata McGraw Hill, 2008.
2. Peter Rob, Carlos Coronel, Database System and Design, Implementation and Management, 7 th edition, Cengage Learning, Jeffrey A Hoffer et al, Modern Database Management, 8th Edition, Pearson Education, 2008,
3. Gordon Davis, Management Information System : Conceptual Foundations, Structure and Development, Tata McGraw Hill, 2000.
4. Jagan Nathan Vaman, ERP in Practice, Tata McGraw-Hill, 2008
5. Rick Parent, *Computer Animation - Algorithms and Techniques,* Third Edition Morgan Kaufman, 2012.

CA 7019	M-COMMERCE	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

OBJECTIVES: The student should be able to
- To understand Mobile Business strategies.
- To understand Mobile marketing tools and techniques.
- To know about Mobile technologies.

UNIT I   INTRODUCTION   9
Introduction – Mobile Marketing Campaign - Fortune 500 and Mobile Marketing - Consumers Engagement with Mobile Terminologies.

UNIT II   MOBILE MARKETING   9
Businesses Vs Mobile Marketing - Classic Mistakes in Mobile Marketing - Laying Foundation for Successful Mobile Marketing Campaign - Understanding Technology behind Mobile Marketing – Android – iOS - Windows Phone.

UNIT III   MOBILE MARKETING TOOLS   9
Strategic thinking about Mobile Marketing Campaign - Mobile Marketing Tools – Setting up Mobile Website for Different Firms using SMS - MMS And Apps - To Drive Customers to Business and Other Ways to Attract Customers.

UNIT IV   MOBILE APPLICATIONS   9
Location Based Marketing – LBS – NFC - Bluetooth and LBA - 2D Codes – Tablet - Other Mobile Applications - Business Firms Connecting To Customers Using Mobile – Case Study - Mobile Marketing For B2B Companies - Mobile E-Commerce to Drive Revenue.

UNIT V   MOBILE APPLICATION DEVELOPMENT   9
Mobile Payments - Present and Future Mobile Technology - Mobile Application Development

TOTAL : 45 PERIODS

OUTCOMES :
Upon completion of this course, the student will:
- Analyze various mobile marketing strategies.
- Market Mobile based Applications.
- Apply various tools in mobile marketing.

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REFERENCES:
1. Jeanne Hopkins, Jamie Turner, "Go Mobile: Location Based Marketing, Apps, Mobile Optimized Ad Campaigns, 2D codes and other Mobile Strategies to Grow your Business", John Wiley & Sons Inc., 2012.
2. Paul Skeldon, "M- Commerce", Crimson Publishing, 2012.
3. Norman Sadeh, "M-Commerce Technologies, Services and Business Models", Wiley, 2002.
4. Paul Mary, Tom Jell, "Mobile Commerce, Opportunities, Applications and Technologies of Wireless Business", Cambridge University Press, 2001.

CA 7024	SOFTWARE RELIABILTY METRICS	L	T	P	C
		3	0	0	3

OBJECTIVES:
The student should be able to
- To introduce the basics of software reliability.
- To illustrate how to perform planning, execution and testing for software reliability.
- To learn about various metrics and models of software reliability

UNIT I   INRODUCTION TO RELIABILITY CONCEPTS   9

Problem - Process and Product - The Software Reliability Engineering Process – Learning Reliability Concepts – Software Reliability and Hardware Reliability.

UNIT II   OPERATING PROFILES   10

Implementing Operational Profiles - Developing Operational Profiles - Using the Graphical Representation of the Operational Profile - Applying the Module Usage Table - Learning Operations and Run Concepts - Applying Operational Profiles.

UNIT III   EXECUTION AND TESTING   9

Failure - Faults and Testing - Defining Failure - Failure Intensity – Software Safety- Failures – Faults - and Errors – Availability - Test - Preparing and Executing.

UNIT IV   FUNDAMENTALS OF MEASUREMENTS   8

Measurements in Software Engineering – Scope of Software Metrics – Fundamentals of Measurements Theory – Goal Based Framework – Software Measurement Validation.

UNIT V   METRICS AND MODELS   9

Measurement of Internal Product Attributes – Size and Structure – External Product Attributes - Reliability Model – Exponential Distribution and Reliability Growth Model – Availability Metrics.

TOTAL : 45 PERIODS

OUTCOMES :
Upon completion of this course, the student will:
- Learn reliability concepts, metrics and models used to evaluate the software reliability.•
- Work with planning, execution and testing of software for reliability.•

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REFERENCES :
1. John D. Musa, "Software Reliability Engineering", Tata McGraw Hill, 2004.
2. Norman E. Fenton, Shari Lawrence Pfleeger, "Software metrics", Second Edition, International Student Edition, 2003.
3. John D. Musa, Anthony Iannino, Kazuhira Okumoto, "Software Reliability – Measurement, Prediction, Application, Series in Software Engineering and Technology", McGraw Hill, 1987.
4. Stephen H. Kan, "Metrics and Models in Software Quality Engineering", Second Edition, Addison-Wesley Professional, 2002.

MM 7072	VISUALISATION TECHNIQUES	L	T	P	C
		3	0	0	3

OBJECTIVES: The student should be able to

- To understand the importance of data visualization.
- To know the different types of visualization techniques.
- To create various visualizations.

UNIT I   INTRODUCTION   9

Introduction – Issues – Data Representation – Data Presentation – Common Mistakes in design.

UNIT II   FOUNDATIONS FOR DATA VISUALIZATION   9

Visualization stages – Experimental Semiotics based on Perception Gibson's Affordance theory – A Model of Perceptual Processing – power of visual perception-Types of Data-visualization and data objects.

UNIT III   COMPUTER VISUALIZATION   9

Non-Computer Visualization – Computer Visualization: Exploring Complex Information Spaces – Fisheye Views – Applications – Comprehensible Fisheye views – Fisheye views for 3D data – Interacting with visualization

UNIT IV   MULTIDIMENSIONAL VISUALIZATION   9

One Dimension – Two Dimensions – Three Dimensions – Multiple Dimensions – Trees – Web Works – Data Mapping: Document Visualization – Workspaces.

UNIT V   CASE STUDIES   9

Small interactive calendars – Selecting one from many – Web browsing through a key hole – Communication analysis – Archival analysis

TOTAL : 45 PERIODS

OUTCOMES :
Upon completion of this course, the student will:
- Compare various visualization techniques.
- Design creative visualizations.
- Apply visualization over different types of data.

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REFERENCES :
1. Stuart.K.Card, Jock.D.Mackinlay and Ben Shneiderman, "Readings in Information Visualization Using Vision to think", Morgan Kaufmann Publishers.
2. Colin Ware, "Information Visualization Perception for Design", 2nd edition, Margon Kaufmann Publishers, 2004.
3. Robert Spence "Information visualization – Design for interaction", 2nd Edition, Pearson Education, 2007.
4. Stephen Few, "Information Dashboard Design-The Effective Visual Communication of Data", 1st Edition, O'Reilly Media Publisher, 2006

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.

CA 7017	**INTELLIGENT DATA ANALYSIS**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

OBJECTIVES:
The student should be able to
- To understand data mining principles and techniques.
- To expose the students to the concepts of Big Data.
- To understand various data analysis tasks.

UNIT I   INTRODUCTION TO BIG DATA   8
Introduction to Big Data Platform –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 PREPROCESSING & ASSOCIATION RULE MINING   9
Need for Data Preprocessing – Data Cleaning – Data Integration and Transformation – Data Reduction – Data Discretization and Concept Hierarchy Generation - Association Rule Mining - Mining Frequent Itemsets with and without Candidate Generation - Mining Various Kinds of Association Rules - Constraint-Based Association Mining.

UNIT III   DATA ANALYSIS   10
Regression modeling - Multivariate analysis - Bayesian modeling - inference and Bayesian networks - Support vector and kernel methods - Analysis of time series - linear systems analysis - nonlinear dynamics - 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.

UNIT IV   CLUSTERING   9
Cluster Analysis - Types of Data in Cluster Analysis – A Categorization of Major Clustering Methods – Partitioning Methods – Hierarchical methods – Density-Based Methods – Grid-Based Methods – Model-Based Clustering Methods – Clustering High- Dimensional Data – Constraint-Based Cluster Analysis – Outlier Analysis.

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UNIT V   CLASSIFICATION & PREDICTION   9

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

TOTAL : 45 PERIODS

OUTCOMES :
Upon completion of this course, the student will:
- Identify the need for Big data analytics for a domain.
- Apply Big data analytics for a given problem.
- Perform Classification and Clustering of data.
- Mine Big data by applying various mining techniques.
- Analyze data using various Modeling techniques.

REFERENCES :
1. Michael Berthold, David J. Hand, "Intelligent Data Analysis", Springer, 2007.
2. Jiawei Han, Micheline Kamber "Data Mining Concepts and Techniques", Second Edition, Elsevier, Reprinted 2008.
3. Anand Rajaraman and Jeffrey David Ullman, "Mining of Massive Datasets", Cambridge University Press, 2012.
4. Pete Warden, "Big Data Glossary", O'Reilly, 2011.
5. Frank J Ohlhorst, "Big Data Analytics:Turning Big Data in to Big Money",Wiley and SAS Business Series,2012.

	FINANCIAL ACCOUNTING AND MANAGEMENT	L T P C
CA 7008		**3 0 0 3**

OBJECTIVES:
The student should be able to
- To understand the operational nuances of a Finance and Account Manager
- To comprehend the technique of making decisions related to finance function.

UNIT I   FOUNDATIONS OF FINANCE   9

Financial management – An overview - Time value of money - Introduction to the concept of risk and return of a single asset and of a portfolio - Valuation of bonds and shares - Option valuation.

UNIT II   INVESTMENT DECISIONS   9

Capital Budgeting - Principles and techniques - Nature of capital budgeting - Identifying relevant cash flows - Evaluation Techniques – Payback - Accounting rate of return - Net Present Value - Internal Rate of Return - Profitability Index - Comparison of DCF techniques - Project selection under capital rationing - Inflation and capital budgeting - Concept and measurement of cost of capital - Specific cost and overall cost of capital.

UNIT III   FINANCING AND DIVIDEND DECISION   9

Financial and operating leverage - capital structure - Cost of capital and valuation - designing capital structure - Dividend policy - Aspects of dividend policy - practical consideration - forms of dividend policy - forms of dividends - share splits.

UNIT IV   WORKING CAPITAL MANAGEMENT   9

Principles of working capital - Concepts - Needs - Determinants - issues and estimation of working capital - Accounts Receivables Management and factoring - Inventory management - Cash management - Working capital finance - Trade credit - Bank finance and Commercial paper.

UNIT V   LONG TERM SOURCES OF FINANCE   9

Indian capital and stock market - New issues market Long term finance - Shares -Debentures and term loans - lease - Hire purchase - Venture capital financing - Private Equity.

TOTAL : 45 PERIODS

OUTCOME:
Upon completion of this course, the student will:
- Possess the techniques of managing finance in an organization.

REFERENCES :
1. M.Y. Khan and P.K.Jain, "Financial management, Text, Problems and cases", 6th edition, Tata McGraw Hill, 2011.
2. M. Pandey, "Financial Management", 10th edition, Vikas Publishing House Pvt. Ltd., 2012.
3. Aswat Damodaran, "Corporate Finance Theory and practice", John Wiley & Sons, 2011.
4. James C. Vanhorne, "Fundamentals of Financial Management", 11th Edition, PHI Learning, 2012.
5. Righam, Ehrhardt, "Financial Management Theory and Practice", 12th edition, Cengage Learning, 2010.
6. Prasanna Chandra, "Financial Management", 9th edition, Tata McGraw Hill, 2012. 7. Srivatsava, Mishra, "Financial Management", Oxford University Press, 2011.

CA 7015	HUMAN RESOURCES MANAGEMENT	L	T	P	C
		3	0	0	3

OBJECTIVES:
The student should be able to
- To provide knowledge about management issues related to staffing, training, performance, compensation, human factors consideration and compliance with human resource requirements.

UNIT I   PERSPECTIVES IN HUMAN RESOURCE MANAGEMENT   5

Evolution of human resource management – The importance of the human factor – Challenges – Inclusive growth and affirmative action - Role of human resource manager – Human resource policies – Computer applications in human resource management – Human resource accounting and audit.

UNIT II   THE CONCEPT OF BEST FIT EMPLOYEE   8

Importance of Human Resource Planning – Forecasting human resource requirement –matching supply and demand - Internal and External sources - Recruitment - Selection – induction – Socialization benefits.

UNIT III   TRAINING AND EXECUTIVE DEVELOPMENT   10

Types of training methods – purpose - benefits- resistance - Executive development programmes – Common practices - Benefits – Self development – Knowledge management.

UNIT IV   SUSTAINING EMPLOYEE INTEREST   12
Compensation plan – Reward – Motivation – Application of theories of motivation – Career management – Development of mentor – Protégé relationships.

UNIT V   PERFORMANCE EVALUATION AND CONTROL PROCESS   10
Method of performance evaluation – Feedback – Industry practices – Promotion – Demotion - Transfer and Separation – Implication of job change - The control process – Importance – Methods – Requirement of effective control systems grievances – Causes – Implications – Redressal methods.

TOTAL : 45 PERIODS

LEARNING OUTCOME:
Upon completion of this course, the student will:
- Gain knowledge and skills needed for success as a human resources professional.

REFERENCES :
1. Dessler, "Human Resource Management", Pearson Education Limited, 2007.
2. Decenzo and Robbins, "Human Resource Management", 8th Edition, Wiley, 2007.
3. Luis R.Gomez-Mejia, David B.Balkin, Robert L Cardy, "Managing Human Resource", PHI Learning, 2012.
4. Bernadin, "Human Resource Management", 8th edition, Tata Mcgraw Hill, 2012.
5. Wayne Cascio, "Managing Human Resource", McGraw Hill, 2007.

CA 7002	CUSTOMER RELATIONSHIP MANAGEMENT	L	T	P	C
		3	0	0	3

OBJECTIVES:
The student should be able to
- To understand the need and importance of maintaining a good customer relationship

UNIT I   CUSTOMER RELATIONSHIP MANAGEMENT   9
Defined Technology – Strategy – CRM – CRM Success Factors – The Customer service/sales profile – The three levels of service/sales customer service/sales profile

UNIT II   CUSTOMER SERVICE   9
Managing your customer service/sales profile – Content center – Brokerage managing initial – stand alone transaction managing for repeat business – Managing for customer advocacy – CRM strategy starting points - CRM strategy selection.

UNIT III   MANAGING CUSTOMER DATA   9
Managing and sharing customer data – Returning to strategies – Data vs information – Managing customer information – Data vs ethics and legalities of data used tools for capturing customer information.

UNIT IV   EFFECTIVE SLA'S   9
Service-level agreements – Keys to effective SLA's – Creating an SLA – Using SLA's to support internal customer relationships – Making SLA's work – E-commerce – Customer relationships on the internet.

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UNIT V   MANAGING CRM   9

Managing relationships through conflict – Managing the moment of conflict – Customer relationship management – Early warning system – Customer problems – Fighting complacency – Resetting CRM strategy – Ready, Set, Reset various phases.

TOTAL : 45 PERIODS

OUTCOME:
Upon completion of this course, the student will:
- use the strategic customer acquisition and retention techniques in CRM

REFERENCES :
1.   Kristin Anderson & Carol Kerr, "Customer relationship management", Mc Graw Hill 2003.
2.   Judith W Kincaid, " Customer relationship management: getting it right", Prentice Hall, 2002.

CA 7027	VIRTUALIZATION TECHNIQUES	L	T	P	C
		3	0	0	3

OBJECTIVES:
The student should be able to
- To understand the concept of virtualization.
- To understand the various issues in virtualization.
- To familiarize the students 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 or 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 – Data Path 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.

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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 this course, the student will:
- 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 the 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", A Press 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 David Marshall, Wade A. Reynolds, "Advanced Server Virtualization: VMware and Microsoft Platform in the Virtual Data Center", Auerbach Publications, 2006.

	L	T	P	C
CA 7010 **GAME PROGRAMMING**	3	0	0	3

OBJECTIVES:
The student should be able to
- To understand Game Designing and Development.
- To design the logic and develop Game Engine Model.
- To enable the students to create Interactive Games.

UNIT I   3D GRAPHICS FOR GAME PROGRAMMING   9

Coordinate Systems - Ray Tracing - Modeling in Game Production - Vertex Processing Rasterization - Fragment Processing and Output Merging - Illumination and Shaders - Parametric Curves and Surfaces - Shader Models - Image Texturing - Bump Mapping - Advanced Texturing – Character Animation - Physics-based Simulation.

UNIT II   GAME DESIGN PRINCIPLES   9

Character development - Story Telling - Narration - Game Balancing - Core mechanics - Principles of level design - Genres of Games - Collision Detection - Game Logic - Game AI - Path Finding.

UNIT III   GAMING ENGINE DESIGN   9

Renderers - Software Rendering - Hardware Rendering - and Controller based animation – Spatial Sorting - Level of detai - Collision detection - Standard objects and physics.

UNIT IV   GAMING PLATFORMS AND FRAMEWORKS   9

Flash - DirectX - OpenGL – Java – Python - XNA with Visual Studio - Mobile Gaming for the Android – iOS - Game engines - Adventure Game Studio - DXStudio - Unity.

UNIT V   GAME DEVELOPMENT   9

Developing 2D and 3D interactive games using OpenGL - DirectX – Isometric and Tile Based Games - Puzzle games - Single Player games - Multi Player games.

TOTAL : 45 PERIODS

OUTCOMES :
Upon completion of this course, the student will:
- Model and develop a new Gaming System.
- Develop interactive games with their knowledge gained out of various Gaming Platforms.

REFERENCES :
1. David H. Eberly, "3D Game Engine Design: A Practical Approach to Real-Time Computer Graphics", 2nd Edition, Morgan Kaufmann, 2006.
2. JungHyun Han, "3D Graphics for Game Programming", 1st edition, Chapman and Hall/CRC, 2011.
3. Mike McShaffrfy, "Game Coding Complete", Third Edition, Charles River Media, 2009.
4. Jonathan S. Harbour, "Beginning Game Programming", 3rd edition, Course Technology PTR, 2009.
5. Ernest Adams and Andrew Rollings, "Fundamentals of Game Design", 1st edition,Prentice Hall 2006.
6. Roger E. Pedersen, "Game Design Foundations", Edition 2, Jones & Bartlett Learning, 2009.
7. Scott Rogers, "Level Up: The Guide to Great Video Game Design", 1st Edition, Wiley, 2010.

CA 7021	PROFESSIONAL PRACTICE AND ETHICS	L	T	P	C
		3	0	0	3

OBJECTIVES:
The student should be able to
- To make the students aware of their responsibilities and duties as a computer professional.
- To acquaint and help the students to analyze the social implications of the rapid computerization.
- To gain knowledge about the ethical issues involved in computing, and improve Communication skills.

UNIT I   INTRODUCTION   9
History of Computing - Social Context of Computing – Privacy – Profiling – Anonymity - Data Matching – Mining - Censorship - offensive Materials.

UNIT II   PROFESSIONAL ETHICS AND RESPONSIBILITIES   9
Methods and Tools of Moral Analysis - Professional and Ethical Responsibilities - Risks and Liabilities of Computer-Based Systems - Computer Crime - Computers and Work - Broader Issues on the Impact and Control of Computers - Professional Ethics and Responsibilities Surveillance - Data Protection and Encryption - Computers in Workplace - Computer Crime and Legal Issues.

UNIT III   INTELLUCTUAL PROPERTY RIGHTS   9
Intellectual Property - Privacy and Civil Liberties - Privacy Enhancing Technology – OPS - P3P - Filtering - Blocking – Rating - Computer Crimes - Economic Issues in Computing – Monopolies - Labor and Computing.

UNIT IV   FRAMEWORKS   9
Philosophical Frameworks - Encryption - Identification - Anonymization - Information Technology and the Law.

UNIT V   COMPUTER ETHICS   9

Introduction - Why Computer Ethics - Philosophical Bases for Computer Ethics - Professional Ethics - Privacy laws - Information Ethics - On-line Ethics - The Meaning of Ethics - Professional Ethics - Social Ethical and Professional Issues in Computing - Computer Crime - Software Theft - Hacking and Viruses - Unreliable Computers - The Invasion of Privacy - Artificial Intelligence and Expert Systems - Computerizing the Workplace - Property Rights and Intellectual Property - Reliability and safety of computer systems - Accountability and responsibility in Information Technology – Freedom - Information and Images - Censorship of the Internet - Intellectual Property - Privacy - Responsibility - What Computers Should Not Do - Quality of Life and Work - Virtual Reality – Minds – Machines - and Morality - Unwrapping the Gift - Privacy and Personal Information - Encryption and the Interception of Communications - Can We Trust the Computer - Freedom of Speech in Cyberspace - Intellectual Property.

TOTAL : 45 PERIODS

OUTCOMES :
Upon completion of this course, the student will:
- Make students aware of their responsibilities and duties as a computer professional.
- Acquaint and help students to analyze the social implications of the rapid computerization.
- Adopt the ethical issues involved in computing, and improve communication skills.

REFERENCES :
1. John Weckert and Douglas Adeney, "Computer and Information Ethics", Greenwood Press, 1997.
2. G. D. Johnson, "Computer Ethics", 3rd Edition, Prentice-Hall, 2003.
3. S. Al-Fedaghi, "Professional and Computer Ethics", Kuwait University Press, 2003.

CA 7004   DEVELOPMENT FRAMEWORKS AND VIRTUAL MACHINES   L T P C
                                                                  3 0 0 3

OBJECTIVES:
The student should be able to
- To learn the basics of JSP and XML.
- To understand the background of distributed information system.
- To analyze and design a web service based application.
- To understand the need of virtualization.
- To understand the concepts of virtualization and virtual machines.

UNIT I   JAVA SERVER PAGES   9

Servlet - Features of Java Servlet -Servlet API - Servlet Life Cycle - Creating a Servlet - Session Handling in servlets - Java Server Pages - JSP Technology - Architecture of a JSP Page - Life Cycle of a JSP Page - JSP Basic Tags and Implicit Objects - Working with Action Tags in JSP - Expression Language -   JSP Tag Library - Introduction - XML Tag Library - Internationalization Tag Library - SQL Tag Library - Functions Tag Library - Java Server Faces - Features and Architecture of JSF - JSF Elements - JSF Request Processing Life Cycle - JSF Tag Libraries and UI components

UNIT II   REMOTE METHOD INVOCATION   9

Remote Method Invocation - Java mail - EJB Architecture - Session Bean - stateless session bean - stateful session bean - Message Driven Bean - Transaction Management - Entity Bean - Java persistence API - Entity life cycle - entity relationship

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UNIT III   HIBERNATE   9
Hibernate -   Architecture - HQL - Object relation mapping -   Seam framework - Java EE
Connector Architecture (JCA) - life cycle and workflow management - comparing JDBC with JCA
- Java EE Design patterns - Java web service - role of SOAP and WSDL - JAX_WS - JAXB -
SAAJ – JAXR

UNIT IV   STRUTS   9
Struts - Architecture - Actions in struts - Interceptors - OGNL support - Integrating struts with
Hibernate - Spring framework - architecture - Managing transaction - Security in J2EE - JAAS

UNIT V   VIRTUALIZATION TECHNOLOGIES   9
Introduction to Virtualization Technologies – Virtualization - Virtual machines – Networking –
Storage - Access Control - Resource Monitoring - Data Protection – Scalability - High Availability -
Patch Management

TOTAL : 45 PERIODS

OUTCOMES :
Upon completion of this course, the student will:
- Develop web services using different technologies.
- Analyze the intricacies of server, storage, network, desktop and application virtualizations
- Design new models for virtualization.
- Design and develop cloud applications on virtual machine platforms.
- Familiarize the memories and cache subsystem.

REFERENCES :
1.   Kogent Learning Solutions Inc , "Java Server Programming Java EE6(J2EE 1.6) Black
     Book", Dreamtech Press, 2010.
2.   "Virtual Machines", James E. Smith and Ravi Nair (Morgan Kaufmann), ISBN 1558609105,
     April 2005.

IF7077	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 .

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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.

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