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Department of Computer Science

Meenakshi College for Women (Autonomous)

Master of Computer Applications

Curriculum 2019-2022

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Curriculum Overview

Programme Specific Objectives

- To provide a strong foundation in the science and mathematics of computing.

- To equip the student with the knowledge and skill that form the basic building blocks for a career in computer science and applications.

- To prepare the student with other necessary skills for employment in the area of software conceptualization, design and development in the present day.

- To provide the student with the necessary know-how to pursue research in the area of Computer Science so that she considers this as a viable option for her career.

- Overall, to provide an ambience for the student to gain knowledge and skills in all aspects of Computer Applications and to pursue a specialization of her choice.

- To equip the student with a basic knowledge of other domains, disciplines and skills, a social and environmental consciousness and a strong value base.

Eligibility

Candidates who have passed B.Sc. Mathematics / Statistics / Physics / Electronics / Computer Science / Information Technology or B.C.A. or an equivalent degree are eligible to undertake this course, subject to rules of the University of Madras.

Credit System

Minimum credits required by a candidate to be eligible for the MCA degree:

Part	Minimum no. of credits
Part A: Core & Electives	195
Part B: Soft Skills	12
Part C: Internship	5

Examination Pattern

Continuous Internal Assessment (CIA)	25 Marks
End-Semester Examination (ESE)	75 marks

To pass in a subject, the student would have to score a minimum of 50% in CIA, a minimum of 50% in ESE and a minimum aggregate of 55% in both put together according to the above weightage.

Pattern of Question Paper

Theory Examinations:

General Pattern of the Question Paper for MCA:

Section A: (2 * 10 marks = 20 marks)
- 10 questions given, all are compulsory.
- Two questions asked from each of the five units.

Section B: (5 * 10 marks = 50 marks)
- 5 questions, each with two parts in the either/or format are asked.
- At least one question is asked from each of the five units.
- Student must answer any one part in each of the 5 questions.

Section C: (2 * 15 marks = 30 marks)
- Student must answer any 2 out of the given 3 questions.

The subjects in the syllabus of MCA is divided into five categories as follows:

1. Theory only

#	Subject Code	Subject
1	3CA14b	Personal Software Process
2	5CA22d	Computer Networks
3	5CA23	Artificial Neural Networks
4	Electives	

2. Theory with Problems

#	Subject Code	Subject
1	1CA05a	Operating Systems
2	2CA07a	Computer Architecture
3	4CA18c	Microprocessor and Microcontroller
4	4CA19d	Principles of Compiler Design
5	5CA21b	Computer Graphics

3. Application Oriented

#	Subject Code	Subject
1	1CA02c	Data Structures
2	1CA04a	Digital Design Concepts
3	2CA08b	Design and Analysis of Algorithms
4	2CA10a	Database Management Systems
5	4CA16b	Object Oriented Analysis and Design
6	4CA17c	Mobile Application Development

4. Programming Language

#	Subject Code	Subject
1	2CA09a	Object Oriented Programming
2	3CA12b	Web Application Development
3	3CA13a	Internet Programming
4	5CA24a	UNIX, PHP and MySQL

5. Application Oriented with Programming Language

#	Subject Code	Subject
1	1CA03b	Problem Solving Techniques and Applications

Question paper guidelines for MCA, for each type of subject indicated above is as follows:

#	Subject Type	Guidelines for Question-setting
1	Theory only	**Section A** Questions could be of the following types: • Multiple Choice / True or False

#	Subject Type	Guidelines for Question-setting
		• One-word/one-line answer • Definition • Give one difference/similarity between two concepts **Section B** For each question, • Option a) Descriptive question • Option b) Direct descriptive / Application of formula / Specific algorithms / Application descriptions or comparisons / Principles or guidelines / Case study, etc. **Section C** • 2 questions - Descriptive question • 1 question - Application of formula / Specific algorithms / Application descriptions or comparisons / Principles or guidelines, etc.
2	Theory with Problems	**Section A** Questions could be of the following types: • Multiple Choice / True or False • One-word/one-line answer • Definition • Give one difference/similarity between two concepts • Simple problem **Section B** For each question, • Option a) Descriptive question • Option b) Problems / Comparisons between concepts / Pin diagram / Algorithm / Block diagram **Section C** • 2 questions - Descriptive question • 1 question - Problems / Comparisons between concepts / Pin diagram / Algorithm / Block diagram
3	Application Oriented	**Section A** Questions could be of the following types: • Multiple Choice / True or False • One-word/one-line answer • Definition • Give one difference/similarity between two concepts • Simple problem / query / evaluation of expression, etc. **Section B** For each question, • Option a) Descriptive question / Algorithm • Option b) Descriptive question / Program / Algorithm / Algorithm Analysis / Problems / Application of algorithm on specific data set / Block Diagram / Queries / Application-oriented question / Comparison between concepts **Section C** • 2 questions - Descriptive question / Algorithm • 1 question - Descriptive question / Algorithm / Algorithm Analysis / Problems / Application of algorithm on specific data set / Block Diagram / Queries / Application-oriented question / Comparison between concepts

#	Subject Type	Guidelines for Question-setting
4	Programming Language	**Section A** Questions could be of the following types: • Multiple Choice / True or False • One-word/one-line answer • Definition • Give one difference/similarity between two concepts • Simple code writing (maximum 3-4 lines) • Find the bug / output given a code snippet **Section B** For each question, • Option a) Descriptive question (with or without code snippets to illustrate) • Option b) Program **Section C** • 1 question - (with or without code snippets to illustrate) • 2 questions - Program
5	Application Oriented with Programming Language	**Section A** Questions could be of the following types: • Multiple Choice / True or False • One-word/one-line answer • Definition • Give one difference/similarity between two concepts • Simple code writing (maximum 3-4 lines) • Find the bug / output given a code snippet **Section B** Option a) Algorithm / Concept / Descriptive question Option b) Algorithm / Concept / Descriptive question on the programming language concept / Program **Section C** • 1 question - Descriptive question on the programming language concept / Program • 2 questions - Algorithm / Concept

Note: In Sections B and C, a question may be split into parts if so required.

Practical Examinations:

The external examiner will prepare a question paper on the spot with the help of the question bank supplied by the Office of the Controller of Examinations.

Grading System

Students will be graded separately for Parts A, B and C. CGPA, Overall Grade and Classification will be given for Part A alone.

Scheme for conversion of marks to Grade Points and Letter Grade for each subject

RANGE OF MARKS	GRADE POINTS	LETTER GRADE	DESCRIPTION
90 – 100	9.0 – 10.0	O	Outstanding
80 – 89	8.0 – 8.9	D+	Excellent
75 – 79	7.5 – 7.9	D	Distinction
70 – 74	7.0 – 7.4	A+	Very Good

60 – 69	6.0 – 6.9	A	Good
55 – 59	5.5 – 5.9	B	Average
00 – 54	0.0	U	Re-appear
Absent	0.0	AA	Absent

Grade Point Average (GPA) for a Semester =

$$\frac{\text{Sum of product of grade points and credits for all subjects in the semester}}{\text{Sum of the credits for the subjects in the semester}}$$

Cumulative Grade Point Average (CGPA) = $\dfrac{\text{Sum of the GPA of every semester}}{\text{Total number of semesters}}$

Overall Performance and Classification

CGPA	GRADE	CLASSIFICATION OF FINAL RESULT
9.5 – 10.0	O+	First Class – Exemplary *
9.0 and above but below 9.5	O	
8.5 and above but below 9.0	D++	First Class with Distinction *
8.0 and above but below 8.5	D+	
7.5 and above but below 8.0	D	
7.0 and above but below 7.5	A++	First Class
6.5 and above but below 7.0	A+	
6.0 and above but below 6.5	A	
5.5 and above but below 6.0	B+	Second Class
0.0 and above but below 5.5	U	Re-Appear

*Applicable to candidates who have passed the courses prescribed for the programme in the first appearance; otherwise they are eligible for classification only.

Course Summary

PART A: Core & Electives

Semester 1

Code	Subject	Credits
1CA01a	Discrete Mathematics	5
1CA02c	Data Structures	5
1CA03b	Problem Solving Techniques and Applications	5
1CA04a	Digital Design Concepts	5
1CA05a	Operating Systems	5
1CAP1b	Practical I: Data Structures and Algorithms Laboratory	5
1CAP2a	Practical II: Digital Electronics Laboratory	5

Semester 2

Code	Subject	Credits
2CBMS1	Statistical Methods (CBCS – Paper 1)	5

Code	Subject	Credits
2CA07a	Computer Architecture	5
2CA08d	Design and Analysis of Algorithms	5
2CA09a	Object Oriented Programming	5
2CA10a	Database Management Systems	5
2CAP3b	Practical III: Object Oriented Programming Laboratory	5
2CAP4a	Practical IV: Database Management Systems Laboratory	5

Semester 3

Code	Subject	Credits
3CBCM2	Accounting and Financial Management (CBCS - Paper 2)	5
3CA12b	Web Application Development	5
3CA13a	Internet Programming	5
3CA14b	Personal Software Process	5
	Elective I	5
3CAP5c	Practical V: Internet Programming Laboratory	5
3CAP6b	Practical VI: Web Application Development Laboratory	5

Semester 4

Code	Subject	Credits
4CA16b	Object Oriented Analysis and Design	5
4CA17c	Mobile Application Development	5
4CA18c	Microprocessor and Microcontroller	5
4CA19b	Principles of Compiler Design	5
	Elective II	5
4CAP7d	Practical – VII: Microprocessor Laboratory	5
4CAP8a	Practical – VIII: Mobile Application Development Laboratory	5

Semester 5

Code	Subject	Credits
5CA21b	Computer Graphics	5
5CA22d	Computer Networks	5
5CA23	Artificial Neural Networks	5
5CA24a	UNIX, PHP and MySQL	5

Code	Subject	Credits
	Elective III	5
5CAP9b	Practical IX: UNIX, PHP and MySQL Laboratory	5
5CAP10b	Practical X: Artificial Neural Networks Laboratory	5

Semester 6

Code	Subject	Credits
6CAPR	Project Work	10
6CAPV	Project Viva-Voce	10

Electives

A student would have to choose an elective stream from the following. The student would accordingly do the electives offered in her chosen stream, over Semesters 3, 4 and 5.

#	Elective Stream	Elective I (Semester 3)	Elective II (Semester 4)	Elective III (Semester 5)
1	**Communication Systems**	Mobile Communication	Wireless Technology	Satellite Communication
2	**Security Systems**	Cryptography and Network Security	Cyber Forensics	Biometric Systems
3	**High-performance Computing**	Parallel Computing	Grid Computing	Cloud Computing
4	**Intelligent Systems**	Linear Algebra	Digital Image Processing	Pattern Recognition
5	**Information Systems**	Management Information Systems	Data Mining	Data Warehousing
6	**Software Testing**	Foundations of Software Testing and Quality Assurance	Software Testing	Advanced Software Testing

Elective 1

Stream	Code	Subject
1	3CAE1MC	Mobile Computing
2	3CAE1CR	Cryptography and Network Security
3	3CAE1PC	Parallel Computing
4	3CAE1LA	Linear Algebra
5	3CAE1IS	Management Information Systems
6	3CAE1ST	Foundations of Software Testing and Quality Assurance

Elective 2

Stream	Code	Subject
1	4CAE2WT	Wireless Technology
2	4CAE2CF	Cyber Forensics
3	4CAE2GC	Grid Computing
4	4CAE2IP	Digital Image Processing
5	4CAE2DM	Data Mining
6	4CAE2ST	Software Testing

Elective 3

Stream	Code	Subject
1	5CAE3SC	Satellite Communication
2	5CAE3BS	Biometric Systems
3	5CAE3CC	Cloud Computing
4	5CAE3PR	Pattern Recognition
5	5CAE3DW	Data Warehousing
6	5CAE3ST	Advanced Software Testing

Choice-Based Credit System (CBCS)
Paper 1 (Semester 2)

Code	Subject	Offering Department
2CBMS1	Statistical Methods	Mathematics
2CBMS2	Data Collection and Analysis	Mathematics
2CBPH1	Basic Quantum Mechanics	Physics
2CBBC1	Biophysics	Biochemistry
2CBHT1	Tourism and Travel Management	History
2CBEC1	General Essays for Civil Services Examinations	Economics
2CBCM1	Principles of Cost and Management Accounting	Commerce
2CBPA1	Human Resource Administration	Public Administration
2CBPA2	Principles and Practices of Public Administration	Public Administration
2CBTA1	Journalism (Ithazh-Iyal)	Tamil
2CBCA1	Visual and Internet Programming	Computer Science

Paper 2 (Semester 3)

Code	Subject	Offering Department
3CBMS1	Mathematical Modeling and Designing through Computer Graphics	Mathematics
3CBPH1	Basic Spectroscopy and its Applications	Physics
3CBBC1	Clinical Biochemistry	Biochemistry
3CBHT1	Journalism	History
3CBEC1	Principles and Practices of General Insurance	Economics
3CBCM1	Financial Management	Commerce
3CBCM2	Accounting and Financial Management	Commerce
3CBPA1	Social Welfare Administration	Public Administration
3CBTA1	Translation (Mozhi-Peyarppu-Iyal)	Tamil
3CBCA1	Software Quality and Assurance	Computer Science

PART B: Soft Skills

All students shall undergo courses on soft skills, choosing one or two courses on soft skills in a semester, to earn a total of 12 credits during the programme.

#	Code	Subject	Credits
1.	OLCS	Language and Communication Skills	2
2.	OLMS	Life and Managerial Skills	2
3.	OF1	French for Beginners I	2
4.	OF2	French for Beginners II	2
5.	OG1	German for Beginners I	2
6.	OG2	German for Beginners II	2
7.	SAR1	Analytical Reasoning I	2
8.	SAR2	Analytical Reasoning II	2
9.	SAR3	Analytical Reasoning III	2
10.	OQCC	Quality Control Circles (Theory)	1
	OQCCP	Quality Control Circles (Presentation)	1

PART C: Internship

Every student shall undergo 8-10 weeks of internship (minimum 5 credits) spanning the summer vacations of the first and second years. This shall consist of the following:

Code	Subject	Credits
INTAM	Admissions Management (during summer of I year)	2
INTIT	Summer Internship (during summer of II year)	3

Course Syllabus

Semester I

1CA01a - Discrete Mathematics

OBJECTIVES:

1. To learn statement and predicate calculus.
2. To learn basics of set theory and graph theory.
3. To learn various algebraic structures.

OUTCOMES:

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

1. Express a logic sentence in terms of predicates, quantifiers, and logical connectives.
2. Understand basics of predicate calculus and universally and existentially quantified statements.
3. Understand the basic principles of sets and operations in sets.
4. Understand groups, semigroups and monoids.
5. Undertsand basics of graph theory.

Unit	Course Content	L	P	T
1	**The Statement Calculus**: Statements and Notation - Connectives – Normal Forms – The Theory of Inference for the Statement Calculus.	12	-	2
2	**The Predicate Calculus**: The Predicate Calculus – Inference Theory of the Predicate Calculus.	12	-	2
3	**Set Theory**: Basic Concepts of Set Theory – Relations and Ordering – Functions – Recursion.	12	-	2
4	**Algebraic Structures**: Algebraic Systems Examples and General Properties - Semigroups and Monoids – Grammars and Languages – Polish Expressions and their Compilation – Groups	15	-	2
5	**Groups**: The Application of Residue Arithmetic to Computers **Graph Theory**: Basic Concepts of Graph Theory – Storage Representation and Manipulation of Graphs	14	-	2
Total		**65**	**-**	**10**

TEXT BOOK

Treatment and content as in

J. P. Tremblay and R. Manohar, *Discrete Mathematical Structures with Applications to Computer Science*, Tata McGraw Hill International Edition, 1987.
Unit I: Section 1.1 to 1.3 excluding 1.2.15 and 1.3.6
Unit II: Section 1.4 to 1.6
Unit III: Section 2.1, 2.3, 2.4, 2.6.1 only
Unit IV: Section 3.1 to 3.5
Unit V: Section 3.6, 5.1, 5.2

REFERENCE BOOKS

1. Winfried Karl Grassman, Jean-Paul Tremblay, *Logic and Discrete Mathematics – A Computer Science Perspective*, Pearson Education, 1996.
2. J. K. Truss, *Discrete Mathematics for Computer Scientists*, 2nd Edition, Addison Wesley, Boston, 1999.
3. Bernard Kolman, Robert C. Bubsy, Sharon C. Ross, *Discrete Mathematical Structures*, 6th Edition, Pearson Education, 2005.

1CA02c - Data Structures

OBJECTIVES:

1. To learn linear and non-linear data structures.
2. To learn specific searching and sorting algorithms.

OUTCOMES:

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

1. Explain the various linear and non-linear data structures.
2. Describe the computer representation of linear and non-linear data structures.
3. Choose the appropriate data structure for simple problems.
4. Convert a given infix expression to postfix and evaluate it.
5. Given a binary tree, traverse the tree using the traversal algorithms learnt.
6. Given a graph, traverse the graph using the traversal algorithms learnt.
7. Given a graph, generate the minimum cost spanning tree using the algorithms learnt.
8. Explain specific searching and sorting algorithms and their characteristics.
9. Understand how to apply the specific searching and sorting algorithms to solve any given problem.

Unit	Course Content	L	P	T
1	**Arrays**: Abstract Data Types – The Array – The Polynomial – Sparse Matrices - Representation of Arrays – The String.	9	-	2
2	**Stacks and Queues**: Stack – Queue – Circular Queue – Priority Queue - Dequeue - Evaluation of Expressions. **Linked Lists**: Singly Linked List – Circular List – Doubly Linked List - Generalized Lists.	12	-	2
3	**Graphs**: Graph Representations – Depth First Search – Breadth First Search – Connected Components – Spanning Trees - Minimum Cost Spanning Trees (Kruskal's, Prim's, Sollin's Algorithms).	15	-	2
4	**Trees**: Binary Trees – Binary Tree Traversals – Binary Tree Representations – Binary Search Trees – Threaded Binary Trees – Red-Black Trees.	15	-	2
5	**Sorting**: Bubble Sort – Insertion Sort – Merge Sort – Quick Sort – Heap Sort – Radix Sort. **Searching**: Linear search – Binary search – Hashing.	14	-	2
Total		**65**	**-**	**10**

TEXT BOOKS

1. E. Horowitz, S. Sahni and Mehta, *Fundamentals of Data Structures in C++*, Galgotia, 1999.
2. Mark Allen Weiss, *Data Structures and Algorithm Analysis in C*, Second Edition, Addison-Wesley, 1997.

REFERENCE BOOKS

1. A. V. Aho, J. D. Ullman, J. E. Hopcraft, *Data Structures and Algorithms*, Adisson Wesley Publications, 2001.
2. S. Sahni, *Data Structures, Algorithms and Applications*, McGraw Hill, 2001.
3. Yashwant Kanetkar, *Data Structures through C*, BPB Publishers, 2nd Edition, 2010.
4. Yedidyah, Langsam, Augensteil, Tanenbaum, *Data Structures using C and C++*, PHI, New Delhi.
5. Gilberg, Forouzan, *Data Structures*, Thomson Asia, Singapore, 2002.

1CA03b - Problem Solving Techniques and Applications

OBJECTIVES:

1. To understand the notions of algorithms and programs, and to know of the basic problem solving strategies.
2. To learn C language and code solutions using the various features of C.
3. To learn efficient strategies and the algorithms to solve standard problems, thus laying a firm foundation for designing algorithmic solutions to problems.

OUTCOMES:

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

1. Understand the systematic approach to problem solving.
2. Write programs in C language to solve problems.
3. Identify bugs in given code snippets and fix them.
4. Determine the output of a given code snippet.
5. Explain the approach and algorithms to solve specific problems, and understand the applications of such algorithms.

Unit	Course Content	L	P	T
1	**Introduction**: Notion of algorithms and programs – The problem-solving aspect – General problem-solving strategies - Problem solving using top-down design. **Programming in C**: Data types - Control statements – Functions – Arrays – Structures – Pointers – Pointers and Functions - Pointers and Arrays – Pointers and Structures - Dynamic memory allocation.	12	-	2
2	**Fundamental Algorithms**: Exchanging the values of two variables – Counting - Summation of a set of numbers - Factorial computation - Sine function computation - Fibonacci Series generation - Reversing the digits of an integer – Base Conversion.	12	-	2
3	**Factoring Methods**: Finding the square root of a number - Generating prime numbers - Generating the prime factors of an integer – Generation of pseudo-random numbers - Raising a number to a large power – Computing the nth Fibonacci number.	14	-	2
4	**Array Techniques**: Array order reversal – Removal of duplicates from an ordered array - Array counting or histogramming – Partitioning an array – Finding the kth smallest element – Longest monotone subsequence.	12	-	2
5	**Text Processing and Pattern Searching**: Text line length adjustment – Left and right justification of text – Keyword searching in text – Text line editing – Linear pattern search. **Recursive algorithms**: Towers of Hanoi – Permutation generation.	15	-	2
Total		**65**	**-**	**10**

TEXT BOOKS

1. R. G. Dromey, *How to Solve it by Computer*, Prentice Hall of India, 2009.
2. B.W. Kernighan and D.M. Ritchie, *The C Programming Language*, Second Edition, PHI, New Delhi, 1990.
3. Yashawant Kanetkar, *Exploring C*, BPB Publications, 2008.
4. Yashawant Kanetkar, *Understanding Pointers in C*, BPB Publications, First Indian Edition, 2001.

REFERENCE BOOKS

1. Jeri R. Hanly, Elliot B. Koffman, *Problem Solving and Program Design in C*, 5th Edition, Pearson Education, 2009.
2. Herbert Schildt, *The Complete Reference – C*, Fourth Edition, McGraw Hill, 2010.

1CA04a - Digital Design Concepts

OBJECTIVES:

1. To learn the functional units of a digital computer and various representation codes.
2. To learn the basic logic gates and Boolean algebra.
3. To learn to design combinational circuits and sequential circuits.
4. To learn the design of various functional units in the processor logic.
5. To learn the design of registers and basics of control design.

OUTCOMES:

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

1. Understand number systems, conversions among them and binary arithmetic.
2. Solve conversion and arithmetic problems in binary and decimal number systems using complements.
3. Use various techniques learnt to simplify Boolean functions and design gated circuits to realize the Boolean functions.
4. Understand specific real-world problems, formulate the problem as a Boolean function and design combinational circuits from scratch to solve the problem.
5. Explain the basic types and circuitry of flip-flops and registers.
6. Explain the design of asynchronous and synchronous counters.
7. Explain the design of ALU.
8. Describe the design of registers and basics of control design.

Unit	Course Content	L	P	T
1	**Binary Systems:** Number System – Number Base Conversions – Complements – Binary Codes – Binary Logic. **Boolean algebra and Logic Gates:** Definition – Theorems and Properties – Boolean functions – Canonical and Standard forms – Digital Logic Gates. **Simplification of Boolean Functions:** Karnaugh Map up to 5 variables – Sum-of-products and Product-of-sums simplification - Don't care condition – Tabulation Method.	11	-	4
2	**Combinational Logic:** Design Procedure - Adders – Subtractors – Code Converters – Analyzing a combinational Circuit - Multilevel NAND and NOR circuits – XOR and Equivalence Functions – Binary Parallel Adder – Decimal Adder – Magnitude Comparator – Decoders – Multiplexers.	14	-	2
3	**Sequential Logic:** Flip Flops – Triggering of Flip-Flops – Analyzing a Sequential Circuit – State reduction and Assignment - Flip Flop Excitation tables – Design of sequential circuit – Design of Counters – Registers - Shift Registers – Ripple and Synchronous Counters.	14	-	2
4	**Processor Logic Design:** Processor Organization - Design of ALU – Status Register - Design of Shifter - Processor Unit - Design of Accumulator.	13	-	1
5	**Computer Design:** System Configuration – Computer Instructions - Timing and Control – Execution of Instructions – Design of Computer Registers - Design of Control.	13	-	1
Total		**65**	**-**	**10**

TEXT BOOK

1. M. Morris Mano, *Digital Logic and Computer Design*, PHI, 1994.

REFERENCE BOOKS

1. M. M. Mano and C. R. Kime, *Logic and Computer Design Fundamentals*, 2nd Ed, Pearson Education, Delhi, 2001.
2. Givone, *Digital Design Principles*, Tata McGraw Hill, New Delhi, 2002.
3. C. H. Roth Jr., *Fundamentals of Logic Design*, 5th Edition, Thomson Learning, Singapore, 2005.

1CA05a - Operating Systems

OBJECTIVES:

1. To learn the basic concepts and responsibilities of operating systems.
2. To understand any operating system based on the concepts studied.

OUTCOMES:

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

1. Articulate the main concepts, key ideas, strengths, limitations and core issues of OS.
2. Explain and solve problems using process and resource management algorithms.
3. Understand process synchronization.
4. Explain and solve problems using algorithms in deadlock handling.
5. Describe memory management techniques.
6. Calculate physical memory address, given a virtual memory address, based on the memory architecture.
7. Apply page replacement algorithms to solve problems.
8. Explain the basic concepts of file management & use disk scheduling algorithms to calculate effective access time.
9. Describe the different aspects of operating system using windows as case study.

Unit	Course Content	L	P	T
1	**Introduction:** Types of Operating Systems – Multiprogramming, Time sharing, Distributed system and Real-time Systems - I/O structure – Hardware protection - Storage Hierarchy - Components – Services - System calls – System programs – System Structure – Virtual machines - System Design and Implementation. **Process and CPU Scheduling:** Process Concept – Process Scheduling – Co-operating processes – Interprocess Communication - Scheduling Concepts, Scheduling Criteria, Scheduling Algorithms, Multiple processor Scheduling.	10	-	2
2	**Process Synchronization**: The Critical Section Problem – Synchronization Hardware – Semaphores, Classical Problem of Synchronization, critical Regions, Monitors. **Deadlocks**: Characterization, Prevention, Avoidance and Detection, Recovery.	15	-	2
3	**Memory Management**: Swapping, Single and Multiple Partition Allocation – Paging – Segmentation – Paged Segmentation. **Virtual Memory:** Demand Paging –Page Replacement Algorithms, Thrashing.	15	-	2
4	**File System Interface**: File Concepts– Access Methods - Directory Structure – File-System Mounting – File Sharing – File Protection. **File System Implementation**: File System Structure and Implementation – Directory Implementation – Allocation Methods – Free Space Management.	15	-	2
5	**Mass-storage Structure**: Disk Structure – Disk Scheduling - Disk Management – Swap-Space Management – RAID Structure. **Case Study**: Windows Operating System.	10	-	2
Total		**65**	**-**	**10**

TEXT BOOK

1. A. Silberschatz and P.B. Galvin, Gange, *Operating System Concepts*, 6th Edition, Addison-Wesley Publishing Co., 2002.

REFERENCE BOOKS

1. Harvey M. Deitel, Paul J. Deitel, David R. Choffnes, *Operating Systems*, Third Edition,Pearson Education, 2004.
2. Tanenbaum A. S., *Operating Systems - Design and Implementation*, PHI, 1996.

1CAP1b - Practical I: Data Structures and Algorithms Laboratory

OBJECTIVES:

1. To learn to code, debug and execute programs in C Language in an IDE
2. To learn to realize the data structures and algorithms as programs.

OUTCOMES:

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

1. Write programs in C Language to implement the data structures and algorithms given.
2. Code, debug and execute a C program in an IDE.

#	Course Content	L	P	T
1	**Working with arrays:** 1. Addition and subtraction of polynomials using arrays 2. Stack using array 3. Queue using array	-	5	-
2	**Working with pointers:** 4. Stack using linked list 5. Queue using linked list 6. Circular linked list 7. Doubly linked list 8. String manipulation using pointers	-	9	-
3	**Working with graphs:** 9. Representing and building a graph 10. Depth first search on a graph 11. Breadth first search on a graph	-	16	-
4	**Working with trees:** 12. Building a Binary Tree 13. Binary Tree traversal – inorder, preorder, postorder	-	16	-
5	**Sorting and Searching:** 14. Bubble Sort 15. Insertion Sort 16. Merge Sort 17. Quick Sort 18. Binary Search	-	15	-
6	**Fundamental Algorithms:** 19. Fibonacci series generation 20. Reversing the digits of an integer 21. Generating the prime factors of an integer 22. Generation of pseudo-random numbers	-	14	-
Total		**-**	**75**	**-**

1CAP2a - Practical II: Digital Electronics Laboratory

OBJECTIVES:

1. To learn to construct combinational and sequential circuits.

OUTCOMES:

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

1. Construct basic logic gates.
2. Construct different types of adders and subtractors.
3. Construct basic combinational circuits and verify their functionalities.
4. Construct flip flops, registers and different types of counters.

#	Course Content	L	P	T
1	**Basic logic gates:** 1. Basic logic gates using ICs 2. Half adder and Full adder using XOR and AND gates 3. Half subtractor and Full subtractor using fundamental gates 4. NAND and NOR as universal building blocks.	-	18	-
2	**Combinational circuits:** 5. Multiplexer and De-multiplexer 6. Encoders and Decoders 7. One-bit Comparator	-	18	-
3	**Registers and Counters:** 8. Flip-Flops 9. Shift registers 10. Ring Counter 11. Johnson's Ring Counter 12. Ripple Up and Down Counter 13. Synchronous Up and Down Counter	-	24	-
4	**Adder and Subtractor:** 14. Binary adder and subtractor using IC 7483 15. Basic BCD Adder using IC 7483	-	15	-
Total		**-**	**75**	**-**

Semester II

2CBMS1 - Statistical Methods

OBJECTIVES:

1. To acquire a working understanding of Statistics including probability, probability distributions, sampling, hypothesis testing, correlation analysis, regression and analysis of variance.

OUTCOMES:

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

1. Understand conditional probability and solve problems.
2. Understand Baye's formula and its application.
3. Understand the concept of continuous and random variables.
4. Understand various probability distributions and its applications.
5. Understand correlation and regression concepts, calculate correlation coefficient, rank correlation and linear regression.
6. Understand the concept of curve fitting and solve problems.
7. Explain the various types of sampling methods and understand and apply F, T and Chi-square test.
8. Understand ANOVA and apply it to solve problems.

Unit	Course Content	L	P	T
1	**Probability & Random Variables:** Sample space – Events – Axiomatic approach to probability – conditional probability – Independent events – Baye's formula – Random variables – Continuous and discrete random variables – distribution function of a random variables – Characteristic of distributions – Expectation variance	10	-	2
2	**Distributions:** Bivariate distribution – conditional and marginal distributions – Discrete distributions – discrete uniform, Binomial poison and geometric Distributions – Continuous distributions – Normal.	15	-	2
3	**Correlation & Regression:** Correlation coefficient – Rank Correlation coefficient of determination – Linear regression – Method of Least squares – Fitting of the curve of the form $ax + b$, $ax^2 + bx + c$, ab^x ax^b – multiple and partial correlation (3 variables only).	15	-	2
4	**Sampling:** Concept of sampling – Methods of sampling – simple random sampling – Systematic sampling and stratified random sampling (descriptions only) – concepts of sampling distributors and standard error – point estimation (concepts only) – Interval estimation of mean and proportion. Tests of Hypotheses – Critical region – Two types of Errors – Level of significance – power of the test – Large sample tests for mean and proportion – Exact tests based on Normal t, F and Chi-square distributions.	15	-	2
5	**ANOVA and Time series:** Analysis of variance – One way and Two way classifications –Time Series Analysis – Measurement of Trend and Seasonal variations.	10	-	2
Total		**65**	**-**	**10**

Note: No derivations are required. Emphasis is on concepts and applications.

TEXT BOOKS

1. A.M. Wood F, Graybil, Boes, *Introduction to Mathematical Statistics*, McGraw Hill, 1974.

2. K. S. Trivedi, *Probability and Statistics with Reliability, Queueing and Computer Science Applications*, Prentice Hall India, 1994.

REFERENCE BOOKS

1. Arnold O. Allen, *Probability, Statistical and Queuing Theory with Computer Science*, 1978.
2. Bajpai A. C., Calus I. M., Fairley J. A., *Statistical Methods for Engineers and Scientists*, John Wiley & Sons, 1979.
3. Doughlas C., Montgomery, Lynwood A., Johnson, *Forecasting and Time Series Analysis*, McGraw-Hill, 1975.
4. Basinab A. P. and Manoranjan Jas, *Elements of Probability and Statistics*, TMH, 1993.
5. Kossack C. F., Henschke C. I., *Introduction to Statistics and Computer Programming*, McGraw Hill, 1975.

2CA07a – Computer Architecture

OBJECTIVES:
1. To learn Control Unit design.
2. To know the concepts of pipelining.
3. To learn the architecture of I/O Interface and Memory.
4. To learn interprocessor arbitration.

OUTCOMES:

Upon completion of the course, the student will be able to
1. Explain the fundamentals of Register Transfer Language.
2. Write any given expression in various instruction formats.
3. Calculate effective address of operands in a given instruction, for various addressing modes.
4. Understand design of the Control Unit.
5. Apply computer arithmetic algorithms to solve simple problems.
6. Explain the concept of pipelining and design a pipeline for a simple problem.
7. Explain I/O Interface concepts.
8. Explain the architecture and working of Main Memory, Associative Memory and Cache Memory.
9. Explain the concept of interprocessor arbitration & different types of interconnection structures.

Unit	Course Content	L	P	T
1	**Data Representation:** Fixed and Floating Point Representation. **Register Transfer and Micro operations:** Register Transfer Language - Register Transfer - Bus and Memory Transfers, Arithmetic, Logic and Shift Micro operations - Arithmetic Logic Shift Unit. **Microprogrammed Control:** Control memory – Address Sequencing – Microprogram Example – Design of Control Unit.	10	-	2
2	**Central Processing Unit:** General Register and Stack Organization, Instruction Formats – Addressing Modes – Data Transfer and Manipulation – Program Control - Reduced Instruction Set Computer (RISC). **Pipeline and Vector Processing:** Pipelining – Arithmetic, Instruction and RISC Pipeline - Vector Processing – Array Processors.	12	-	2
3	**Computer Arithmetic:** Addition and Subtraction – Multiplication Algorithms – Division Algorithms – Floating Point Arithmetic Operations - Decimal Arithmetic operations.	16	-	2
4	**Input-Output Organization:** Peripheral devices – Input / Output Interface – Asynchronous Data Transfer – Modes of Transfer – Priority Interrupt - Direct Memory Access – Input / Output Processor (IOP) – Serial Communication.	16	-	2
5	**Memory Organization:** Memory Hierarchy – Main Memory – Auxiliary Memory– Associative Memory – Cache and Virtual Memory - Memory Management Hardware. **Multiprocessors:** Interconnection Structures - Interprocessor Arbitration – Cache Coherence.	11	-	2
Total		**65**	**-**	**10**

TEXT BOOK
1. M. Morris Mano, *Computer System Architecture*, PHI, 3rd Edition, 1993.

REFERENCE BOOKS
1. David A. Patterson, John L. Hennessy, *Computer Organization and Design: The Hardware/Software Interface*, Fourth Edition, Morgan Kaufman Publications.
2. V.C.Hamacher, G.Vranesic, S.G.Zaky, *Computer Organization*, McGraw Hill, 1990.
3. J.P. Hayes, *Computer Architecture and Organization*, McGraw Hill, 1988.

2CA08d – Design and Analysis of Algorithms

OBJECTIVES:

1. To learn how to measure performance of an algorithm.
2. To learn various algorithm design strategies.
3. To gain a good understanding of how to derive performance metrics for algorithms and understand how to compare them.

OUTCOMES:

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

1. Appreciate the need for performance measurement of algorithms and asymptotic notation.
2. Explain the various algorithmic design strategies with their characteristics.
3. Write algorithms for specific problems using one of the given design strategies.
4. Analyze the specific algorithms and express their performance complexity in asymptotic notation.
5. Understand lower bound theory and methods to establish the lower bound for solving specific problems.

Unit	Course Content	L	P	T
1	**Introduction:** Definition of Algorithm – Iterative and Recursive Algorithms - Algorithm design strategies – Time and Space Complexities – Asymptotic Complexities - Big-O, little-o, Big-Omega, little-omega and theta notations – Solving recurrence relations - Practical complexities. **Randomized Algorithms:** O~ notation - Repeated element testing (with proof) – Primality testing (with proof).	11	-	2
2	**Divide and Conquer Method:** General Method - Finding maximum and minimum elements (complexity analysis) – Merge sort (complexity analysis) – Quick sort (complexity analysis) – Selection - Strassen's matrix multiplication (complexity analysis) – Convex hull.	13	-	2
3	**Greedy Method:** General Method – Subset and Ordering Paradigms - Knapsack problem (with proof) - Tree vertex splitting (with proof) - Job sequencing with deadlines – Single source shortest path - Optimal storage on tapes (with proof). **Dynamic Programming Method:** General Method - Multistage graph – All-pairs shortest paths – Single source shortest path - String editing.	15	-	2
4	**Backtracking Method:** General Method – 8-queens - Sum of subsets - Graph colouring. **Branch and Bound Method:** General Method - Traveling Salesperson problem – 0/1 Knapsack problem.	13	-	2
5	**Lower Bound Theory:** Comparison trees (Ordered searching, sorting) - Oracles and adversary arguments (Merging, Largest and second largest, State space method) - Lower bounds through reduction (Finding the convex hull, Disjoint sets problem, Online median finding, Multiplying triangular matrices).	13	-	2
Total		**65**	**-**	**10**

TEXT BOOK

1. E. Horowitz, S. Sahni and S. Rajasekaran, *Computer Algorithms*, Galgotia, New Delhi, 1999.

REFERENCE BOOKS

1. G. Brassard and P. Bratley, *Fundamentals of Algorithms*, PHI, New Delhi, 1997.

2. A.V. Aho, J. E. Hopcroft, J. D. Ullman, *The Design and Analysis of Computer Algorithms*, Addison Wesley, Boston, 1974.

3. S. E. Goodman and S. T. Hedetniemi, *Introduction to the Design and Analysis of Algorithms*, Tata McGraw Hill International Edition, New Delhi, 1977.

4. Jeff Edmonds, *How to Think about Algorithms*, Cambridge University Press, 2008.

5. Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest, Clifford Stein, *Introduction to Algorithms*, MIT Press, 2009.

2CA09a - Object Oriented Programming

OBJECTIVES:
1. To appreciate the need for and characteristics of object orientation.
2. To learn the grammar of and to use the programming constructs of the C++ programming language.
3. To learn to implement programs in C++ covering the object-oriented concepts.

OUTCOMES:
Upon completion of the course, the student will be able to
1. Explain the various basic concepts of Object-orientation.
2. Conceptualize a given problem in an object-oriented way.
3. Write a program to solve a given problem, by applying the concepts of object orientation and features of C++.
4. Find and fix any bug in a given program snippet.
5. Determine the output of a given program snippet.

Unit	Course Content	L	P	T
1	**OOP Concepts:** Complexity in software - The need for object-orientation – Abstraction – Encapsulation – Modularity – Hierarchy. **Basic Elements of C++:** Classes – Objects – Data members and member functions – *private* and *public* access specifiers - Static members - Constructors – Singleton class - Destructors - Friend Functions and Friend Classes - Array of objects – Pointer to objects - *this* pointer – References – Dynamic memory allocation - Namespaces.	15	-	2
2	**Function Overloading:** Overloading a function - Default arguments – Overloading Constructors. **Operator Overloading:** Overloading an operator as a member function – Overloading an operator as a friend function – Overloading the operators [], (), -> and comma operators – Conversion Functions.	13	-	2
3	**Inheritance:** Types of inheritance – *protected* access specifier –Virtual Base Class – Base class and derived class constructors. **Run-time Polymorphism:** Virtual Functions – Function overriding - Pure virtual function – Abstract base class.	11	-	2
4	**Templates:** Function templates – Overloading a function template – Class templates. **Standard Template Library (STL):** Containers: vector, list – Iterators: forward, backward – Algorithms: removing and replacing elements, sorting, counting, reversing a sequence. **Exception Handling:** Exceptions – *try*, *catch*, *throw* – Rethrowing an exception – Restricting exceptions - Handling exceptions in derived classes - *terminate(), abort(), unexpected(), set_terminate().*	13	-	2
5	**I/O Streams:** Formatted I/O with *ios* class functions - Manipulators – Creating own manipulator – Overloading << and >> operators. **File I/O:** *fstream* class – Opening and closing a file – Reading from and writing to a text file - Unformatted and Binary I/O – Random access I/O.	13	-	2
Total		**65**	**-**	**10**

TEXT BOOKS
1. Herbert Schildt, *C++ - The Complete Reference*, Third Edition, TMH, 1999.
2. Grady Booch, *Object Oriented Analysis and Design*, Pearson Education, 2008.
REFERENCE BOOKS
1. Bjarne Strousstrup, *The C++ Programming Language*, Addison Wesley, 2000.
2. J. P. Cohoon and J. W. Davidson, *C++ Program Design – An Introduction to Programming and Object-Oriented Design*, Second Edition, McGraw Hill, 1999.
3. C. J. Lippman, *C++ Primer*, Third Edition, Addison Wesley, 2000.

2CA10a – Database Management Systems

OBJECTIVES:
1. To understand the need, basic concepts and applications of DBMSs.
2. To learn the E-R model and basic operations of Relational Algebra.
3. To learn Relational Database concepts and Normalization concepts.
4. To learn advanced SQL.
5. To learn the fundamental concepts of transaction processing, concurrency control protocols and database system architectures.

OUTCOMES:
Upon completion of the course, the student will be able to
1. Explain the purpose, characteristics, components & applications of database management systems.
2. Know the fundamental operations of Relational Algebra and construct expressions.
3. Write DDL statements and advanced SQL queries.
4. Detect and fix errors in SQL statements and identify the output of given code.
5. Understand the basic concepts of NoSQL.
6. Understand E-R Model and construct an E-R diagram for a given simple database.
7. Understand normalization concepts and normalize a given simple database.
8. Understand the concepts of transaction management and recovery systems.
9. Explain the various protocols for concurrency control.
10. Describe the various types of database system architectures.

Unit	Course Content	L	P	T
1	**Introduction:** Database System Applications – Purpose of Database Systems – View of data - Database languages - Relational Databases – Database design – Data Storage and Querying – Transaction management – Data mining and analysis - Database Architecture – Database users and administrators. **Relational Model:** Structure of Relational Databases – Relational Algebra Operations – Null Values – Modification of the database.	10	-	2
2	**SQL**: Data Definition – Basic Structure of SQL Queries – Set Operations – Aggregate Functions – Null Values – Nested Sub queries – Complex Queries – Views – Modification of the Database – Joined Relations. **Advanced SQL:** SQL Data Types and Schemas – Integrity Constraints – Authorization – Embedded SQL - Dynamic SQL – Functions and Procedural Constructs – Recursive Queries – Assertions - Triggers – Views. **NoSQL:** Introduction.	13	-	4
3	**E-R Model**: Constraints – E-R Diagrams – E-R Design Issues - Weak Entity Sets – Extended E-R Features - Reduction to Relational Schemes. **Relational Database Design:** Data Normalization – Tables, Classes and Keys – First Normal Form – Second Normal Form – Third Normal Form – Boyce-Codd Normal Form – Fourth Normal Form – Domain-key Normal Form – Data Rules and Integrity – Converting a Class diagram to Normalized tables – View Integration - Data Dictionary.	12	-	5
4	**Transactions:** Transaction concept – Transaction state - Implementation of Atomicity and Durability – Concurrent executions - Serializability – Recoverability – Implementation of isolation – Testing for serializability.	15	-	2

Unit	Course Content	L	P	T
	Concurrency Control : Lock-based protocols – Time stamp-based protocols – Validation-based protocols – Multiple granularity – Multi-version schemes - Deadlock handling.			
5	**Recovery System:** Log-based recovery – Recovery with concurrent transactions – Buffer Management. **Database System Architecture:** Centralized and Client-Server Architecture – Parallel Systems – Distributed Databases: Homogeneous and Heterogeneous Databases – Directory System.	10	-	2
Total		**60**	**-**	**15**

TEXT BOOKS
1. Abraham Silberschatz, H.F. Korth and S. Sudharshan, *Database System Concepts*, Fifth Edition, Tata McGraw Hill, New Delhi 2006.
2. Gerald V. Post, *Database Management Systems,* Third Edition, TATA McGraw-Hill, Third Edition 2005.

REFERENCE BOOK
1. Ramez Elmasri, Shamkant B. Navathe, *Database Systems*, Sixth Edition, Pearson Education, Delhi 2011.

2CAP3b - Practical III: Object Oriented Programming Laboratory

OBJECTIVES:

1. To learn to code, debug and execute programs in C++ in an IDE.

OUTCOMES:

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

1. Design classes and draw class diagrams for the given problems.
2. Write programs in C++.
3. Code, debug and execute a C++ program to solve the given problems in an IDE.

#	Course Content	L	P	T
1	Write a class to represent a complex number which has member functions to do the following a. Set and show the value of the complex number b. Add, subtract and multiply two complex numbers c. Multiplying the complex number with a scalar value	-	6	-
2	Write a Point class that represents a 2-d point in a plane. Write member functions to a. Set and show the value of a point b. Find the distance between two points c. Check whether two points are equal or not	-	4	-
3	Design and implement a class that represents a Harmonic Progression (HP). Implement functions to do the following: a. Generate the HP up to a specified number of terms b. Calculate the sum of the HP to n terms and to infinity c. Generate the nth term of the HP d. Generate the corresponding Arithmetic Progression. (Design and implement a class that encapsulates an AP, and allow the HP class to use its facilities by implementing friend functions.)	-	7	-
4	Design and implement a class to represent a Solid object. a. Apart from data members to represent dimensions, use a data member to specify the type of solid. b. Use functions to calculate volume and surface area for different solids.	-	6	-
5	Design a class representing time in hh:mm:ss. Write functions to a. Set and show the time b. Find the difference between two time objects c. Adding a given duration to a time d. Conversion of the time object to seconds	-	6	-
6	Design a 3x3 matrix class and demonstrate the following: a. Addition and multiplication of two matrices using operator overloading b. Maintaining a count of the number of matrix object created	-	6	-
7	Design a class called cString to represent a string data type. Create a data member in the class to represent a string using an array of size 100. Write the following functionality as member functions: a. Copy Constructor b. Concatenate two strings c. Find the length of the string d. Reversing a string e. Comparing two strings	-	6	-

#	Course Content	L	P	T
8	Design a class called cString to represent a string data type. Create a data member in the class to represent a string whose size is dynamically allocated. Write the following as member functions: a. Copy Constructor b. Destructor c. Concatenate two strings d. Find the length of the string e. Reversing a string f. Comparing two strings	-	8	-
9	Create a class to represent a 2-d shape and derive classes to represent a triangle, rectangle and circle. Write a program using run-time polymorphism to compute the area of the figures.	-	6	-
10	Define a class template representing a single-dimensional array. Implement a function to sort the array elements. Include a mechanism to detect and throw an exception for array-bound violations.	-	6	-
11	Demonstrate the use of the vector STL container.	-	7	-
12	Implement a telephone directory using files.	-	7	-
Total		**-**	**75**	**-**

2CAP4a - Practical IV: Database Management Systems Laboratory

OBJECTIVES:

1. To learn to create a database of tables for a given schema, and write SQL code or PL/SQL block to implement queries / triggers on the database.

OUTCOMES:

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

1. Create a database with requisite tables, primary keys and foreign keys.
2. Write SQL code / PL/SQL block to implement given queries and triggers.

#	Course Content	L	P	T
1	**Video Store database** **Video** table has the following fields: catalogNo (Text), title (Text), category (Text), dailyRental (Currency), price (Currency), directorNo (Text). The primary key is catalogNo. **Member** table has the following fields : memberNo (Number), fName (Text), lName (Text), gender (Char), dateOfBirth (Date/Time), address (Text), mobileNo (Text). The primary key is memberNo. **VideoForRent** table has the following fields: videoNo (Text), available (Yes/No), catalogNo (Text). The primary key is videoNo. **RentalAgreement** table has the following fields: rentalNo (AutoNumber), dateOut (Date/Time), dateReturn (Date/Time), memberNo, (Number), videoNo(Text). The primary key is rentalNo. (For this table, set the format property for the dateOut and dateReturn fields to the format dd-mmm-yy.) 1. Only female members of the video shop. 2. Only male members of the shop who joined the shop this year in order of last name and first name. 3. All members born in the 1960s. 4. Only videos in the Children category with a daily rental rate of less than Rs. 40 and sorted according to video title. 5. Only videos currently available for rent with a certification of "A" or "U". 6. Only videos by a certain director. 7. List the catalogNo, title and category of the Video table, ordered by video title 8. List title, certificate, category and dailyRental of the Video table for videos in the "Children" category with a rental rate less than Rs. 40. 9. List all videos with a certification of "PG" or "18" in the Video table. 10. Create a report for your Video table containing the catalogNo, title, category and certificate fields. Group your records according to the values in the category field and then sort on the values in the title field. 11. Create a report for your Video table containing the category, dailyRental and price fields. Group your records according to the values in the category field and then sum the values in the dailyRental and price fields. 12. Create a report based on a query that contains the following fields memberNo, fName, lName, videoNo, title, dateOut and dateReturn. Group your records according to memberNo and then order by videoNo.	-	12	-

#	Course Content	L	P	T
	13. Write a PL/SQL block that calculates the total number of videos rented and number returned on a given date. 14. Write a trigger that is fired when a member who wants to rent a video has outstanding dues.			

2	**Employee Database**
	Employee (EmpNo, EmpName, Gender, Salary, Address, DNo)
	Department (DeptNo, DeptName, Location)
	1. **Employee table**
	  a. Make EmpNo as Primary key
	  b. Do not allow EmpName, Gender, Salary and Address to have null values
	  c. Allow Gender to have one of the two values: 'M', 'F'
	  d. Set the default salary value to Rs. 1000.
	2. **Department table**
	  a. Make DeptNo as Primary key
	  b. Make DeptName as candidate key
	  c. Make DNo of Employee as foreign key which refers to DeptNo of Department
	  d. Insert few tuples into Employee and Department which satisfies the above constraints.
	  e. Insert few tuples into Employee and Department which violates some of the above constraints
	  f. Modify / Delete a tuple which violates a constraint
	  g. Modify the foreign key constraint of Employee table such that whenever a department tuple is deleted, the employees belonging to that department will also be deleted.
		-	12	-

3	**Hospital Database** **Billed** (bill no number(5) - pri key, patient_no number(9), item_code number(5), charge number(7,2)) **Treatments** (phy_id number(4) - pri key, patient_no number(4) - pri key, procedure_no number(4) - pri key,date_treated date - pri key treat_result varchar2(50)) **Item** (item_code number(4) - pri key, description varchar2(50), normal_charge number(7,2)) **Physicians** (phy_id number(4) - pri key, phy_phone char(8), phy_name varchar2(50), specialization varchar(30)) **Patient** (patient_no number(4) - pri key, date_admitted date, date_discharaged date, pat_name varchar2(50), room_location char(4)) **Room** (room_location char(4) - pri key, room_accomodation char(2), room_extension number(4)) **Procedures** (procedure_no number(4) - pri key, proc_description varchar2(50)) 1. Get the PATIENT_NO, ITEM_CODE, and CHARGE from the BILLED table for a specific PATIENT_NO. 2. List all of the different charges that are stored to the table. 3. Display all columns and all rows from the BILLED table. 4. Display all charges greater than Rs. 5.00 for the PATIENT_NO 1116. 5. Display all charges for either patient 1116 or patient 1117. 6. Count the number of times patient 1116 has been charged for items. 7. Display number of DISTINCT procedures performed on a patient. 8. Give a meaningful column name for number of DISTINCT procedures in the above Query.	-	12	-

#	Course Content	L	P	T
	9. Display a calculated value such as the current charge and the amount that would be charged if the charge were increased by 6% for all rows in the ITEM table 10. List all patients hospitalized for more than 6 days 11. List the total charges per patient for expensive medical items (CHARGE greater than Rs100 for an item) where patients owe the hospital a sum (total charges over Rs500) 12. List the patients who had either Dr. Vaidyanathan or Dr. David or Dr. Mohammed as a physician. 13. Show the patient names (PAT_NAME field) and associated physician names (PHY_NAME field) along with the Patient information 14. List the PATIENT_NO and DATE_DISCHARGED from the PATIENT table and the associated CHARGE from the BILLED table. 15. Write a PL/SQL block that shows the number of days for which each room was occupied during a given month. 16. Write a trigger that lists the doctors with the same specialization, which fires when a doctor newly joins the hospital.			
4	**Sales Processing Database** **Client_master** (client_no, name, address1, address2, city, state, pincode, bal_due) **Product_master** (Product_no, Description, Profit_percent, Unit_measure, Qty_on_hand, reorder_lvl, Sell_price, Cost_price) **Write SQL Queries for the following:** 1. Retrieve the list of names and cities of all the clients. 2. List the various products available from the product_master table. 3. List all the clients who are located in Mumbai. 4. Display the information for client no 0001 and 0002. 5. Find the products with description as '1.44 drive' and '1.22 Drive'. 6. Find all the products whose selling price is greater than 5000. 7. Find the list of all clients who stay in the cities 'Mumbai' or 'Delhi' or 'Madras'. 8. Find the product whose selling price is greater than 2000 and less than or equal to 5000. 9. List the name, city and state of clients not in the state of 'Maharashtra'. 10. Change the selling price of 1.44 floppy drive to Rs.1150.00. 11. Delete the record with client 0001 from the client master table. 12. Change the city of client_no'0005' to Bombay. 13. Change the bal_due of client_no 0001, to 1000. 14. Find the products whose selling price is more than 1500 and also find the new selling price as original selling price multiplied by 15. 15. Find out the clients who stay in a city whose second letter is 'a'. 16. Find out the name of all clients having 'a' as the second letter in their names. 17. List the products in sorted order of their description. 18. Count the total number of orders 19. Calculate the average price of all the products. 20. Calculate the minimum price of products. 21. Count the number of products having price greater than or equal to 1500.	-	12	-
5	**Banking database**	-	27	-

#	Course Content	L	P	T
	account (account_number, branch_name, balance)			
	branch (branch_name, branch_city, assets)			
	customer (customer_name customer_street, customer_city)			
	loan (loan_number, branch_name, amount)			
	depositor (customer_name, account_number)			
	borrower (customer_name, loan_number)			
	1. List all branch names and their assets			
	2. List all accounts of Brooklyn branch			
	3. List all loans with amount > 1000.			
	4. List all accounts of Perryridge branch with balance < 1000.			
	5. List Numbers of accounts with balances between 700 and 900			
	6. Change the assests of Perryridge branch to 340000000.			
	7. Transfer the accounts and loans of Perryridge branch to Downtown branch.			
	8. Transfer Rs. 100 from account A-101 to A-215.			
	9. Delete the branch Perryridge.			
	10. Waive off all the loans with amount < 1000.			
	11. Delete the accounts and loans of Downtown branch.			
	12. Add a column phoneNo to customer table.			
	13. Change the size of the branch_city to varchar(20).			
	14. Drop the column phoneNo from customer table.			
	15. For all customers who have a loan from the bank, find their names, loan numbers, and loan amount.			
	16. Find the customer names, loan numbers, and loan amounts, for all loans at the Perryridge branch.			
	17. For all customers who have a loan from the bank, find their names and loan numbers with the attribute loan_number replaced by loan_id.			
	18. Find the names of all branches that have assets greater than atleast one branch located in Brooklyn.			
	19. Find the names of all customers whose street address includes the substring 'Main'.			
	20. List loan data, ordered by decreasing amounts, then increasing loan numbers. (Use union all to retain duplicates)			
	21. Find all the bank customers having a loan, an account, or both at the bank. (Use intersect all to retain duplicates)			
	22. Find all the bank customers having both a loan and an account at the bank.			
	23. Find all customers who have an account but no loan at the bank.			
	24. Find the average account balance at the Perryridge branch.			
	25. Find the average account balance at each branch.			
	26. Find the number of depositors for each branch (Use distinct).			
	27. Find those branches where the average accounts balance is more than Rs. 1200.			
	28. Find the number of branches of the bank.			
	29. Find the average balance for each customer who lives in Harrison and has at least three accounts.			
	30. Find all loan numbers that appear in the loan relation with null values for amount.			
	31. Find all the customers who have both a loan and an account at the Perryridge branch.			
	32. Find all customers who do have a loan at the bank, but do not have an account at the bank.			

#	Course Content	L	P	T
	33. Select the names of customers who have a loan at the bank, and whose names are neither Smith nor Jones.			
	34. Find the names of all branches that have assets greater than those of at least one branch located in Brooklyn.			
	35. Find the names of all branches that have an asset value greater than that of each branch in Brooklyn.			
	36. Find all customers who have both an account and a loan at the bank			
	37. Find all customers who have an account at all the branches located in Brooklyn.			
	38. Find all customers who have at most one account at the Perryridge branch.			
	39. Find all customers who have at least two accounts at the perryridge branch			
	40. Find the average account balance of those branches where the account balance is greater than Rs. 1200.			
	41. Find the maximum across all branches of the total balance at each branch.			
	42. Select the accounts with maximum balance.			
	43. Find all branches where the total account deposit is greater than the average of the total account deposits at all branches.			
	44. Create a view all_customers consisting of branches and their customers. Select all the customers from all_customers view.			
	45. Create a view Perryridge_customers consisting of customers of Perryridge branch using all_customers view.			
	46. Delete all loans with loan amounts between Rs. 1300 and Rs, 1500.			
	47. Delete all account tuples at every branch located in Brooklyn.			
	48. Present a new Rs. 200 savings account as a gift to all loan customers of Perryridge branch(Note: It requires insert into account and depositor).			
	49. Pay 5% interest to all accounts with a balance of Rs. 1000 or more.			
	50. Pay 5% interest on accounts whose balance is greater than average.			
	51. Pay 6% interest on accounts with balances over Rs. 10000 whereas pay 5% interest on all other accounts.			
	52. List the customer names along with the length of the customer names			
	53. List the customer names in lower case			
	54. List the customer names and 3 characters from 3_{rd} position of each customer name			
	55. List the customer names in upper case			
	56. List the balance and balance/3 rounded to nearest hundred from account.			
	57. Display the birth date of all the employees in the following format: DD-MON-YYYY', 'DD-MON-YY', 'DD-MM-YY'			
	58. List the employee names and the year (fully spelled out) in which they born			
	59. List the employee names and the day of the week (fully spelled out) in which they born			
	60. List the employee names and the month (fully spelled out) in which they born			
	61. Find the last day of the month (and its day of the week) in which employee Mr. X is born			
	62. Find the age of all the employees			
	63. List the employees whose birthday falls in the given year X			

#	Course Content	L	P	T
	64. List the employees whose birthday fall between the given years X and Y			
	65. List the employees who will retire on the given year X.			
	66. Write a PL/SQL code block that will accept an account number from the user and debit an amount of Rs. 2000 from the account if the account has a minimum balance of 500 after the debit. The process is to be fired on the account table.			
Total		-	75	-

Semester III

3CBCM2 - Accounting and Financial Management

OBJECTIVES:
1. To gain an insight into the basics of Accounting Concepts.

OUTCOMES:
Upon completion of the course, the student will be able to
1. Understand the principles of Double entry.
2. Understand how to journalize a ledger.
3. Prepare a trial balance.
4. Understand how to prepare trading, profit & loss account and balance sheet.
5. Understand how to analyse and interpret financial statements, including ratio analysis.
6. Understand the concepts of break-even analysis and marginal costing.
7. Calculate break-even point.
8. Perform decision-making analysis such as profit planning and sales planning.
9. Understand the concept of budgeting and budget forecasting, including preparation of a functional budget.
10. Understand the methods of capital investment decision making including Pay back method, ARR, Cash Flow, NPV, IRR methods.

Unit	Course Content	L		P	T
1	**Principles of Accounting:** Principles of Double entry – Journalising Ledger – Posting and preparation of Trial Balance – Preparation of Trading Account, Profit and Loss Account and Balance Sheet including Adjustments (Simple problems only).	12		-	2
2	**Analysis and Interpretation of Financial Statements:** Ratio Analysis – Uses of ratios in Interpreting the Final Accounts (Trading A/c – Profit and Loss A/c and balance Sheet) – Final Accounts to Ratios as well as Ratios to Final Accounts Problems.	12		-	2
3	**Break-even Analysis and Marginal Costing:** Meaning of variable cost and Fixed Cost – Cost-Volume – Profit Analysis – Calculation of Break-even Point, Profit Planning, Sales planning and other decision – making Analysis involving Break-even Analysis – Computer Accounting and Algorithm. (Differential Cost Analysis to be omitted).	15		-	2
4	**Budget Forecasting:** Preparation of and Characteristics of functional Budgets – Production, Sales, Purchases, Cash and Flexible budgets.	15		-	2
5	**Project Appraisal:** Method of Capital investment decision making: Pay back Method, ARR Method – Discounted Cash Flow – Methods including Net Present Value and IRR Method.	11		-	2
Total		**65**		**-**	**10**

TEXT BOOKS
1. Shukla M. C. and Grewal T. S., *Advanced Accounts*, S. Chand & Company, New Delhi.
2. Gupta R. L. & Radhaswamy M., *Advanced Accounts (Vol. II)*, Sultan Chand & Sons, New Delhi, 1991.

REFERENCE BOOKS
1. Man Mohan & Goyal S.N, *Principles of Management Accounting*, Arya Shithya Bhawan, 1987.
2. Kuchhal S. C., *Financial Management*, Chaitanya Allahabad, 1880.
3. Hingorani N. L. and Ramanathan A. R., *Management Accounting*, Sultan Chand, New Delhi, 1962.

3CA12b - Web Application Development

OBJECTIVES:

1. To understand the difference between server-side and client-side programming.
2. To learn HTML5 for designing web pages and Java script for client-side programming.
3. To learn XML to represent data and create user-defined tags.
4. To learn the concepts of Web 2.0 and ASP.NET.
5. To learn programming in C#.
6. To learn to interface databases with the web application using ADO.NET.

OUTCOMES:

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

1. Explain the features of HTML 5 and create web pages.
2. Understand the features of Javascript and write simple scripts.
3. Represent web data and create user-defined tags using XML.
4. Explain the various ways to parse XML files.
5. Explain the various features of C# and ASP.NET and develop simple web applications.
6. Explain the concepts of ADO.NET.
7. Write code to interface a web application with a database using ADO.NET.
8. Identify bugs in a C# code snippet and fix them.
9. Determine the output of a given C# code snippet.

Unit	Course Content	L	P	T
1	**Introduction to Scripting:** Need for scripting - Script vs programming language – Client-side and server-side scripting. **HTML 5:** Introduction to HTML 5 – Introduction to New elements – Working with Lists, Tables and Frames – Working with hyperlink and images- Working with Forms and Controls **JavaScript:** Structures – Variables – Operators - Conditional and looping structures - Popup boxes – Functions – Events - Cookies.	11	-	2
2	**Introduction to XML**: Fundamentals of XML Syntax - Namespaces - XML validation: DTD, XML Schema. **X-Files:** XPATH – XQUERY – XLINK – XPOINTER.	14	-	2
3	**Introduction to C#:** Overview of C# - Data Types, Literals, Variables and Operators - Classes, Objects, Methods - Operator Overloading - Indexers and Properties - Interfaces, Structures and Enumerations.	14	-	2
4	**ASP.NET:** The .NET Framework - Using Namespaces - Setting up ASP.NET and IIS **-** ASP.NET Applications - Web Form Fundamentals - Web Controls - Validation and Rich Controls.	13	-	2
5	**Working with Data:** ADO.NET Data Access - Data Binding - DataList, DataGrid and Repeaters – Files, Streams and Emails. **Advanced ASP.NET:** Implementing Security.	13	-	2
Total		**65**	**-**	**10**

TEXT BOOKS

1. Ivan Bayross, *Web Enabled Commercial Application Development using HTML, DHTML, JavaScript and Perl CGI*, BPB Publications, 2002.

2. Daniel Read, Adrian Kingsley Hughes, *VB Script Programmer's Reference*, 2nd Edition, Wiley India Pvt. Ltd., 2009.

3. Kogent Learning Solutions Inc, HTML 5 in Simple Steps, Dreamtech press.

4. Ron Schmelzer, *XML and Web Services*, Pearson Education, 2008.

5. Herbert Schildt, *The Complete Reference C#*, Tata McGraw-Hill, 2002.

6. Matthew MacDonald, *ASP.NET: The Complete Reference*, Tata McGraw-Hill, 2010.

REFERENCE BOOKS

1. Greg Buczek, *ASP.NET Developer's Guide*, Tata McGraw-Hill, 2008.

2. David Hunter, Jeff Rafter, *Beginning XML*, 4th Edition, Wiley Eastern, 2007.

REFERENCE WEBSITES:

1. www.w3schools.com

2. www.functionx.com

3CA13a - Internet Programming

OBJECTIVES:
1. To learn socket programming, servlet programming and the use of integrated platforms to develop advanced Java applications.
2. To learn to write simple programs using servlets, Javabeans, spring, RMI and JSP.

OUTCOMES:
Upon completion of the course, the student will be able to
1. Explain basics features and write programs using socket programming.
2. Write programs using JDBC.
3. Explain the basic concepts of servlets.
4. Understand applet-servlet, HTML-servlet communication and write programs.
5. Understand the concept of Java Beans and write simple programs.
6. Understand the basic concepts of Spring and build simple apps using Spring MVC.
7. Explain the concept of RMI & protocols used and write simple programs using RMI.
8. Explain basic concepts and protocols of JSP, and write simple programs.

Unit	Course Content	L	P	T
1	**Java Basics:** I/O Streams – File Streams – Applets - Socket Programming – Proxy Servers – TCP/IP Sockets – Net Address – URL - JDBC connectivity.	10	-	2
2	**Servlets:** Overview of servlets – The Java web server - Session management – HTML forms – using JDBC in servlets – Applet to Servlet communication. **Java Beans:** The software component assembly model - The java beans development kit - developing beans - Application Builder tool- JAR files – Introspection - Bound Properties – Persistence - customizers – Java Beans API.	15	-	2
3	**Spring Application Framework** **Core Spring:** Springing into action - Wiring beans - Minimizing XML configuration in Spring - Aspect-oriented Spring. **Spring Application Essentials:** Hitting the database - Managing transactions - Building web applications with Spring MVC.	15	-	2
4	**Remote Method Invocation:** Overview of RMI – Developing applications with RMI: Declaring & Implementing remote interfaces - stubs & skeletons, Registering remote objects, writing RMI clients – Pushing data from RMI Servlet – RMI over Inter-ORB Protocol.	10	-	2
5	**Java Server Pages:** Introduction JSP - Examining MVC and JSP – JSP scripting elements & directives - Working with variables scopes - Error Pages - using Java Beans in JSP - Working with Java Mail - Understanding Protocols in Java mail – Components - Java mail API.	15	-	2
Total		**65**	**-**	**10**

TEXT BOOKS
1. H. Schildt, *Java 2 Complete Reference*, 5th Edition, Tata McGraw Hill, New Delhi, 2002.
2. J. McGovern, R. Adatia, Y. Fain, *J2EE 1.4 Bible*, Wiley-Dreamtech India Pvt. Ltd, New Delhi, 2003.
3. Craig Walls, *Spring in Action*, Manning Publications Company, 2011.

REFERENCE BOOKS
1. K. Moss, *Java Servlets*, Second Edition, Tata McGraw Hill, New Delhi, 1999.
2. Joseph O'Neil, *Java Beans from the Ground Up*, Tata McGraw Hill, New Delhi, 1998.
3. TomValesky, *Enterprise JavaBeans*, Addison Wesley.
4. Cay S Horstmann, Gary Cornell, *Core Java Vol II - Advanced Features*, Addison Wesley, 2007.

3CA14b – Personal Software Process

OBJECTIVES:

1. To learn the concept of software process and PSP.
2. To learn the various phases in a software project and the importance of planning.
3. To learn the key software metrics.
4. To learn the basics of software quality management.
5. To learn the Agile Process Model.

OUTCOMES:

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

1. Understand the concepts and importance of software process and the application of PSP.
2. Explain the basics of project planning.
3. Describe the important metrics used in measuring software size, and estimating software size, resources and schedule.
4. Estimate software size using function point method and PROBE size estimating method.
5. Articulate the important PSP metrics in the GQM paradigm.
6. Explain the concepts involved in software quality including benchmarking, yield management and defect removal and prevention.
7. Describe the aspects of design and code reviews in the software process.
8. Understand the Agile Process Model.

Unit	Course Content	L	P	T
1	**The Personal Software Process Strategy:** The logic for a Software Engineering discipline – The definition of a software process – Process maturity – The PSP strategy – The logic for PSP – Productivity and the PSP. **The Baseline Personal Process:** The baseline process – The PSP process elements – The PSP0 Process – PSP0 measures – Time recording log – Defect recording log - PSP0 Project plan summary – Customizing the initial process. **Introduction to Planning:** The 'why' and 'what' of a plan – Contents of a software plan – Planning a software project – Producing a quality plan.	10	-	-
2	**Measuring Software Size:** Size measures – A size measurement framework – Establishing a counting standard – Using LOC counts – Reuse considerations – LOC accounting – Calculating productivity – LOC counters. **Estimating Software Size:** Popular estimating methods – Proxy-based estimating – The PROBE size estimating method – Object categories – Estimating considerations.	12	-	4
3	**Resource and Schedule Estimating:** Resource Planning – Estimating development time – Estimating task time – Combining multiple estimates – Using multiple regression – Schedule estimating – Earned value tracking – Estimating accuracy. **Measurements in the PSP:** Overview – Fundamental process measures – Goal-Question-Metric (GQM) paradigm – General PSP objectives, goals and questions – Example of GQM – Gathering data – The impact of data gathering – Establishing a baseline for the personal process.	13	-	5

Unit	Course Content	L	P	T
4	**Design and Code Reviews:** The 'what' and 'why' of reviews – Personal reviews – Review principles - Relationship between reviews and inspections. **Software Quality Management:** Meaning of software quality – The economics of software quality – Developing a quality strategy – Process benchmarking – Yield management – Defect removal strategies – Defect prevention strategies.	10	-	2
5	**Software Design:** The Design process – Design quality – Structuring the design process – Design notation – Design templates – The Functional Specification – The functional, state and logic specification templates – Operational scenario template – using templates in Design – Design guidelines. **Defining the Software Process:** Need for definition of software processes – Software process basics – Process definition – Defining process phases – Process development considerations – Process evolution – The Process-development process. **An Agile View of Process:** What is Agility – What is an Agile process – Agile Process Models: Extreme Programming, Adaptive Software Development, Dynamic Systems Development Method, Scrum, Crystal, Feature Driven Development, Agile Modeling.	15	-	4
Total		**60**	**-**	**15**

TEXT BOOKS

1. Watts S. Humphrey, *A Discipline for Software Engineering*, Pearson Education Inc., 2012.

2. Roger Pressman, *Software Engineering – A Practitioner's Approach*, 6th Edition, Tata McGraw Hill, 2010.

REFERENCE BOOK

1. Watts S. Humphrey, *Introduction to the Personal Software Process*, Pearson Education, 2000.

Elective I

#	Elective Stream	Elective I
1	Communication Systems	Stream 1: 3CAE1MC – Mobile Communication
2	Security Systems	Stream 2: 3CAE1CR – Cryptography and Network Security
3	High-performance Computing	Stream 3: 3CAE1PC – Parallel Computing
4	Intelligent Systems	Stream 4: 3CAE1LA – Linear Algebra
5	Information Systems	Stream 5: 3CAE1IS – Management Information Systems
6	Software Testing	Stream 6: 3CAE1ST – Foundations of Software Testing and Quality Assurance

3CAP5c - Practical V: Internet Programming Laboratory

OBJECTIVES:

1. To learn to code, debug and execute simple programs using servlets, Javabeans, spring, RMI and JSP using IDE.

OUTCOMES:

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

1. Implement socket programming and Client side scripting in Java.
2. Develop Java program using JDBC.
3. Design a web application to demonstrate HTML and applet communication with servlet.
4. Implement simple programs using spring.
5. Write code to connect client with remote server using RMI.
6. Develop simple applications using JSP.

#	Course Content	L	P	T
1	Write a Java program to implement the usage of Socket programming.	-	8	-
2	**JDBC:** Write a Java program to create a student database and do the following using JDBC. a. Insert b. Delete c. Modify d. Display	-	7	-
3	Create a web application with personal details of an employee that demonstrates HTML-to-Servlet communication.	-	6	-
4	Demonstrate Applet-to-Servlet communication that displays the day and time from the Servlet.	-	6	-
5	Create a login page which redirects to a Servlet page that displays the session id for the user.	-	6	-
6	Design a web application with Servlet for inserting and viewing the details of an employee database.	-	6	-
7	Given the cost of 5 items and a discount percentage, display the discounted value of all the items using Spring.	-	5	-
8	Demonstrate simple calculations with RMI.	-	6	-
9	Write a program to reverse a given string using RMI.	-	6	-
10	Write a program to display the student details from the database. Use JSP.	-	6	-
11	Design an online quiz application with JSP.	-	6	-
12	Develop a web application to validate an e-mail id in a text field using a Java Bean in JSP.	-	7	-
Total		**-**	**75**	**-**

3CAP6b – Practical VI: Web Application Development Laboratory

OBJECTIVES:

1. To design interactive web pages using Javascript, HTML 5, XML, C# and ASP.NET.

OUTCOMES:

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

1. Design web pages using HTML5 and Java script.
2. Represent web data using XML while creating websites.
3. Code, debug and execute a C# program to solve the given problems using the .NET framework.
4. Develop simple web application using ASP.NET controls.
5. Interface a .NET web application to a database using ADO.NET.

#	Course Content	L	P	T
1	**HTML5:** 1. Create an HTML program using frames to generate your own creativity. 2. Create a website as a collection of HTML pages which gives details about you. Have a homepage which has links of Personal information, Favourites, Academic excellence and any such information you want to post about yourself. The design, look and feel of the page can be designed by you. 3. Create a HTML table for Student information system. It must contain, columns for Register Number, Name, Marks, Total, Percentage.	-	12	-
2	**JavaScript:** 1. Write a JavaScript to create an array of elements, accept the values and display the same. 2. Write a JavaScript that creates a document that opens a new explorer window without a toolbar, address bar and status bar, and that unloads itself after one minute. 3. Create a web page that will create a cookie with the details of the user and his favourite colour. When the same username is given the next time, the colour detail should be retrieved from the cookie and displayed.	-	12	-
3	**XML:** 1. Create an XML document that lists 5 books in a bookstore with the following details about each book – title of the book, author, year and price. Validate using Internal DTD. 2. Create an XML document that lists at least 10 items in a shopping mall with the following details about each item – Product name, Brand name, Description, Category, Popularity rating and Cost. Validate using External DTD. 3. Create an XML document that lists the desktop and laptop models available in a computer showroom. The details expected for each item : Product name, Product code, Company, Configuration (Processor No., Processor speed, Motherboard model, HD, RAM, Accessories list). Validate using XML Schema.	-	17	-
4	**C#:** 1. Develop a program to demonstrate the concepts of boxing and unboxing.	-	17	-

#	Course Content	L	P	T
	2. Write a program using while construct and indexer property to display the content of a string object. 3. Design a structure data type named DateOfBirth to contain date, month and year of birth. Develop a C# program using this data structure that would assign your date of birth to the individual members and display the date of birth in the format, dd/mm/yy. Do not use any methods in the program.			
5	**ASP.NET:** 1. Develop a simple web application to create a sign-in form. 2. Develop a simple web application to create a file manager form. 3. Develop a simple web application for online library.	-	17	-
Total		-	75	-

Semester IV

4CA16b - Object Oriented Analysis and Design

OBJECTIVES:

1. To learn to apply various methods used for performing object oriented analysis and design.
2. To learn to visualize the design of a system using the Unified Modelling Language (UML).

OUTCOMES:

Upon completion of the course, the student will be able to
1. Understand the various object-oriented methodologies.
2. Understand the need and modelling aspects of the UML.
3. Understand the role of object-oriented analysis in software design.
4. Understand Use cases and learn to identify and draw Use cases for a given problem.
5. Learn various approaches to classification apart from the Use case driven approach.
6. Understand the axioms and corollaries of object oriented design.
7. Identify and refine attributes, designing methods and protocols for a given problem, using Use case diagram and sequence/collaboration diagram.
8. Apply design axioms and corollaries for designing access layer and view layer classes.
9. Describe the concepts of design patterns.

Unit	Course Content	L	P	T
1	**Overview:** Introduction – Orthogonal views of software – Object-Oriented systems development methodology – Why object-orientation – Overview of the Unified Approach - Object Basics. **Object-Oriented Systems Development Life Cycle:** The software development process – Buidling high quality software – Object-Oriented systems development with a use-case driven approach – Reusability. **Object-Oriented Methodologies:** Toward unification - Survey of some of the Object-Oriented methodologies – Rumbaugh et al.'s Object Modeling Technique – The Booch Methodology – The Jacobson et al. Methodologies – The Unified Approach. **The Unified Modeling Language:** Introduction – Static and dynamic models – Why modeling – Introduction to the UML – UML Diagrams – UML Class Diagram – Use-case Diagram – UML Dynamic Modeling – Model management : Packages and Model organization - UML Extensibility – UML Meta-model.	8	-	4
2	**Object-Oriented Analysis – Identifying Use-Cases:** Why analysis is a difficult activity – Business object analysis – The Unified Approach to use-case driven Object-Oriented analysis – Business process modeling – Use-case model – Developing effective documentation - The process - Identifying Use-cases – Classification – Identifying Object relationships, attributes and methods – Case study. **Object-Oriented Analysis – Classification:** Classifications theory – Approaches for identifying classes – Noun-phrase approach – Common class patterns approach – Use-case driven approach – Classes, responsibilities and Collaborators approach – Naming classes – Case Study. **Object-Oriented Analysis – Identifying Object Relationships, Attributes and Methods:** Associations – Super-sub class relationships – A-part-of relationships – Defining class and object responsibilities – Case Study.	14	-	4
3	**Object-Oriented Design:** Design axioms – Corollaries - The OOD philosophy – The UML Object Constraint Language – The design	13	-	2

Unit	Course Content	L	P	T
	process – Class visibility – Designing classes: Refining attributes, designing methods and protocols – Case study – Packages and managing classes. **Access Layer Design:** Object-Oriented DBMS (the pure world) – Object-relational systems (the practical world) – Designing Access Layer classes – Case study.			
4	**View Layer Design:** User interface design as a creative process – Designing view layer classes – Macro-level process – Micro-level process – The purpose of a view layer interface – Prototyping the user interface – Case Study. **Software Quality:** Quality Assurance tests – Testing strategies – Impact of object-orientation on testing – Test cases – Test plan – Continuous testing – Myers's Debugging Principles - Usability testing – User satisfaction test – The User Satisfaction Test Template – Case Study.	8	-	5
5	**Design Patterns:** What a Design Pattern is – Design patterns in Smalltalk MVC – Describing design patterns – The catalog of design patterns – organizing the catalog – How design patterns solve design problems – How to select a design pattern – How to use a design pattern. **Case Study (Designing a Document Editor):** Design problems – Document structure – Formatting – Embellishing the user interface – Supporting multiple look-and-feel standards – Supporting multiple window systems – User operations – Spell-check and hyphenation.	12	-	5
Total		**55**	**-**	**20**

TEXT BOOKS

1. Ali Bahrami, *Object Oriented Systems Development*, McGraw Hill International Edition, 1999.
2. Erich Gamma, Richard Helm, Ralph Johnson, John Vlissides, *Design Patterns*, Pearson Education, 2002.

REFERENCE BOOKS

1. Grady Booch, *Object Oriented Analysis and Design*, Addison-Wesley, 2nd Edition, 1999.
2. R. S. Pressman, *Software Engineering*, Fourth Edition McGraw Hill International Edition, 1997.

4CA17c - Mobile Application Development

OBJECTIVES:

1. To learn the components and structure of mobile application development frameworks for Android OS based mobiles.
2. To learn how to develop simple android applications.

OUTCOMES:

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

1. Understand the basics of Android devices and the Android platform.
2. Explain the basic building blocks of Android programming required for App development.
3. Explain the components used in Activity Life Cycle.
4. Understand how to create basic user interfaces with layouts, views and fragments.
5. Explain persistence and data storage mechanism in Android.
6. Describe advanced application concepts like Networking, Animations and Google Maps services.
7. Develop and publish Android applications to Android Market.

Unit	Course Content	L	P	T
1	**Introduction to Android:** Getting Started with Android : Android Versions - Features - Architecture of Android - Examples of Android Devices – Tools : Android Studio, Android SDK, Creating Android Virtual Devices, Android Developer Community – Creating First Application. **Using Android Studio:** Exploring the IDE – Debugging Android Application : Setting Breakpoints, Navigating Paused Code – Publishing the Application.	11	-	2
2	**Android User Interfaces:** Understanding Activities – Linking Activities using Intents – Fragments – Displaying Notifications – Components of a Screen – Display Orientation – Managing Screen Orientation : Persisting State Information during changes in Configuration – Utilizing Action Bar.	14	-	2
3	**Views:** Basic Views – Picker Views – List Views – Image View – Using Menus with Views. **Basic Android Development:** Audio playback, Photo capture.	14	-	2
4	**Advanced Android Development:** Animations – Publishing – Messaging : SMS Messaging, Sending Email – Location-Based Services – Data Persistence : Persisting data to Files, Creating and using Databases.	16	-	2
5	**Advanced Topics:** Distribution and Monetizing, Networks : Managing Network and Internet Connectivity, Security: Mobile Malware.	10	-	2
Total		**65**	**-**	**10**

TEXT BOOKS
1. J.F.DiMarzio, *Beginning Android Programming with Android Studio*, Wrox Press, 4th Ed.
2. Reto Meier, *Professional Android Application Development*, Wrox Press, 2009.
3. Himanshu Dwivedi, Chris Clark, David Thiel, *Mobile Application Security*, TMH, 2010.
WEB REFERENCES
1. http://developer.android.com
2. http://www.html5rocks.com/en/mobile
3. http://mobilehtml5.org/

4CA18c - Microprocessor and Microcontroller

OBJECTIVES:

1. To learn the architecture and instruction set of 8086 microprocessor and 8051 microcontroller, to gain a firm footing in Microprocessor theory using simple fundamental concepts.
2. To learn the basic concepts of assembly language programming, modular and I/O programming.
3. To learn to interface microprocessors with various peripherals.

OUTCOMES:

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

1. Understand the architecture of 8086 microprocessor.
2. Explain the instruction set and system bus structure of 8086 microprocessor.
3. Describe the various instructions of assembly language programming and write simple programs.
4. Understand the basic concepts of modular and I/O programming.
5. Describe serial and parallel I/O interfacing.
6. Understand the architecture of 8051 microcontroller.

Unit	Course Content	L	P	T
1	**Introduction:** Overview of Microcomputer Systems – Data Representation – Addresses – General Operation of a Computer. **8086 Architecture:** CPU Architecture – Internal Operation – Machine Language Instructions – Instruction Execution Timing.	12	-	2
2	**Assembler Language Programming:** Directives and Operators - Assembler Instruction Format – Data Transfer Instructions – Arithmetic Instructions – Branch Instructions – Loop Instructions – NOP and HLT Instructions – Flag Manipulation Instructions – Logical Instructions – Shift and Rotate Instructions – Byte and String Manipulation Instructions.	15	-	2
3	**Modular Programming:** Linking and Relocation – Stacks – Procedures – Interrupts and Interrupt Routines – Macros. **System Bus Structure:** Basic configurations of 8086 – System bus timing. **I/O programming**: Fundamental I/O Considerations – Programmed I/O – Interrupt I/O – Block Transfers and DMA.	18	-	2
4	**I/O Interfacing:** Serial Communication Interfaces – Parallel communication interface – D/A and A/D Interface - Timer – Keyboard /Display controller – Interrupt controller – DMA controller.	10	-	2
5	**Introduction to Microcontroller 8051:** Microcontrollers and Embedded Processors – Pin-out functions of 8051 – Architecture – Addressing Modes – Instruction set.	10	-	2
Total		**65**	**-**	**10**

TEXT BOOKS

1. Yu-cheng Liu & Glenn A. Gibson, *Microcomputer Systems: The 8086/8088 Family*, 2nd Edition, Prentice-Hall, 2009.
2. Muhammad Ali Mazidi & Janice Gillispie Mazidi, *The 8051 Microcontroller and Embedded Systems*, Pearson Prentice Hall, 2006.

REFERENCE BOOK

1. Douglas V. Hall, *Microprocessors and Interfacing – Programming and Hardware* -TMH, 1992, 2nd Edition

4CA19b - Principles of Compiler Design

OBJECTIVES:

1. To learn the fundamentals of finite automata.
2. To acquire knowledge of the design aspects in the various steps of a language compiler.

OUTCOMES:

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

1. Explain the steps involved in the design of a lexical analyser.
2. Construct a state diagram, given a state table.
3. Minimize the number of states in a given state diagram.
4. Describe the various types of parsers and the design aspects involved.
5. Construct a parse tree for a given expression.
6. Apply algorithms to parse a given expression.
7. Understand syntax-directed translation schemes and symbol tables.
8. Learn Code Optimization principles and Code generation.
9. Understand code optimization techniques.

Unit	Course Content	L	P	T
1	**Introduction to Compilers:** Compilers and Translators - Why we need translators - The structure of compiler - Lexical analysis - Syntax analysis - Intermediate code generation – Optimization – Code generation - Bookkeeping - Error handling. **Finite Automata and Lexical Analysis:** The role of the lexical analyzer – Regular expressions - Finite automata - From regular expressions to finite automata - Minimizing the number of states of a DFA - A language for specifying lexical analyzers - Implementation of lexical analyzer.	12	-	2
2	**Syntactic Specification of Programming Languages:** Context-free grammars - Derivation of parse trees - Capabilities of CFGs. **Basic Parsing Techniques:** Parsers - Shift-reduce parsing - Operators precedence parsing - Top-down parsing - Predicitive parsers.	13	-	2
3	**Automatic Construction of Efficient Parsers:** LR parsers - The canonical collection of LR(0) items - Constructing SLR parsing tables - Constructing canonical LR parsing tables - Constructing LALR parsing tables – Using ambiguous grammars.	15	-	2
4	**Syntax-Directed Translation:** Schemes - Implementation of syntax directed translators - Intermediate code - Postfix notation - Parse trees and syntax trees - Three-address code, Quadruples and triples - Translation of assignment statements - Boolean expressions - Statements that alter the flow of control - Postfix translations - Translation with the top-down parser.	10	-	2
5	**Symbol tables:** The contents of symbol tables - Data structures for symbol tables - Representing scope information. **Error Detection and Recovery:** Errors – Lexical phase errors – Syntactic phase errors, Semantic errors. **Introduction to Code Optimization:** The principle sources of code optimization – Loop optimization – The DAG representation of basic blocks – Value numbers and Algebraic laws.	15	-	2
Total		**65**	**-**	**10**

TEXT BOOK

1. Alfred V. Aho., Jeffrey D. Ulman, *Principles of Compiler Design*, Narosa Publishing House, New Delhi, 1989.

REFERENCE BOOKS

1. Alfred V. Aho, Ravi Sethi, Jeffrey D. Ullman, *Compilers: Principles, Techniques and Tools*, Pearson Education, VIII Ed. 2002.
2. Torben Ægidius Mogensen, *Basics of Compiler Design*, lulu.com, 2007.

Elective II

#	Elective Stream	Elective II
1	Communication Systems	Stream 1: 4CAE2WT – Wireless Technology
2	Security Systems	Stream 2: 4CAE2CF – Cyber Forensics
3	High-performance Computing	Stream 3: 4CAE2GC – Grid Computing
4	Intelligent Systems	Stream 4: 4CAE2IP – Digital Image Processing
5	Information Systems	Stream 5: 4CAE2DM – Data Mining
6	Software Testing	Stream 6: 4CAE2ST – Software Testing

4CAP7d - Practical VII: Microprocessor Laboratory

OBJECTIVES:

1. To learn to write simple assembly language programs.
2. To debug and execute programs using MASM software.

OUTCOMES:

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

1. Write programs to perform arithmetic and string operations.
2. Write programs to implement specific mathematical algorithms on a microrpocessor.

Unit	Course Content	L	P	T
1	Addition and Subtraction of two numbers	-	6	-
2	Multiplication and Division of two numbers	-	6	-
3	Computing LCM of n Numbers		6	
4	Computing GCD of n Numbers		7	
5	Sorting numbers in Ascending/Descending Order		7	
6	Linear Search with Screen message		8	
7	Matrix Multiplication		8	
8	Computing Factorial		9	
9	Computing Fibonacci Number		9	
10	Moving string of characters on the CRT		9	
Total		**-**	**75**	**-**

4CAP8a - Practical VIII: Mobile Application Development Laboratory

OBJECTIVES:

1. To learn to code, debug and run Android Apps using Android Studio.

OUTCOMES:

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

1. Write programs to create Android Apps.
2. Code, debug and run the programs.
3. Create Apps for the given problems through Android programming.
4. Design and develop simple Android Apps.

Unit	Course Content	L	P	T
1	Create a Hello World App. Run the app on the emulator and on the Physical Device.	-	2	-
2	Create an app to accept the user's name and to greet him/her.	-	2	-
3	Develop an App named AppRater that suggests other Applications for users to download and try. The purpose of the application is to share fun and interesting applications with other users. The users can then rate the applications.	-	3	-
4	Develop an App to select a set of items from the given list using the Check Box component. The application is used to place an order once the items are selected.	-	4	-
5	Create an App with two different Activities using the user interface, Intent. Run the app on the emulator which allows the user to navigate from one activity to the other once a button is clicked.		4	-
6	Design an App using the List View Component to add desired items to a list.	-	4	-
7	Demonstrate an App using Menu groups in Android.	-	4	
8	Create an Application to demonstrate a Radio group button in Android.	-	4	
9	Develop an App to demonstrate the Time picker dialog in Android.	-	4	
10	Develop an app with two buttons named Save and Load using the concept of Internal Storage. Create a file by specifying its name. File must be saved and loaded when the appropriate buttons are clicked.	-	6	-
11	Develop an Application with a button called Send to send text messages from one device to another using the SMS Action in Android.	-	6	-
12	Create an Internet Connection app. Run the app on the emulator to check whether the emulator is connected to the network or not.		7	
13	Create a simple Animation App with an Image View icon to perform following activities i. Zoom In/ Zoom Out ii. Clockwise/AntiClockwise iii. Move iv. Fade v. Blink		12	
14	Create an app to demonstrate a simple login page which authenticates existing users and allows new users to sign up.		13	
Total		-	**75**	-

Semester V
5CA21b - Computer Graphics

OBJECTIVES:

1. To learn the basic concepts of computer graphics devices.
2. To learn the mathematical basis of and how to apply 2D and 3D transformation.
3. To learn some fundamental algorithms in raster scan graphics.
4. To learn various curve representations, clipping transformations and algorithms.
5. To learn various hidden line and hidden surface removal algorithms.

OUTCOMES:

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

1. Explain the working of various 2D and 3D graphical devices.
2. Know the mathematical basis for 2D and 3D transformations.
3. Apply 2D and 3D transformations on a graphical image.
4. Understand basic algorithms for line-drawing, circle-drawing, image compression, polygon-filling and aliasing for raster scan systems.
5. Explain the various types of plane and space curves.
6. Apply clipping and hidden line/surface removal algorithms.

Unit	Course Content	L	P	T
1	**Basics of Computer Graphics:** Introduction to Computer Graphics - Area of Computer Graphics - Design and Drawing - Animation Multimedia applications - Simulation – **Graphics Devices:** Cathode Ray Tube – CRTs for Color Display: Beam Penetration CRT - The Shadow - Mask CRT - Direct View Storage Tube - Tablets - The light pen – 3D devices.	15	-	2
2	**2D Transformations:** Introduction to Transformations - Identity Transformation - Scaling - Reflection - Shear - Rotation - Translation - Rotation about an Arbitrary Point - Combined Transformation - Homogeneous Coordinates - 2D Transformations using Homogeneous Coordinates. **3D Transformations:** Scaling – Translation - Rotation - Shearing - Reflection	10	-	2
3	**Graphics Primitives:** Scan-Conversion of a Line (Digital Differential Analyzer Algorithm - Bresenham's Line Drawing Algorithm - Scan-Conversion of Circle (Bresenham's Method of Circle Drawing - Midpoint Circle Algorithm). **Scan-Conversion:** Conversion - Inside–Outside Test – Non Zero Number Winding Test - Scan Conversion of Character - Aliasing - Half-toning **Polygon Filling:** Seed Fill Algorithms (Boundary Fill, Flood Fill) - Scan Line Algorithm	15	-	2
4	**Viewing and Clipping:** Introduction to Viewing and Clipping – 2D Viewing Pipeline - Window–to-Viewport Coordinate Transformation - Two- Dimensional Clipping: Point Clipping, Line Clipping, Cohen-Sutherland line clipping algorithm. **Introduction to Curves:** Plane Curves**: C**urve representation – Non-Parametric curves - Parametric curves **Space Curves:** Applications and mathematical representation of Space Curves - Bezier Curve Representation (Mathematical Representation, Properties)	15	-	2

Unit	Course Content	L	P	T
5	**Visible Surfaces:** Introduction to visible and hidden surfaces - Coherence for visibility - Extents and Bounding Volumes - Back Face Culling - Painter's Algorithm - Z-Buffer Algorithm - Floating Horizon Algorithm	10	-	2
Total		**65**	**-**	**10**

TEXT BOOKS

1. D.F. Rogers, J.A.Adams, *Mathematical Elements for Computer Graphics*, II Edition, TMH, New Delhi, 2002.
2. D.F. Rogers, *Procedural Elements for Computer Graphics*, II Edition, TMH, New Delhi, 2001.
3. D.Hearn and M.P. Baker, *Computer Graphics*, II Edition, Pearson Education, 2004.

REFERENCE BOOKS

1. W.M. Newmann and R.F. Sproull, *Principles of Interactive Computer Graphics*, TMH, New Delhi.
2. S. Harrington, *Fundamentals of Computer Graphics*, TMH, New Delhi, 1989.

5CA22d – Computer Networks

OBJECTIVES:
1. To learn the basic terminology of computer networking.
2. To learn OSI Reference Model with the functions of and protocols and algorithms involved in each layer.
3. To learn basics of TCP/IP protocol suite.
4. To learn the basics of cryptography and network security.

OUTCOMES:
Upon completion of the course, the student will be able to
1. Describe the basic aspects of computer networks, viz. network topologies, transmission modes, network categories, protocols and standards.
2. Understand in order to compare and contrast the features of OSI Reference Model and TCP/IP protocol suite.
3. Explain the responsibilities of each of the seven network layers.
4. Understand the protocols and algorithms connected with each layer.
5. Solve problems using error detection and correction methods.
6. Apply routing algorithms to calculate the shortest route in a given network.
7. Apply the Token Bucket Algorithm to avoid congestion in a given network.

Unit	Course Content	L	P	T
1	**Network Basics:** Introduction– Network Hardware – Software – Topology - Reference Models (OSI & TCP/IP) - Physical Layer – Transmission Media (Guided & Unguided) - Switching methods (Circuit Switching, Packet Switching) – Internet working - Communication satellites.	10	-	2
2	**Data Link Layer:** Design issues – Framing, Flow control, Error control - Error detection and correction – Elementary Data Link protocols – Sliding Window protocols.	14	-	2
3	**Medium Access Control Subl layer:** Medium Access Layer – Channel Allocation Problem – Multiple Access Protocols – Ethernet – Wireless LANs – Bluetooth.	15	-	2
4	**Network Layer :** Design issues – Routing Algorithms – Congestion control algorithms – IP Protocol – IP Address – Internet Control Protocol.	14	-	2
5	**Transport Layer and Application Layer:** Connection management – Addressing, Establishing and Releasing a connection – Simple Transport Protocol – Internet Transport Protocol (TCP) – DNS - E–mail – Network Security – Cryptography.	12	-	2
Total		**65**	**-**	**10**

TEXT BOOKS
1. A. S. Tannenbaum, *Computer Networks*, Fourth Edition, Pearson Education Inc., 2003.
2. Behrouz Forouzan, *Introduction to Data Communication and Networking*, Tata McGraw-Hill, 1998.

REFERENCE BOOKS
1. Fred Halsall, *Data Communication, Computer Networks and Open Systems*, Addison Wessley, 1995.
2. D. Bertsekas and R. Gallagher, *Data Networks*, Prentice Hall of India, New Delhi, 1992.
3. Lemarca, *Communication Networks*, McGraw Hill, 2002.

5CA23 – Artificial Neural Networks

OBJECTIVES:

1. To learn the fundamental theory and concepts of neural networks for creating computationally intelligent systems.
2. To understand the architecture, learning algorithms and issues of various feed forward and feed backward neural networks.

OUTCOMES:

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

1. Understand the need and basic concepts of neural networks.
2. Describe the various neural computational models.
3. Understand supervised and unsupervised learning methods.
4. Understand how to train a neural nework.
5. Explain the architecture of feed-forward and feed-backward neural networks.
6. Find the output of a neural networks using various methods, given the inputs, input weights and learning rule.
7. Describe the basic concepts of expert systems.
8. Understand the basic concepts of pattern recognition using neural networks.

Unit	Course Content	L	P	T
1	**Introduction:** Background – Knowledge-based information processing – Neural information processing – Hybrid intelligence. **Basic Neural Computational Models:** Basic Concepts of Neural Networks – Interface and Learning – Classification Models – Association Models – Optimization Models – Self-organization Models.	15	-	2
2	**Learning:** Supervised and Unsupervised Learning – Statistical Learning – AI Learning – Neural Network Learning – Genetic Algorithms. **Knowledge-Based Neural Networks**: Rule Based Neural Networks - Network Training – Network Revision – Issues – Examples of Theory Revision – Decision Tree-based NN – Constraint-based NN.	10	-	2
3	**Incremental Learning:** Introduction – Fundamental principles - Symbolic Methods – Neural Network Approaches – The Incremental RBCN. **Mathematical Modeling:** Introduction – Mathematical modeling in general - Application of NN – Neural Networks as Mathematical Models – Knowledge-based Approaches.	15	-	2
4	**Complex Domains:** Expert System Heuristics – Hierarchical Models – Hybrid Models – Parallel Models – Differentiation Models – Control Networks. **Discovery:** Symbolic Methods – NN Methods.	10	-	2
5	**Structures and Sequences:** Connectionist Representation – A Hybrid Network Approach. **Learning Spatiotemporal Patterns:** Spatiotemporal Neural Network – Learning Procedures – Knowledge-based Approaches.	15	-	2
Total		**65**	**-**	**10**

TEXT BOOK

1. LiMin Fu, *Neural Networks in Computer Intelligence*, McGraw Hill International Edition, 1994.

REFERENCE BOOKS

1. Robert J. Schalkoff, *Artifical Neural Networks*, McGraw Hill, 1997.
2. James A. Anderson, *An Introduction to Neural Networks*, PHI, 2001.

5CA24a – UNIX, PHP and MySQL

OBJECTIVES:

1. To learn the basic concepts and commands of UNIX.
2. To learn basic UNIX Shell programming.
3. To learn the basic concepts and programming constructs of PHP.
4. To learn to create and use databases using MySQL.

OUTCOMES:

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

1. Understand file system commands.
2. Understand the concept of pipes and filters.
3. Explain the basic concepts of shell programming
4. Write shell scripts for various applications.
5. Explain the programming constructs of PHP.
6. Write simple PHP programs.
7. Develop simple applications using PHP.
8. Create databases using MySQL and connect to it and manipulate it through a PHP application.

Unit	Course Content	L	P	T
1	**UNIX:** Introduction to Unix – Files and File Organization – File Attributes and Permissions – Standard I/O - Redirection – Pipes and Filters.	10	-	2
2	**Regular Expression:** grep family of commands. **Shell Programming**: Shell Variables – The export Command– The read Command – Positional Parameters – The $? Variable - The exit Commands – Branching Control Structures – Loop-Control Structures – The continue and break Statements - Arithmetic in Shell Programming – The here Document (<<) – The sleep Command – Debugging Scripts – The script Command – The eval Command – The exec Command.	15	-	2
3	**PHP:** Overview of PHP structure and syntax – Creating a first program – Integrating HTML with the PHP – Consideration with HTML inside PHP – Overview of Constants and Variables – Passing variables between pages – Using if/else arguments – Using Includes for Efficient code – Using Functions for Efficient code – Array Syntax – Sorting Arrays – foreach Constructs – Alternate syntax for PHP.	13	-	2
4	**FORM Elements - Letting the user work with Data:** FORM Element – INPUT Element – Processing the Form – Driving the User Input – One Form, Multiple Processing – Radio INPUT Element – Multiple Submit Buttons – Basic Input Testing – Ternary Operator. **Handling and Avoiding Errors:** Error Handling and Creating Error Handling Pages with PHP – Other Methods of Error Handling.	14	-	2
5	**MySQL:** An Introduction to MySQL - How to use phpMyAdmin – How to connect to a database and handle exceptions – How to get and modify data. **How to use SQL to create a MySQL database:** How to work with databases - How to work with tables - How to work with indexes - How to work with users and privileges - Other skills for creating a database.	13	-	2
Total		**65**	**-**	**10**

TEXT BOOKS

1. M.G.Venkateshmuthy, 2009, Introduction to Unix and Shell Programming, Pearson Education India , Delhi.

2. Michael Glass, Yann Le Seoarnec, Elizabeth Naramore, Jeremy Stolz, Jason Gerner, Timothy Boronczyk, Beginning PHP6, Apache, MySQL Web Development, Wiley India Pvt. Ltd., 2011.

3. Joel Murach and Ray Harris, Murach's PHP and MySQL, Murach Publications.

REFERENCE BOOKS

1. B.A. Fozougar, R.Failberg, 2003, Unix and Shell Programming, Thomson.

2. PHP IN ACTION: OBJECTS DESIGN AGILITY, Reiersol dagfinn; Baker Marcus; Shiflett Chris.

Elective III

#	Elective Stream	Elective III
1	Communication Systems	Stream 1: 5CAE3SC – Satellite Communication
2	Security Systems	Stream 2: 5CAE3BS – Biometric Systems
3	High-performance Computing	Stream 3: 5CAE3CC – Cloud Computing
4	Intelligent Systems	Stream 4: 5CAE3PR – Pattern Recognition
5	Information Systems	Stream 5: 5CAE3DW – Data Warehousing
6	Software Testing	Stream 6: 5CAE3ST – Advanced Software Testing

5CAP9b - Practical IX: UNIX, PHP and MySQL Laboratory

OBJECTIVES:

1. To learn to use UNIX commands.
2. To learn to write shell scripts.
3. To use MySQL and PHP to develop simple applications on UNIX.

OUTCOMES:

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

1. Write simple UNIX shell scripts.
2. Write simple programs using PHP over the UNIX operating system.
3. Create a database using MySQL and develop simple applications using PHP.

Unit	Course Content	L	P	T
1.	**Unix Programming :** 1. Write a script that accepts user's age. If it is equal to or greater than 18, print a message saying that this user is allowed to drive any vehicle. If the user's age is below 16, print a message telling the user how many years he or she has to wait before legally being allowed to drive. 2. Check whether the given number is an Armstrong number. 3. Write a shell script to print all prime numbers between m and n. 4. Write a shell script to check whether a given string is palindrome or not. 5. Write a shell script to check file permissions (read / write / execute / exit) and file types (file / directory /size zero) 6. Write a program to change current working directory and display the inode details for each file in the new directory.	-	15	-
2.	**PHP** 1. Create a PHP page which accepts the user name and displays a welcome page for the user with his name being displayed. 2. Write a program that displays a different message, based on the time of day. For example, have the site display 'Good Morning!' if it is accessed in the morning. 3. Write a program that formats a block of text (to be input by the user) based on preferences chosen by the user. Get the user options for color of text, font choice, and size. Display the output on a new page. 4. Write a program that keeps track of how many times a visitor has loaded the page and display the login time of the user using functions. 5. Create code to send a message to an e-mail account, and blind carbon copy (BCC) yourself or another account.	-	25	-
3.	**PHP & MySQL** 1. Create a PHP program that prints the student name and email id of an outstanding student in each class from the database. 2. Create the edit & delete code for the student_detail table. Use the student details code as an example. 3. Design a simple login page which authenticates existing users for a website and allows new users to sign up. 4. Write a program to import Excel data into MySQL database using PHP.	-	35	-
Total		**-**	**75**	**-**

5CAP10b - Practical X: Artificial Neural Networks Laboratory

OBJECTIVES:

1. To gain hands-on experience in understanding the basics of ANN models and pattern recognition tasks.

OUTCOMES:

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

1. Develop solutions to demonstrate basic neural network features.
2. Create neural networks to solve specific problems.

Unit	Course Content	L	P	T
1	**Classification Problem:** 1. Write a program to prove and solve any classification problem by applying logical XOR problem. 2. Create a program to demonstrate the use of Perceptron in classifying simple "AND" problem.	-	12	-
2	**Linear Separability:** 3. Write a Program to prove or disprove the linear separability of two classes by using the Perception Learning Law.	-	12	-
3	**Learning Rules:** 4. Write a Program to implement the Least Mean Square learning rate. 5. Write a Program to implement the steepest descent learning law. 6. Write a Program to implement the Back propagation algorithm for single hidden layer by applying generalized delta rule.	-	17	-
4	**Neural Networks:** 7. Write a program to generate Bayesian decision boundaries 8. Develop a feedforward neural network with a single hidden layer of sigmoidal neurons and a single linear output neuron.	-	12	-
5	**Applications:** 9. Write a Code to Import images and resize them from 512 x 512 pixels to 8 x 8 pixels. 10. Simulate a bidirectional associative memory with the following associations a. $A_1=(0\ 1\ 0\ 1\ 0)^T$ $B_1=(1\ 0\ 0\ 1)^T$ b. $A_2=(1\ 1\ 0\ 0\ 0)^T$ $B_2=(0\ 1\ 0\ 1)^T$	-	22	-
Total		**-**	**75**	**-**

Semester VI

6CAPR - Project Work

OBJECTIVES:

1. To gain real-time experience in software project development in a production environment.

OUTCOMES:

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

1. Understand how to execute a software project from scratch to delivery and deployment.
2. Understand the various processes involved in the engineering of software through practical implementation.
3. Understand how to develop a software solution for the given large problem.
4. Write a project report that incorporates all the stages of software engineering and processes involved in the project.

6CAPV - Project Viva-voce

OBJECTIVES:

1. To learn to present project work done.

OUTCOMES:

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

1. Understand how to make an effective presentation of the project work.
2. Explain the project work and answer technical questions on the work done.

Elective I

Stream 1: 3CAE1MC – Mobile Communication

OBJECTIVES:

1. To learn the fundamental concepts and technologies of mobile and wireless devices.
2. To learn the GSM architecture and protocols.
3. To learn the basic concepts and strategies in mobile network and transport layer.

OUTCOMES:

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

1. Understand the need and fundamental concepts of mobile and wireless devices.
2. Explain the GSM architecture and protocols.
3. Explain the concept of Wireless LAN, HiperLAN and bluetooth technologies.
4. Understand the basic concepts, goals and routing strategies of the mobile network layer.
5. Understand the concepts of mobile transport layer and methods for congestion control.

Unit	Course Content	L	P	T
1	**Introduction:** Mobile and Wireless Devices – Simplified Reference Model – Need for Mobile Computing – Wireless Transmissions – Multiplexing – Spread Spectrum and Cellular Systems - Medium Access Control – Comparisons.	10	-	2
2	**Telecommunication Systems:** GSM – Architecture – Sessions – Protocols – Hand over and Security – UMTS and IMT-2000 – Satellite Systems.	12	-	2
3	**Wireless Networks:** Wireless LAN - IEEE 802.11 – HiperLAN – Bluetooth – Security and Link Management.	13	-	2
4	**Mobile Network Layer:** Mobile IP – Goals – Packet Delivery – Strategies – Registration – Tunneling and Reverse Tunneling – Ad hoc Networks – Routing Strategies.	15	-	2
5	**Mobile Transport Layer:** Congestion Control – Implication of TCP Improvement – Mobility – Indirect – Snooping – Mobile – Transaction-oriented TCP - TCP over wireless – Performance.	15	-	2
Total		**65**	**-**	**10**

TEXT BOOK

1. J. Schiller, *Mobile Communications*, Second Edition, Pearson Education, Delhi, 2003.

REFERENCE BOOKS

1. Sandeep Singhal, Thomas Bridgman, Lalitha Suryanarayana, Danil Mouney, Jari Alvinen, David Bevis, Jim Chan and Stetan Hild, *The Wireless Application Protocol: Writing Applications for the Mobile Internet*, Pearson Education Asia, 2001.

2. Kumkum Garg, *Mobile Computing – Theory and Practice*, Dorling Kindersley India Pvt. Ltd., 2010.

Stream 2: 3CAE1CR – Cryptography and Network Security

OBJECTIVES:
1. To learn the important role of cryptography in network security.
2. To study the mathematical concepts required for understanding the algorithms/techniques of cryptography.
3. To understand public key encryption standards and algorithms.
4. To learn the importance of network security, its principles and security protocols.

OUTCOMES:
Upon completion of the course, the student will be able to
1. Learn of various encryption techniques from classical to modern.
2. Understand the important aspects of number theory used in cryptography.
3. Understand the RSA algorithm and connected protocols.
4. Learn the importance of message authentication and understand the secure hash algorithm.
5. Describe the technique, protocols and standards for digital signature.
6. Explain the concept and types of user authentication, and Kerberos concepts.
7. Describe the various internet security services.

Unit	Course Content	L	P	T
1	**Introduction:** Basic Terminologies – Generic Model for Secure Communication – Requirements of Secure Communication – OSI Security Architecture X.800 – Categories of Cryptographic Systems – Symmetric Encryption Model – Classical Substitution Ciphers.	8	-	2
2	**Mathematical Foundations of Cryptography:** Introduction to Group, Ring and Field – Modular Arithmetic – Primes and Co-Primes – Euclid's Algorithm for GCD – Extended Euclid's Algorithm – Galoi's Finite Fields – Fermat's Little Theorem – Euler's Totient Function – Euler's Theorem – Prime Numbers – Discrete Logarithms – Primality Testing – Chinese Remainder Theorem.	17	-	2
3	**Modern Symmetric Ciphers:** Basic Concepts of Symmetric Ciphers – Claude Shannon's Theory of Diffusion and Confusion – Fiestel Cipher – DES – Avalanche Effect – Multiple DSE – Avalanche Effect – Multiple DES – IDEA – AES – Key Management **Public-Key Cryptography:** Requirements – Data Confidentiality using PKC – RSA Algorithm – Strength of RSA – Key Management.	14	-	2
4	**Authentication Schemes:** Types of Authentication Services – Application Modes of Digital Signatures – Authentication Protocols – Message Digest Hash Function Algorithm – SHA-1 – Digital Signature Schemes. **Centralized Authentication Service:** Simple Authentication Exchange in Open Environment – KERBEROS V.4 – Inter-Kerberi Authentication Sequence – PKI X.509.	16	-	2
5	**Pretty Good Privacy:** Services Supported – R64 Transformation – Public Key Ring and Private Key ring in PGP – S/MIME. **Internet Security Services:** IPSec – Services Provided by IPSec – ISAKMP – SSL/TLS – SET.	10	-	2
Total		**65**	**-**	**10**

TEXT BOOK
1. P. S. Gill, *Cryptography and Network Security*, MacMillan Publishers India Ltd., 2011.
REFERENCE BOOK
1. Atul Kahate, *Cryptography and Network Security*, Tata McGraw Hill, 2008.

Stream 3: 3CAE1PC – Parallel Computing

OBJECTIVES:

1. To learn the design principles, architectures, network topologies and basic programming paradigms for parallel computing.

OUTCOMES:

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

1. Understand the various parallel computer models, issues and architectures.
2. Understand the design principles of processors for various parallel computing architectures.
3. Describe the various network topologies used for parallel computing.
4. Explain the programming models for parallel computing.

Unit	Course Content	L	P	T
1	**Scalability and Clustering:** Evolution of Computer Architecture – Dimensions of Scalability – Parallel Computer Models – Basic Concepts of Clustering – Scalable Design Principles – Parallel Programming Overview – Processes, Tasks and Threads – Parallelism Issues – Interaction / Communication Issues – Semantic Issues in Parallel Programs. - Pipelining and Super scalar processors – Vector Processors – Array Processors – SIMD processors – Systolic architecture - Dataflow.	10	-	2
2	**Enabling Technologies:** System Development Trends – Principles of Processor Design – Microprocessor Architecture Families - Hierarchical Memory Technology – Cache Coherence Protocols – Shared Memory Consistency – Distributed Cache Memory Architecture – Latency Tolerance Techniques – Multithreaded Latency Hiding.	15	-	2
3	**System Interconnects:** Basics of Interconnection Networks – Network Topologies and Properties – Buses, Crossbar and Multistage Switches, Software Multithreading – Synchronization Mechanisms.	13	-	2
4	**Parallel Programming:** Paradigms and Programmability – Parallel Programming Models – Shared Memory Programming.	15	-	2
5	**Message Passing:** Message Passing Paradigm – Message Passing Interface – Parallel Virtual Machine.	12	-	2
Total		**65**	**-**	**10**

TEXT BOOK

1. Kai Hwang, Zhi.Wei Xu, *Scalable Parallel Computing*, Tata McGraw Hill, New Delhi, 2003.

REFERENCE BOOKS

1. David E. Culler, Jaswinder Pal Singh, Anoop Gupta, *Parallel Computing Architecture: A Hardware Software Approach*, Morgan Kaufman Publishers, 1999.

2. Michael J. Quinn, *Parallel Programming in C with MPI & OpenMP*, Tata McGraw-Hill, 2003.

3. Kai Hwang, *Advanced Computer Architecture*, Tata McGraw-Hill, New Delhi, 2003.

Stream 4: 3CAE1LA – Linear Algebra

OBJECTIVES:

1. To learn the methods of Linear Algebra in order to later apply them to machine learning problems and other applications.

OUTCOMES:

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

1. Solve a given system of linear equations.
2. Check for linear dependency between equations.
3. Find the inverse of a given matrix.
4. Explain the Leontief Input-Output Model.
5. Find the determinant of a matrix using Cramer's rule.
6. Find the vector space for a given matrix.
7. Explain the applications of difference equations and Markov chains.
8. Find the Eigen vector and Eigen values for a given matrix.
9. Check the orthogonality of a given matrix.
10. Explain the Gram-Schmidt process.
11. Understand and apply the concept of least squares.
12. Understand inner product spaces and their applications.
13. Diagonalize the given symmetric matrix.
14. Calculate singular value decomposition of a given matrix.
15. Learn to apply the concepts to image processing.

Unit	Course Content	L	P	T
1	**Linear Equations in Linear Algebra**: Systems of Linear Equations - Row reduction and echelon Forms - Vector equations - The matrix equation $Ax = b$ - Solution sets of linear systems - Applications of linear systems - Linear independence - Introduction to linear transformations - The matrix of a linear transformation - Linear models in Business, Science and Engineering.	13	-	2
2	**Matrix Algebra**: Matrix operations - The inverse of a matrix - Characterizations of invertible matrices - Partitioned matrices - Matrix factorizations - The Leontief Input-Output Model - Applications to computer graphics - Subspaces of R^n - Dimension and Rank. **Determinants**: Introduction to determinants - Properties of determinants - Cramer's rule - volume and linear transformations.	14	-	2
3	**Vector Spaces**: Vector spaces and subspaces - Null spaces - column spaces and linear transformations - Linearly independent sets – Bases - Coordinate systems - The dimensions of a vector space – Rank - Change of basis - Applications to Difference Equations - Applications to Markov Chains. **Eigenvalues and Eigenvectors**: Eigenvectors and Eigenvalues - The Characteristic Equation – Diagonalization - Eigenvectors and linear transformations - Complex Eigenvalues - Discrete dynamical systems - Applications to Differential Equations - Iterative estimates for Eigenvalues.	14	-	2
4	**Orthogonality and Least Squares**: Inner product, length and orthogonality - Orthogonal sets - Orthogonal projections - The Gram-Schmidt Process - Least-Squares problems - Applications to linear models - Inner product spaces - Applications of inner product spaces.	14	-	2
5	**Symmetric Matrices and Quadratic Forms**: Diagonalization of symmetric matrices - Quadratic forms - Constrained optimization - The	10	-	2

Unit	Course Content	L	P	T
	singular value decomposition - Applications to Image Processing and Statistics.			
Total		**65**	**-**	**10**

TEXT BOOK

1. David C. Lay, *Linear Algebra and its Applications*, Pearson Education, 2007.

REFERENCE BOOKS

1. Lipschutz, Seymour, *Linear Algebra*, McGraw Hill, Singapore, 1981.
2. Hoffman,Kenneth; Kunze, Ray, Linear Algebra, Second Edition, Prentice Hall, New Delhi, 1990.

Stream 5: 3CAE1IS – Management Information Systems

OBJECTIVES:
1. To learn the basic concepts, techniques and security aspects of Information Systems.
2. To study the contributions of MIS in various functional areas and techniques used for decision-making.
3. To learn the concepts of Expert systems and its role in MIS.

OUTCOMES:
Upon completion of the course, the student will be able to
1. Understand the model of a system and its organizational structure.
2. Understand the types of information and needs at diferent levels.
3. Explain the basic concepts, structure and functions of MIS.
4. Understand the Newell-Simon model.
5. Understand the different models and techniques used for decision-making.
6. Compare and contrast MIS, DSS and Expert System structure.
7. Understand the various auditing and security aspects of MIS.

Unit	Course Content	L	P	T
1	**System Concept:** General Model - Types of systems – Subsystems - Organizational structure and functions - Systems approach to organization - Dynamics to Decision Making - Control by exception - Feedback control - Law of requisite variety - Cases related to Feedback Control. **Information Concepts:** Definition - Types of Information - Quality of information - Value of information - Information needs of managers at different levels - Cases related to Information.	12	-	2
2	**Management Information Systems:** Definitions - Integrated system - MIS vs. Data processing - MIS and other academic disciplines - Structure of MIS based on management activity and functions - Systems concepts to MIS. **Humans as Information Processors:** Newell-Simon model - Limits on Human Information Processing - Characteristics of Human Information - Processing performance	14	-	2
3	**Information Systems for Functional Areas:** Information for financial – Marketing - Inventory control - Production function - Personnel function - Cases related to information requirement for the above functional areas. **Decision Making Systems and Modeling:** Modeling process - Information needed for different phases & decision making - Sensitivity analysis - Static and dynamic models – Simulation - Operations Research Techniques - Heuristic programming - Case studies.	15	-	2
4	**Management Support Systems Overview:** Decision making phases - Concept of decision making - Decision Support Systems - Differences between MIS and DSS. **Executive Information and Support Systems:** Needs – Characteristics - Software and Hardware - Integrated EIS and DSS - EIS implementation.	14	-	2
5	**Expert Systems:** Basic concepts of Expert Systems - Comparison of conventional & Expert Systems - Structure of Expert Systems. **Control audit & security of Information Systems (IS):** Objectives and types of control, Techniques - Need for Auditing of IS - Security of IS.	10	-	2
Total		**65**	**-**	**10**

TEXT BOOKS

1. Gordan Devis, Margrethe H. Olson, *Management Information Systems*, TMH, 2000.
2. Robert Murdick, Joel E. Ross, *Information Systems for Modern Management*, Prentice Hall, 1984.
3. Efraim Turban, *Decision Support and Expert Systems*, III Edition, Pearson Ptr, 1993.
4. Waman S. Jawadekar, *Management Information Systems*, Tata McGraw Hill, 2007.
5. V. Rajaraman, *Analysis and Design of Information Systems*, PHI, 1991.

REFERENCE BOOK

1. Ron Weber, *Information System Control and Audit*, PHI, 1998.

Stream 6: 3CAE1ST – Foundations of Software Testing and Quality Assurance

OBJECTIVES:
1. To learn the concepts of Software Quality Assurance.
2. To understand the basic concepts of testing, test design techniques and testing tools.
3. To get prepared for ISTQB Certified Tester Foundation Level (CTFL) examination.

OUTCOMES:
Upon completion of the course, the student will be able to

1. Understand the fundamental quality standards in SQA.
2. Understand the Metrics in a software process.
3. Describe the principles, processes, static techniques of testing.
4. Differentiate among the various test design techniques.
5. Understand how to do Test Management.
6. Understand the types and use of testing tools.

Unit	Course Content	L	P	T
1	**Software Quality Assurance:** Quality concepts – Software Quality Assurance issues and activities – Software reviews – Formal technical review – Formal approaches to SQA – Statistical SQA – Software reliability – SQA plan - ISO 9000 quality standards – CMMI quality standards.	10	-	-
2	**Metrics:** Metrics in the process and project domains – Software measurement – Metrics for software quality – Integrating metrics within the software process – Metrics for small organizations – Establishing a software metric program.	10	-	-
3	**Fundamentals of Testing:** Why testing is necessary – What is testing – Testing principles – Fundamental test process – The psychology of testing. **Testing throughout the software life cycle:** Software developmnet models – Test levels – Test types : the targets of testing – Maintenance testing. **Static Techniques:** Reviews and the test process – Review process – Static analysis by tools.	16	-	-
4	**Test Design Techniques:** Identifying test conditions and designing test cases – Categories of test design techniques – Specification-based or white-box techniques – Experience-based techniques – Choosing a test technique.	12	-	9
5	**Test Management:** Test organization – Test plans, estimates and strategies – Test progress monitoring and control – Configuration management – Risk and testing – Incident management. **Tool Support for Testing:** Types of test tools – Effective use of tools: Potential benefits and risks – Introducing a tool into an organization.	12	-	6
Total		**60**	**-**	**15**

TEXT BOOKS
1. Roger Pressman, *Software Engineering – A Practitioner's Approach*, 6th Edition, Tata McGraw Hill, 2010.
2. Dorothy Graham, Erik Van Veenendaal, Isabel Evans, Rex Black, *Foundations of Software Testing*, Cengage Learning EMEA, 2008.

REFERENCE BOOKS
1. Renu Rajani, Pradeep Oak, *Software Testing – Effective Methods, Tools and Techniques*, Tata McGraw Hill, 2011.

2. Cem Kaner, Jack Falk, Hung Quoc Nguyen, *Testing Computer Software*, 2nd Edition, Wiley India, 2012.

WEBSITES
1. istqbexamcertification.com
2. www.istqb.in
3. www.istqb.org

Elective II

Stream 1: 4CAE2WT – Wireless Technology

OBJECTIVES:

1. To learn the architecture, transmission techniques and principles behind working of wireless networks.
2. To learn the fundamentals of different wireless technologies.

OUTCOMES:

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

1. Understand the basic concepts and characteristics of wireless networks.
2. Explain the different transmission techniques.
3. Understand the principles behind wireless network operation.
4. Describe the basic concepts and mechanisms of wireless LAN, WAN, ATM HIPERLAN, WPAN.
5. Explain the architecture, technologies and performance measures of wireless geolocation systems.

Unit	Course Content	L	P	T
1	**Introduction:** Introduction to Wireless Networks - Different Generations of Wireless Networks **Characteristics of the Wireless Medium:** Introduction – Radio Propagation Mechanisms – Path - Loss Modeling and Signal Coverage – Effects of Multipath and Doppler - Channel Measurement and Modeling Techniques – Simulation of the radio Channel.	10	-	2
2	**Physical Layer Alternatives for Wireless Networks:** Applied Wireless Transmission Techniques - Short distance Base Band Transmission - UWB Pulse Transmission – Carrier modulated Transmission – Digital Cellular Transmissions – Broadband Modem for Higher Speed - Spread spectrum Transmissions - High speed modems for spread spectrum Technology - Diversity and Smart receiving Techniques – Comparison of Modulation Schemes - coding Techniques for wireless Transmissions. **Wireless Medium Access Alternatives:** Fixed Assignment Access for Voice – Oriented Networks - Random access for data oriented Networks – Integration of Voice and Data Traffic.	15	-	2
3	**Principles of Wireless Network Operation :** Network Planning – Wireless Network Topologies – Cellular Topology – Cell Fundamentals – Signal to Interference Ratio Calculation – Capacity Expansion Techniques – Network Planning for CDMA Systems - Wireless Network operation - Mobility Management – Radio Resources and Power Management – Security in Wireless Networks **Wireless WANs:** Introduction to GSM – Mechanisms to support a mobile environment – communications in the infrastructure – CDMA Technology, IS-95 and IMT – 2000 – Mobile Data Networks - Data oriented CDPD Network – GPRS and Higher data rates – SMS in GSM – Mobile Application Protocols.	14	-	2
4	**Wireless LANs:** Introduction to Wireless LANs – Historical Overview of the LAN Industry – Evolution of the WLAN Industry	13	-	2

Unit	Course Content	L	P	T
	– Wireless Home Networking – IEEE 802.11 – The PHY Layer – MAC Sub layer – MAC Management Sub layer **Wireless ATM and HIPERLAN:** Wireless ATM – HIPERLAN – HIPERLAN-2			
5	**Ad Hoc Networking and WPAN:** IEEE 802.15 WPAN – Home RF – Bluetooth – Interference between Bluetooth and 802.11 **Wireless Geolocation Systems:** Wireless Geo location - Wireless Geo location System Architecture - Technologies for Wireless Geo location - Geo location Standards for E-911 Services – Performance measures for Geo location Systems	13	-	2
Total		**65**	**-**	**10**

TEXT BOOK

1. Kaveh Pahlavan, Prashant Krishnamurthy, *Principles of Wireless Networks*, Pearson Education, Delhi, 2004.

REFERENCE BOOKS

1. Theodre S. Rappaport, *Wireless Communications: Principles and Practice*, Pearson Education, Delhi, 2002.
2. William Stallings, *Wireless Communications and Networks*, Pearson Education, Delhi, 2002.
3. Martyn Mallick, *Mobile and Wireless Design Essentials*, Wiley, 2003.
4. Kamilia Feher, *Wireless Digital Communications*, Prentice Hall of India, Delhi, 2002.

Stream 2: 4CAE2CF – Cyber Forensics

OBJECTIVES:

1. To learn the fundamentals of computer forensics technology and services.
2. To learn how to collect evidence using data recovery procedures.
3. To learn to analyze and validate forensics data using various tools.

OUTCOMES:

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

1. Explain the fundamentals of computer forensics and the types of technology.
2. Describe methods for evidence collection and data recovery.
3. Explain the hardware and software tools used for evidence recovery.
4. Understand address data hiding techniques.
5. Understand various email investigation processes.
6. Identify the vulnerabilities and explain the acquisition procedures for mobile devices.

Unit	Course Content	L	P	T
1	**Overview of Computer Forensics Technology -** Computer Forensics Fundamentals - Types of Computer Forensics Technology - Types of Vendor and Computer Forensics Services.	13	-	2
2	**Computer Forensics Evidence and Capture:** Data Recovery **-** Evidence Collection and Data Seizure – Duplication and Preservation of Digital Evidence – Computer Image Verification and Authentication.	13	-	2
3	**Computer Forensics Analysis:** Discover of Electronic Evidence – Identification of Data – Reconstructing Past Events – Networks.	13	-	2
4	**Current Computer Forensics Tools:** Evaluating Computer Forensics Tools Needs: Types of Computer Forensics Tools – Tasks performed by Computer Forensics Tools – Computer Forensics software tools – Computer Forensics hardware tools. **Computer Forensics Validation:** Validating Forensic Data – Addressing Data Hiding Techniques	13	-	2
5	**E-Mail Investigation:** Exploring the role of E-Mail in Investigations – Exploring the roles of the client and the server in E-Mail – Investigating E-Mail crimes and violations – Using Specialized E-Mail Forensics Tools. **Cellphone and Mobile Device Forensics:** Understanding Mobile Device Forensics – Understanding Acquisition Procedures for Cell Phones and Mobile Devices.	13	-	2
Total		**65**	**-**	**10**

TEXT BOOK

1. John R. Vacca, *Computer Forensics*, Firewall Media, 2004.
2. Bill Nelson, Amelia Phillips and Cristopher Steuart, "*Guide to Computer Forensics and Investigations*" Third Edition, 2010.

REFERENCE BOOKS

1. Chad Steel, *Windows Forensics*, Wiley India, 2006.
2. Majid Yar, *Cybercrime and Society*, Sage Publications, 2006.
3. Robert M Slade, *Software Forensics*, Tata McGrawHill, 2004.

Stream 3: 4CAE2GC – Grid Computing

OBJECTIVES:
1. To understand the basic concepts of grid computing.
2. To learn grid computing architecture, core components and services.

OUTCOMES:
Upon completion of the course, the student will be able to
1. Explain the fundamental concepts of grid and utility computing, the classification of grid computing organizations and their roles.
2. Describe the problems of coordinated resource sharing, virtual organization formation, and a protocol architecture solution for Grid problems.
3. Explain the current and prominent technology initiatives that are affecting the recent Grid Computing revolution.
4. Explain the merging Grid Services Architecture with the Web Services Architecture.
5. Explain the concept of Open Grid Service Architecture, GLOBUS GT3 Toolkit Architecture, its core components and services.

Unit	Course Content	L	P	T
1	**Introduction:** Early Grid Activities - Current Grid Activities - An Overview of Grid Business Areas - Grid Applications - Grid Infrastructure. **Grid Computing Organizations and their Roles:** Organizations Developing Grid Standards and Best Practice Guidelines - Organizations Developing Grid Computing Toolkits and the Framework - Organizations Building and using Grid-Based Solutions to Solve Computing - Data and Network Requirements - Commercial Organizations Building and using Grid-Based Solutions.	10	-	2
2	**The Grid Computing Anatomy & Road Map:** The Grid Problem - Autonomic Computing - Business on Demand and Infrastructure Virtualization - Service-Oriented Architecture and Grid - Semantic Grids.	12	-	2
3	**Architectures:** Service-Oriented Architecture - Web Services Architecture – XML, Related Technologies and their Relevance to Web Services - XML Messages and Enveloping - Service Message Description Mechanisms - Relationship between Web Service and Grid Service - Web Service Interoperability and the Role of the WS-I Organization. **OGSA Overview:** OGSA Architecture and Goal, Commercial Data Center (CDC), National Fusion Collaborator (NFS), Online Media and Entertainment	15	-	2
4	**OGSA Platform Components:** Native Platform Services and Transport Mechanisms - OGSA Hosting Environment - Core Networking Services Transport and Security - OGSA Infrastructure - OGSA Basic Services. **Open Grid Services Infrastructure (OGSI):** Grid Services - A High-Level Introduction to OGSI - Technical Details of OGSI Specification - Introduction to Service Data Concepts - Grid Service: Naming and Change Management Recommendations.	15	-	2
5	**OGSA Basic Services:** Common Management Model (CMM) - Service Domains - Policy Architecture - Security Architecture - Metering and Accounting - Common Distributed Logging - Distributed Data Access and Replication. **GLOBUS GT3 Toolkit:** Architecture.	13	-	2
Total		**65**	**-**	**10**

TEXT BOOK

1. Joshy Joseph, Craig Fellenstein, *Grid Computing*, Pearson Education, Delhi, 2007.

REFERENCE BOOK

1. Ahmar Abbas, *Grid Computing: A Practical Guide to Technology and Applications*, Firewall Media, 2008.

Stream 4: 4CAE2IP – Digital Image Processing

OBJECTIVES:

1. To gain knowledge of the various characteristics and aspects of digital images.
2. To learn how to apply spatial and frequency filters for intensity and image enhancements.
3. To learn the methods of image compression and restoration.
4. To learn the basics of colour image processing.

OUTCOMES:

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

1. Understand the fundamentals of digital image processing, such as digitization, sampling, quantization, and 2D-transforms.
2. Explain the basics of colour image processing.
3. Understand simple image enhancement techniques in spatial and frequency domains.
4. Understand the concept of filters.
5. Explain image compression and restoration techniques.

Unit	Course Content	L	P	T
1	**Introduction:** Steps in Image Processing – Image Acquisition, representation, sampling and quantization, relationship between pixels – colour models, basics of colour image processing	10	-	2
2	**Image Enhancement in Spatial Domain:** Some basic gray level transformations – Histogram processing – Enhancement using Arithmetic and logic operations – basics of spatial filtering and smoothing.	14	-	2
3	**Image Enhancement in Frequency Domain:** Introduction to Fourier Transform – 1D, 2D, DFT and its inverse transform, smoothing and sharpening filters	15	-	2
4	**Image Restoration:** Model of degradation and restoration process – noise models – restoration in the presence of noise – periodic noise reduction – image segmentation – thresholding and region based segmentation	14	-	2
5	**Image Compression:** Models – Information Theory – Error free compression – Lossy compression – predictive and transform coding, JPEG Standard	12	-	2
Total		**65**	**-**	**10**

TEXTBOOK

1. R. C. Gonzalez, R. E. Woods, *Digital Image Processing*, 2nd Edition, Pearson Education, 2002.

REFERENCE BOOKS

1. Pratt W. K., *Digital Image Processing*, John Wiley and Sons, 3rd Edition.
2. Rosenfled A., Kak A. C., *Digital Picture Processing*, Vol. I and II, Academic Press, 1982.
3. Anil K. Jain, *Fundamental of Digital Image Processing*, 2nd Edition, Prentice Hall of India, New Delhi, 1994.

Stream 5: 4CAE2DM – Data Mining

OBJECTIVES:

1. To appreciate the types of problems for which Data Mining is used.
2. To learn the various issues involved in Data Mining, and how to handle them.

OUTCOMES:

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

1. Understand the concept of data discovery in various types of databases, and the need for data mining.
2. Understanding the various methods of data preprocessing.
3. Understand the need for data reduction and strategies to perform data reduction.
4. Learn the rules and algorithms involved in association rule mining.
5. Understand supervised and unsupervised learning techniques, including classification, prediction, clustering and outlier analysis.
6. To understand the concepts of web mining and spatial data mining.

Unit	Course Content	L	P	T
1	**Introduction**: Data Mining tasks – Data Mining versus Knowledge Discovery in Data bases – Relational databases – Data warehouses – Transactional databases – Object oriented databases – Spatial databases – Temporal databases – Text and Multimedia databases – Heterogeneous databases - Mining Issues – Metrics – Social implications of Data mining.	8	-	2
2	**Data Preprocessing**: Why Preprocess the data – Descriptive data summarization-Data cleaning – Data Integration – Data Transformation. **Data Reduction Strategies:** Data cube aggregation - Attribute subset Selection – Dimensionality Reduction - Data Compression -- Numerosity Reduction – Clustering - Sampling.	14	-	2
3	**Association Rule Mining:** Basic concept and road map – Mining Single Dimensional Association Rules: The Apriori Algorithm – Improving efficiency of Apriori algorithm - Multilevel Association Rules: Approaches to mining Multilevel Association Rules – Multidimensional Association Rules using Static discretization of quantitative attributes – Constraint Based Association Mining.	14	-	2
4	**Classification Techniques:** Issues regarding Classification and Prediction – Classification by Decision Tree induction – Bayesian Classification – Classification by Backpropagation – Classifiers accuracy: Estimating Classifier Accuracy. **Prediction Techniques:** Linear Regression Model - Multiple Regression Model - Non Linear Regression Model - Other regression Models.	14	-	2
5	**Cluster Analysis:** Categorization of major Clustering Methods – Classical Partitioning Clustering Method: K-Means method, K-Medoid Method - Hierarchical Clustering Methods: Agglomerative Hierarchical Clustering, Decisive Hierarchical Clustering Methods – Density Based Clustering Methods: DBSCAN. **Outlier Analysis:** Statistical Distribution based outlier detection - Distance based outlier detection. **Overview of Advanced Topics:** Web Mining - Spatial Data mining.	15	-	2
Total		**65**	**-**	**10**

TEXT BOOK

1. Jiawei Han, Micheline Kamber, *Data Mining Concepts and Techniques*, Second Edition, Elsevier, 2006.

REFERENCE BOOKS

1. Margaret H. Dunham, *Data Mining – Introductory and Advanced Topics*, Pearson, 2006.

2. S. N. Sivananda, S. Sumathi, *Data Mining*, Thomson Learning, Chennai, 2006.

Stream 6: 4CAE2ST – Software Testing

OBJECTIVES:

1. To learn test process models and risk management in testing.
2. To learn different test techniques, review methods and tools for test automation.
3. To get prepared for ISTQB Advanced Certification for Advanced Test Analyst.

OUTCOMES:

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

1. Compare and contrast different Test Process Models.
2. Analyze Risks and apply Risk Mitigation Processes.
3. Explain different specification-based and structure-based testing techniques.
4. Understand the basic concepts of static and dynamic analysis methods.
5. Describe the quality attributes for domain and technical testing.
6. Explain the various types of test reviews.
7. Understand methods and tools for test automation.

Unit	Course Content	L	P	T
1	**Test Basics:** Testing in the Software Lifecycle – Specific systems – Metrics and measurement – Ethics. **Testing Processes:** Test Process Models – Test planning and control – Test analysis and design: Functional test objectives, Test oracles, Standards, Static tests, Metrics – Test implementation and execution: Test procedure and readiness, Test environment readiness, Blended test strategies, Starting test execution, Running a single test procedure, Logging test results, Use of amateur testers, Standards, Metrics – Evaluating exit criteria and reporting: Test suite summary, Defect breakdown, Confirmation test failure rate, System test exit review, Standards – Evaluating exit criteria and reporting exercise - Test closure activities.	10	-	2
2	**Test Management:** Test management documentation – Test plan documentation templates – Test estimation – Scheduling and test planning – Test progress monitoring and control – Business value of testing – Distributed, outsourced and insourced testing – Risk-based testing: Risk management, Risk identification, Risk analysis or risk assessment, Risk mitigation or risk control, An example of risk identification and assessment results, Risk-based testing throughout the lifecycle, Risk-aware testing standards – Risk-based testing exercises - Failure mode and effects analysis: Test management issues. **Test Techniques** **Specification-based techniques:** **Equivalence Partitioning:** Avoiding equivalence partitioning errors - Composing test cases with equivalence partitioning - equivalence partitioning exercise. **Boundary Value Analysis:** Examples of equivalence partitioning and boundary values - Number of boundary values - Boundary value exercise.	10	-	2
3	**Specification-based techniques (contd):** **Decision Tables:** Collapsing columns in the table - Cause-effect graphs - Combining decision table testing with other techniques - Nonexclusive rules in decision tables - Decision table exercise. **Use Cases:** Use cases - Use case exercise.	11	-	8

Unit	Course Content	L	P	T
	State-based Testing: State-based testing and state transition diagrams - Superstates and substates - State transition tables - Switch coverage - State testing with other techniques - State testing exercise. **Pairwise testing:** Pairwise testing - Pairwise testing exercise. **Classification trees:** Classification trees exercise **Deriving tests from the test basis:** Deriving tests from the test basis exercise.			
4	**Structure-based techniques:** Defect-based and Experience-based techniques – Defect taxonomies – Error guessing – Checklist testing – Exploratory testing – Test charters – Software attacks – An example of effective attacks – Other attacks – Common themes – Exercises. **Static analysis:** Introduction. **Dynamic analysis:** Introduction. **Tests of Software Characteristics:** **Quality Attributes for Domain Testing:** Functional accuracy – Functional suitability – Functional interoperability – Functional interoperability exercise – Functional security – Accessibility – Usability – Usability exercise. **Quality Attributes for Technical Testing:** Technical security – Security attacks – Reliability – Efficiency testing – Maintainability testing – Portability testing.	13	-	2
5	**Reviews:** Principles of reviews – Types of reviews – Introducing reviews – Success factor for reviews: Wiegers's review checklist, Deutsch's review checklist - Wiegers's checklist review exercise - Deutsch's checklist review exercise. **Incident Management:** When can a defect be detected? – Defect lifecycle – Defect fields – Metrics and incident management – Communicating incidents – Incident management exercise. **Test Tools and Automation:** **Test Tool Concepts:** Test automation costs - Test automation risks - Test automation benefits - Test automation strategies – test tool integration and scripting – Test tool classification. **Test Tool Categories:** Test management tools – Test execution tools – Debugging, troubleshooting, fault seeding, injection tools – Static and dynamic analysis tools – Performance test tools – Web testing tools – Simulators and emulators.	9	-	8
Total		**53**	**-**	**22**

TEXT BOOK

1. Rex Black, *Advanced Software Testing - Volume 1*, Rocky Nook Inc., 2009.

REFERENCE BOOK

1. Dorothy Graham, Erik Van Veenendaal, Isabel Evans, Rex Black, *Foundations of Software Testing*, Cengage Learning EMEA, 2008.

WEBSITES

1. istqbexamcertification.com

2. www.istqb.in

3. www.istqb.org

Elective III

Stream 1: 5CAE3SC – Satellite Communication

OBJECTIVES:

1. To learn the concept of satellite orbits and launching.
2. To learn the basics of the communication systems involved.
3. To learn the various applications of satellites.

OUTCOMES:

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

1. Understand orbital mechanics and launch methodologies.
2. Describe satellite subsystems.
3. Explain the communication systems involved with satellites.
4. Explain the various applications of satellites.

Unit	Course Content	L	P	T
1	**Orbit Dynamics:** Kepler's Laws - Newton's Laws - Orbit Parameters - Orbital perturbation - Station keeping - Geostationary and non-Geostationary orbits - Frequency allocation - frequency co-ordination and regulatory services - Sun transit outages - Limits of visibility - Launching vehicles and propulsion.	13	-	2
2	**Space Segment:** Spacecraft configuration - Communication payload and supporting sub systems - Satellite uplink – down link - Link power budget - C/No - G/T - Noise temperature - System noise - Propagation factors - Rain and Ice effects - Polarization.	14	-	2
3	**Satellite Access:** Modulation and Muliplexing: Voice, Data, Video, Analog – Digital transmission system - Digital Video Broadcast - Multiple Access: FDMA, TDMA, CDMA - Assignment Methods - Spread spectrum communication - Compression – Encryption.	14	-	2
4	**Earth Segment:** Transmitter – Receivers – Antennas - Terrestrial interface – TVRO – MATV – CATV - Test equipments - Measurements on G/T - c/No. – EIRP - Antenna Gain.	14	-	2
5	**Satellite Applications:** INTELSAT series – INSAT – VSAT - Facsimile system - Weather Service - Remote sensing - Mobile Satellite Service: GSM, GPSM, INMARSAT, SARSAT, LEO, MEO - Satellite navigation System - Direct Broadcast Satellites (DBS) - Direct to Home broadcast (DTH) - Digital Audio Broadcast (DAB) - Business TV(BTV) – GRAMSAT - Specialized services – E-mail, Video Conferencing, Internet.	10	-	2
Total		**65**	**-**	**10**

TEXT BOOKS

1. Dennis Roddy, *Satellite Communication*, Regents / Prentice Hall, Englewood Cliffs, New Jersey, 1989.
2. Wilbur L. Pritchard, Hendir G. Suyderhoud, Rober A. Nelson, *Satellite Communication Systems Engineering*, Prentice Hall, 2nd Edition, 1993.

REFERENCE BOOKS

1. N. Agarwal, *Design of Geosynchronous Space Craft*, Prentice Hall, 1986.
2. Bruce R. Elbert, *The Satellite Communication Application Hand Book*, Artech House Bostn, London, 1997.
3. Tri T. Ha, *Digital Satellite Communication*, 2nd Edition, Tata McGraw Hill, 1990.
4. Emanuel Fthenakis, *Manual of Satellite Communication*, McGraw Hill, 1984.
5. Robert G. Winch, *Telecommunication Transmission Systems*, McGraw Hill, 1993.

6. Brian Ackroyd, *World Satellite Communication and Earth Station Design*, BSP Professional Books, 1990.

7. G. B. Bleazard, *Introducing Satellite Communications*, NCC Publications, 1985.

Stream 2: 5CAE3BS – Biometric Systems

OBJECTIVES:
1. To learn the basic concepts of Biometric systems.
2. To understand the representation, techniques and applications of fingerprint identification, Iris & face recognition and voice scan.

OUTCOMES:

Upon completion of the course, the student will be able to
1. Understand the fundamental concepts of biometric systems.
2. Understand the technologies and applications of fingerprint identification.
3. Understand the basic concepts of Iris recognition, its representation, strengths and weaknesses.
4. Describe the basic concepts of face recognition, its representation, strengths and weaknesses.
5. Explain the technologies and methods for face detection.
6. Understand the basic concepts, approaches, strengths and weaknesses of voice scan.

Unit	Course Content	L	P	T
1	**Biometric Fundamentals:** Key Biometric terms and Processes – Definitions - Verification and identification – Matching - Accuracy in Biometric Systems – False match rate - False nonmatch rate - Failure to enroll rate – Derived metrics - An Introduction to Biometric Authentication Systems- a taxonomy of application environment, a system model, biometrics and privacy.	13	-	2
2	**Fingerprint Identification Technology:** History, Components, Application of Fingerprints, The Technology- Finger Scan Strengths and Weaknesses, Criminal Applications, Civil Applications, Commercial Applications, Technology Evaluation of Fingerprint Verification Algorithms.	13	-	2
3	**Iris Recognition:** Introduction, Anatomical and Physiological underpinnings, Components, Sensing, Iris Scan Representation and Matching, Iris Scan Strengths and Weaknesses, System Performance, Future Directions.	13	-	2
4	**Face Recognition:** Introduction, components, Facial Scan Technologies, Face Detection, Face Recognition- Representation and Classification, Kernel- based Methods and 3D Models, Learning the Face Spare, Facial Scan Strengths and Weaknesses, Methods for assessing progress in Face Recognition.	13	-	2
5	**Voice Scan:** Introduction, Components, Features and Models, Addition Method for managing Variability, Measuring Performance, Alternative Approaches, Voice Scan Strengths and Weaknesses, NIST Speaker Recognition Evaluation Program, Biometric System Integration.	13	-	2
Total		**65**	**-**	**10**

TEXT BOOKS
1. James Wayman & Anil Jain, *Biometric Systems – Technology, Design and Performance Evaluation*, Springer-verlag London Ltd, USA, 2005.
2. Sanir Nanavati, Michael Thieme, *Biometrics Identity Verification in a Networked World*, Wiley Computer Publishing Ltd, New Delhi, 2003.

REFERENCE BOOK
1. John D. Woodword Jr., *Biometrics*, Dreamtech Press, New Delhi, 2003.

Stream 3: 5CAE3CC – Cloud Computing

OBJECTIVES:

1. To learn the main concepts, key technologies, strengths and limitations of cloud computing and the possible applications of cloud computing.
2. To learn the different types of cloud services and cloud service providers.
3. To learn cloud service architecture.

OUTCOMES:

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

1. Explain the main concepts, strengths and limitations of cloud computing.
2. Explain various applications on service models.
3. Identify the architecture, infrastructure and delivery models of cloud computing.
4. Select the suitable cloud service provider and apply an appropriate deployment model for an organization.
5. Understand the concept of abstraction and virtualization.
6. Understand the concept of cloud management and security.
7. Understand the working of cloud storage.

Unit	Course Content	L	P	T
1	**Defining Cloud Computing :** Defining Cloud Computing – Cloud Types – Examining the characteristics of Cloud Computing – Assessing role of open Standards **Understanding Cloud Architecture :** Exploring the cloud computing stack – Connecting to the cloud **Understanding Services and Applications by Type :** Defining Infrastructure as a Service (IaaS), Defining platform as a Service (PaaS), Defining Software as a Service (SAAS), Defining Identity as a Service (IDaaS), Defining Compliance as a Service (CaaS)	13	-	2
2	**Understanding Abstraction and Virtualization :** Using Virtualization Technologies – Load balancing and Virtualization – Understanding Hypervisors – Understanding Machine Imaging – Porting Applications **Exploring Platform as a service :** Defining services – Using PaaS Application Frameworks	13	-	2
3	**Using Google Web Services :** Exploring Google Applications – Surveying Google Aplications Portfolio –Exploring Google Toolkit – Working with the Google App Engine **Using Amazon Web Services :** Understanding Amazon Web Services – Amazon Web Service Components and Services – Working with the Elastic Compute Cloud (EC2) – Working with Amazon Storage Sytems – Understanding Amazon Database Services **Using Microsoft Cloud Services :** Exploring Microsoft Cloud Services – Defining the Windows Azure Platform – Using Windows Live	13	-	2
4	**Managing the Cloud :** Administrating the Clouds – Cloud Management Products – Emerging Cloud Management Standards **Understanding Cloud Security :** Securing the cloud – Securing Data – Establishng Identity and Presence	13	-	2

Unit	Course Content	L	P	T
	Understanding Service Oriented Architecture : Introducing Service Oriented Architecture – Defining SOA Communications – Managing and Monitoring SOA – Relating SOA and Cloud Computing			
5	**Moving Applications to the Cloud :** Applications in the Cloud – Applications and Cloud APIs **Working with Cloud Based Storage :** Measuring the Digital Universe – Provisioning Cloud Storage – Exploring Cloud Backup Solutions – Cloud Storage Interoperability **Communicating with the Cloud :** Exploring Instant Messaging – Exploring Collaboration Technologies – Using Social Networks	13	-	2
Total		**65**	**-**	**10**

TEXT BOOK

1. Barrie Sosinsky, *Cloud Computing Bible*, Wiley India Pvt. Ltd., 2013

REFERENCE BOOKS

1. Kris Jamsa, *Cloud Computing*, Jones and Bartlett India Pvt. Ltd., 2014.
2. Barrie Sosinsky, *Cloud Computing*, Wiley-India Edition, 2013.
3. John Rittinghouse & James Ransome, *Cloud Computing, Implementation, Management and Strategy*, CRC Press, 2010.
4. Michael Miller, *Cloud Computing: Web-Based Applications that Changes the Way You Work and Collaborate*, Que Publishing, August 2008.
5. James E Smith, Ravi Nair, *Virtual Machines*, Morgan Kaufmann Publishers, 2006.
6. David E.Y. Sarna, *Implementing and Developing Cloud Applications*, CRC Press 2011.
7. Lee Badger, Tim Grance, Robert Patt-Corner, Jeff Voas, NIST, *Draft Cloud Computing Synopsis and Recommendations*, May 2011.
8. Anthony T Velte, Toby J Velte, Robert Elsenpeter, *Cloud Computing: A Practical Approach*, Tata McGraw-Hill 2010.

Stream 4: 5CAE3PR – Pattern Recognition

OBJECTIVES:
1. To learn the basic concepts, paradigms and data structures used for pattern recognition.
2. To learn the concepts of feature extraction, selection and clustering methods.
3. To learn the basic concepts of classifiers and different methods used for classification.
4. With a sample application, understand the concepts and methods involed pattern recognition.

OUTCOMES:
Upon completion of the course, the student will be able to
1. Explain the basic concepts and different paradigms for pattern recognition.
2. Explain the data structures used for representing patterns.
3. Undertstand feature extraction, feature selection, evaluation of classifers and clustering methods.
4. Understand the algorithms for nearest neighbour-based classifiers.
5. Understand the Bayes classifier, compare and contrast Bayes classifier with NN classifier.
6. Understand how Markov models, decision trees and support vector machines are used for classification.
7. Explain the methods used for combining classifiers.
8. Explain the concept of clustering and associated algorithms.
9. Understand the concepts of pattern recognition with an application.

Unit	Course Content	L	P	T
1	**Introduction:** What is Pattern Recognition – Data Sets for Pattern Recognition – Different Paradigms for Pattern Recognition. **Representation:** Data Structures for pattern representation – Representation of clusters – Proximity measures – Size of patterns – Abstractions of the data set – Feature extraction – Feature selection – Evaluation of classifiers – Evaluation of clustering.	10	-	1
2	**Nearest Neighbour-based Classifiers:** Nearest Neighbour algorithm – Variance of the NN algorithm – Use of NN algorithm for transaction databases – Efficient algorithms – Data reduction – Prototype selection.	15	-	1
3	**Bayes Classifier:** Bayes' Theorem – Minimum error rate classifier – Estimation of probabilities – Comparison with the NN classifier – Naïve Bayes Classifier – Bayesian Belief Network. **Hidden Markov Models:** Markov Models for classification – Classification using HMMs.	15	-	1
4	**Decision Trees:** Introduction – Decision trees for Pattern Classification – Construction of Decision Trees – Splitting at the Nodes – Overfitting and Pruning – Example of Decision Tree Induction. **Support Vector Machines:** Introduction – Learning and Linear Discriminant Functions – Neural Networks – SVM for Classification.	15	-	1
5	**Combination of Classifiers:** Introduction – Methods for Constructing Ensembles of Classifiers – Methods for Combining Classifiers.	15	-	1

Unit	Course Content	L	P	T
	Clustering: Importance – Hierarchical Algorithms – Partitional Clustering – Clustering large Data Sets. **An Application**: Handwritten Digit Recognition.			
Total		**70**	**-**	**5**

TEXT BOOK

1. Susheela Devi V., Narasimha Murty M., *Pattern Recognition – An Introduction*, Universities Press, 2011.

REFERENCE BOOKS

1. Sergios Theodoridis, Konstantinos Koutroumbas, *Pattern Recognition*, Fourth Edition, Elsevier, 2011.
2. Robert Schalkoff, *Pattern Recognition – Statistical, Structural and Neural Approaches*, Wiley India, 2010.

Stream 5: 5CAE3DW – Data Warehousing

OBJECTIVES:
1. To understand the building blocks, architecture, principles and quality control in the context of data warehousing.

OUTCOMES:
Upon completion of the course, the student will be able to
1. Understand the fundamental concepts of data warehousing.
2. Explain the various aspects of planning and warehouse project management.
3. Describe the architectural components of a DW.
4. Understand the decision-making process for selection of infrastructure for a DW.
5. Understand the dimensions of quality control with respect to a DW.
6. Understand the architecture of STAR Schema.
7. Learn the importance of OLAP, its features, functions & models.
8. Understand the basic concepts of ERP and CRM.
9. Understand how to build a web enabled data warehouse.

Unit	Course Content	L	P	T
1	**Overview and Concepts** **The Compelling Need for Data Warehousing:** Escalating Need for Strategic Information, Operational Versus Decision-Support Systems, Data Warehousing-The Only Viable Solution-Data Warehouse Defined **Data Warehouse:** The Building Blocks: Defining Features- Data Warehouses and Data Marts- Overview of the Components- - Metadata in the Data Warehouse **Significant Trend:** Data Warehousing and ERP - Data Warehousing and CRM- Web-Enabled Data Warehouse	8	-	2
2	**Planning and Requirements** **Planning and Project Management:** Planning Your Data Warehouse: Key Issues - The Data Warehouse Project: How is it Different? - Assessment of Readiness - The Life-Cycle Approach - The Development Phases - Project Management Considerations: Guiding Principles - Warning Signs - Success Factors - Anatomy of a Successful Project. **Defining the Business Requirements:** Dimensional Analysis - Requirements Gathering Methods. **Requirements as the Driving Force for Data Warehousing:** Data Design - The Architectural Plan - Data Storage Specifications.	13	-	2
3	**Architecture and Infrastructure** **The Architectural Components-** Understanding Data Warehouse Architecture - Architectural Framework – Technical architecture of Data Acquisition, Data Storage and Information Delivery. **Infrastructure as the Foundation for Data Warehousing:** Guidelines for Hardware selection for Data warehouse – Single and hybrid Platform options for Data warehouse - Parallel Processing Server hardware - Data warehouse - S/W tools for Data warehouse. **The Significant Role of Metadata:** Why Metadata is Important: Critical need in the Data warehouse - Metadata Types by Functional Areas: Data Acquisition, Data Storage, Information Delivery - Challenges for Metadata Management - Metadata Repository	15	-	2
4	**Data Design and Data Preparation** **Principles of Dimensional Modeling:** From Requirements to Data Design - Design Decisions - Dimensional Modeling Basics - E-R Modeling Versus Dimensional Modeling - Use of CASE Tools - The STAR Schema: Review of a Simple STAR Schema - Inside a Dimension	14	-	2

Unit	Course Content	L	P	T
	Table - Inside the Fact Table - The Factless Fact Table -STAR Schema Keys - Advantages of the STAR Schema **Data Quality:** A Key to Success: What is Data Quality? Benefits of Improved Data Quality - Types of Data Quality Problems - Data Quality Tools			
5	**Information Access And Delivery** **OLAP in the Data Warehouse:** Demand for Online Analytical Processing: Need for Multidimensional Analysis - Limitations of Other Analysis Methods - OLAP Definitions and Rules - OLAP Characteristics - Major Features and Functions: General Features - Dimensional Analysis - Hyper cubes - Drill-Down and Roll-Up - Slice-and-Dice or Rotation – overview of OLAP Models : MOLAP, ROLAP, MOLAP verses ROLAP. **Data Warehousing and the Web:** Web-Enabled Data Warehouse-Web-Based Information Delivery - Building a Web-Enabled Data Warehouse: Nature of the Data Web house - Implementation Considerations - Putting the Pieces Together - Web Processing Model.	15	-	2
Total		**65**	**-**	**10**

TEXT BOOK

1. Paulraj Ponniah, *Data Warehousing Fundamental Comprehensive Guide for IT Professionals*, Wiley-India, New Delhi, 2001.

REFERENCE BOOKS

1. J. Han and M. Kamber, *Data Mining: Concepts and Techniques*, Morgan Kaufmann, New Delhi, 2001.

2. BPB Editorial Board, *Data Warehousing*, BPB Publications, New Delhi, 2004.

Stream 6: 5CAE3ST – Advanced Software Testing

OBJECTIVES:

1. To learn to integrate testing into software lifecycle and test process models.
2. To learn risk-based testing techniques, risk analysis using FMEA.
3. To learn to schedule and monitor test progress.
4. To learn advanced tools for test automation.
5. To get prepared for the ISTQB Advanced Test Manager examination.

OUTCOMES:

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

1. Understand how testing is integrated in SDLC and test process models.
2. Understand quality risk analysis and determine the risk priority.
3. Use test management and test plan documentation templates.
4. Understand test estimating techniques and product risk metrics.

Unit	Course Content	L	P	T
1	**Test Basics:** Testing in the software lifecycle – Sequential lifecycle models – Iterative or incremental lifecycle models – Spiral lifecycle models – Test Levels: Case studies of integrating testing into the lifecycle, Testing in the software lifecycle exercise – Specific systems: Case study of a system of systems project, safety-critical systems – Metrics and measurement: Metrics and measurement exercise – Ethics. **Testing Processes:** Test Process Models - Test planning and control: Test planning and control case study - Test analysis and design – Test implementation and execution: Test execution, Case study of test execution preconditions, BS 7925/2 Standard – Evaluating exit criteria and reporting - Test closure activities: Case studies of test closure, test closure activities exercise.	8	-	5
2	**Test Management:** **Risk-based Testing:** Characteristics and benefits of risk-based testing – The history of risk-based testing – How to do risk-based testing – The level of risk – Controlling the risks – Project risks – Two industry standards and their relations to risk - Risk-based testing exercise 1 - Risk identification and assessment techniques – Categories of quality risks – Documenting quality risks – Quality risk analysis using ISO 9126 - Quality risk analysis using cost of exposure - Quality risk analysis using hazard analysis – Determining the aggregate risk priority - Stakeholder involvement – Risk-based testing exercise 2.	10	-	5
3	**Failure Mode and Effects Analysis (FMEA):** FMEA – Quality risk analysis using FMEA – Determining the risk priority number – Benefits, costs and challenges of FMEA – Case study of FMEA – Risk-based testing and FMEA Exercise 3 – Risk-based testing and testing process – Risk-based testing throughout the lifecycle - Risk-based testing in the fundamental test process – Challenges of risk-based testing - Risk-based testing and FMEA Exercise 4 – Another case study of FMEA - Risk-based testing and test control - Risk-based test results evaluation and reporting - Risk-based testing and FMEA exercise 5. **Test Management Documentation and Test Plan Documentation Templates:** Test policy documents – test strategy documents – Types of test strategies – Test plan templates – The other IEEE 829 templates and how they relate to test planning documents – Master test plan documents – Detail test plan documents – Case study of a test plan and deviations	14	-	5

Unit	Course Content	L	P	T
	from it – Case study of master test plan – Detailed case study of a test plan for a simple PC application – test management documentation and test plan documentation templates exercise.			
4	**Test Estimation:** Factors affecting estimation – Estimating techniques – Using industry averages – Test point analysis – Negotiation and reducing test scope – Test estimation exercise. **Scheduling Test Planning:** Case study in early test planning. **Test Progress Monitoring and Control:** Product risk metrics – Defect metrics – Test case or procedure metrics – test progress monitoring and control exercise 1 – Test coverage metrics – Risk coverage – Use of metrics – Case studies of test reporting – Test progress monitoring and control exercise 2. **Business Value of Testing:** Cost of quality – Other values for testing – Business value of testing exercise. **Test Management Issues:** Case study in managing exploratory testing – System of systems issues – Safety-critical system issues. **Nonfunctional Testing Issues:** Tools and hardware requirements – Organizational and security considerations.	12	-	3
5	**Standards for Test Process Improvement:** Standards considerations – Test improvement process – Improving the test process: A generic process improvement framework, Case study - Improving the test process with TMM - Improving the test process with TPI - Improving the test process with CTP - Improving the test process with STEP – CMMI – Test improvement process exercise. **Test Tools and Automation:** **Test Tool Concepts:** Case study in test automation strategy – Case study of integrated test tools. **Test Tool Categories:** Keyword-driven automated test execution – Case study of test execution objectives - Case study of custom tool development.	10	-	3
Total		**54**	**-**	**21**

TEXT BOOK

1. Rex Black, *Advanced Software Testing - Volume 2*, Rocky Nook Inc., 2009.

REFERENCE BOOKS

1. Rex Black, *Advanced Software Testing - Volume 1*, Rocky Nook Inc., 2009.

2. Dorothy Graham, Erik Van Veenendaal, Isabel Evans, Rex Black, *Foundations of Software Testing*, Cengage Learning EMEA, 2008.

WEBSITES

1. istqbexamcertification.com
2. www.istqb.in
3. www.istqb.org

Soft Skills

OLCS: Language and Communication Skills

OBJECTIVES:

1. To revisit the basics of English grammar.
2. To develop better reading and writing skills.
3. To learn to communicate effectively, thereby enhancing interpersonal skills.

OUTCOMES:

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

1. Understand the different methods of verbal and non-verbal communication and use them effectively.
2. Develop reading and writing skills through specific methods and practice exercises.

Unit	Course Content	L	P	T
1	**Grammar:** Vocabulary – Sentences – Prepositions – Verbs, Phrasal Verbs, Parallel Structure and Verb Forms - Active and Passive Voice - Direct and Indirect Speech - Tenses - Short Form Responses - Question Tags - Transformation of Sentences – Synthesis of Sentences – Rectifying Grammatical Errors.	5	-	1
2	**Reading Skills:** Reading Comprehension – Listening Skills – Reading Skills.	3	-	3
3	**Writing Skills:** Technical Writing - Report Writing – Memos – Precis Writing – Essay Writing.	3	-	3
4	**Non-Verbal Communication:** Personal Appearance – Posture – Gestures – Facial Expression – Eye Contact – Proxemics.	5	-	1
5	**Verbal Communication:** Communication – Public Speaking Skills – Situational Dialogues – Making Effective Telephone Calls – Group Discussion.	5	-	1
Total		**21**	**-**	**9**

TEXT BOOKS

1. Nira Konar, *Communication Skills for Professionals*, PHI Learning Pvt. Ltd., 2009.

2. Krishna Mohan & Meera Banerji, *Developing Communication Skills*, Macmillan India Ltd., 2008.

OLMS: Life and Managerial Skills

OBJECTIVES:
1. To learn how to manage stress.
2. To learn the effective ways of dealing with people by developing social and conflict management skills.
3. To develop interpersonal skills.
4. To effectively manage time.
5. To learn various aspects involved in overall empowerment.

OUTCOMES:

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

1. Understand different stress management techniques.
2. Understand the types of conflict, conflict stimulation and conflict resolution techniques for effective conflict management.
3. Understand the concept of team, characteristics of a team member, recognizing one's own leadership, self-motivation and self-management methods.
4. Understand time management strategies and effectively manage time.
5. Create innovation and bring in change, understand different empowerment strategies.

Unit	Course Content	L	P	T
1	**Stress Management:** Definitions and manifestations of stress - Stress coping ability and stress inoculation training - Management of various forms of fear (examination fear, stage fear or public speaking anxiety), depression and anger - Dealing with crisis and disasters.	4	-	2
2	**Social Skills and Conflict Management Skills:** Component of Social Skills, effective ways of dealing with people - Types of conflict (intrapersonal, intra group and inter group conflicts) - Basic concepts, cues, signals, symbols and secrets of body language - Significance of body language in communication and assertiveness training - Conflict stimulation and conflict resolution techniques for effective conflict management.	4	-	2
3	**Interpersonal Skills:** Concept of team in work situation, promotion of team spirit, characteristics of team player - Awareness of one's own leadership style and performance - Nurturing leadership qualities - Emotional intelligence and leadership effectiveness – self-awareness, self-management, self-motivation, empathy and social skills - Negotiation skills- preparation and planning, definition of ground rules, clarification and justification, bargaining and problem solving, closure and implementation.	4	-	2
4	**Time Management:** Time wasters: Procrastination - Time management personality profile - Time management tips and strategies - Advantages of time management.	4	-	2
5	**Towards Empowerment:** Stimulating innovation and change- coping with "temporariness" - Network culture - Power tactics and power in groups (coalitions) - Managerial empowerment and entrepreneurship - Prevention of moral dwarfism – Moral and social code of conduct, ethics and other values, social concerns - Altruism (prosocial behavior/ helping behavior) - Spirituality (clarifications with regard to spirituality) - strong sense of purpose- trust and respect - humanistic practices - toleration of fellow human beings expressions.	4	-	2
Total		**20**	**-**	**10**

RECOMMENDED READING

1. Swaminathan V.D., Kaliappan K.V., *Psychology for Effective Living*, The Madras Psychology Society, Chennai, 2001.
2. Robbins, S.B., *Organizational Behavior*, Prentice Hall of India, New Delhi, 2005.
3. Smith B., *Body Language*, Rohan Book Company, Delhi, 2004.
4. Hurlock E.B., *Personality Development*, 28th Reprint, Tata McGraw Hill, New Delhi, 2006.

OF1: French for Beginners I

OBJECTIVES:

1. To learn basics of French grammar.
2. To learn basic conversation in French.

OUTCOMES:

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

1. Write French alphabets and numbers.
2. Undertsand basics of French grammar.
3. Name and locate simple objects and colors.
4. Converse in French to ask directions, suggestions, date and time.
5. Give a simple description of people, profession and activities.
6. Use past tense.

Unit	Course Content	L	P	T
1	Alphabets and numbers Simple Grammar: Basics of French conversation (To greet a person, Introducing oneself, Asking basic information)	4	-	2
2	Simple Grammar: Name and locate objects, colours and simple description of people.	4	-	2
3	Simple Grammar: Asking for directions, Giving suggestions.	4	-	2
4	Simple Grammar: Indicate date and time. Asking and giving information on one's profession and activities.	4	-	2
5	Simple Grammar: Use of past tense. Narrating past events. Giving one's opinion.	4	-	2
Total		**20**	**-**	**10**

TEXT BOOK

1. Guy Cappelle, Robert Menand, *Taxi*.

REFERENCE BOOKS

1. Philippe Dominique, Jacky Girardet, *NSF I (Nouveau sans frontières)*.
2. Guy Cappelle, *Nouvel Espace I*.
3. D. Berger, L. Mérieux, *Cadences I*.

WEBSITES

1. www.fle.fr
2. www.bonjourdefrance.com
3. www.polarfle.com

OF2: French for Beginners II

OBJECTIVES:

1. To speak in French.
2. To gain knowledge of the French civilization.

OUTCOMES:

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

1. Speak in French about specific topics.
2. Reply to emails in French.
3. Know the culture, food habits, fashion, tourist spots and daily life of French people.

Unit	Course Content	L	P	T
1	Express one's opinion or objection. Reply to an enquiry (E.g. Job application). E-mails. Accept or refuse a proposal.	4	-	2
2	Speak of one's hobbies and holidays.	4	-	2
3	Speak of one's childhood, current events.	4	-	2
4	Speak of the weather. Speak of one's future plans.	4	-	2
5	French civilization: Culture, Food, Fashion, Daily life and Tourism.	4	-	2
Total		**20**	**-**	**10**

Number of Credits: 2

TEXT BOOK

1. Guy Cappelle, Robert Menand, *Taxi*.

REFERENCE BOOKS

1. Philippe Dominique, Jacky Girardet, *NSF II (Nouveau sans frontières)*.
2. Guy Cappelle, *Nouvel Espace II*.
3. D. Berger, L. Mérieux, *Cadences II*.

WEBSITES

1. www.fle.fr

2. www.bonjourdefrance.com

3. www.polarfle.com

OG1: German for Beginners I

OBJECTIVES:
1. To learn basics of German Grammar.
2. To learn basic conversation in German.

OUTCOMES:
Upon completion of the course, the student will be able to
1. Write German alphabets and numbers.
2. Greet, introduce oneselves and ask simple questions.
3. Use verbs, pronouns, cases and tenses.
4. Know facts about Germany viz. Fall of Berlin Wall, Unification of Germany, education system, Universities, Germany and European Union and make a simple presentation in German.

Unit	Course Content	L	P	T
1	Alphabets and numbers (1 - 20) Simple Grammar: Articles (Definite, Indefinite, Negative), Nouns, Gender; Singular and plural. Conjugation of the auxiliary verb "To be" "Sein" Contextual Vocabulary and Dialogue: Greeting, Self Introduction, Simple questions. Hard Facts of Germany: (i) Fall of Berlin Wall (ii) Unification of Germany	4	-	2
2	Numbers (20 – 100) Simple Grammar: Conjugation of verbs, pronouns (personal and interrogative), Present tense, Imperative tense, auxiliary verb "To have", "Haben", Nominative and accusative cases. Contextual Vocabulary and Dialogue: At the Railway Station, Airport. Hard Facts of Germany: Education System.	4	-	2
3	Simple Grammar: Modal verbs, Past and perfect tenses, Dative case. Contextual Vocabulary and Dialogue: Reading the time, days, months and year Hard Facts of Germany: Universities in Germany.	4	-	2
4	Simple Grammar: Irregular verbs, Reflexive pronouns, Possessive pronouns Contextual Vocabulary and Dialogue: Daily life, Meals, How to place an order in a restaurant. Hard Facts of Germany: Germany and the European Union.	4	-	2
5	Simple Grammar: Separable and inseparable verbs, Revision of Grammar learn so far Contextual Vocabulary and Dialogue: Idiomatic expressions, One's family and background. Hard Facts of Germany: Presentation of topics on German Civilization discussed earlier.	4	-	2
Total		**20**	**-**	**10**

TEXT BOOK
1. Holt, Rinehart & Winston, *Komm Mit – Level I.*
2. *Moment Mal! – Level I*
3. *Themen – Level I*

REFERENCE BOOKS
1. *Facts about Germany*
2. Schulz-Griesbach, *Deutsch Für Ausländer.*

WEBSITES
1. www.german.about.com
2. www.bbc.co.uk/languages/german
3. www.germanculture.com

OG2: German for Beginners II

OBJECTIVES:

1. To learn advanced German Grammar.
2. To develop reading and writing skills.

OUTCOMES:

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

1. Use clauses and adjectives.
2. Read, write and speak in German.

Unit	Course Content	L	P	T
1	Grammar: Subordinate Clauses, Comparison of adjectives. Contextual Vocabulary and Dialogue: Skills in reading.	4	-	2
2	Grammar: Relative Sentences, Future tense. Contextual Vocabulary and Dialogue: Speaking skills.	4	-	2
3	Grammar: Adjective declension, Verbs with propositional objects. Oral and written comprehension. Contextual Vocabulary and Dialogue: Hobbies and holidays.	4	-	2
4	Contextual Vocabulary and Dialogue: E-mail – Reading and writing, How to apply for admission, How to reply to an enquiry.	4	-	2
5	Recap of Grammar, vocabulary, reading and writing skills learnt so far.	4	-	2
Total		**20**	**-**	**10**

TEXT BOOKS

1. Holt, Rinehart & Winston, *Komm Mit – Level II*.
2. *Moment Mal! - Level II*
3. *Themen - Level II*

REFERENCE BOOKS

1. *Facts about Germany*
2. Schulz-Griesbach, *Deutsch FÜr Ausländer*.

WEBSITES

1. www.german.about.com
2. www.bbc.co.uk/languages/german
3. www.germanculture.com

SAR1: Analytical Reasoning I

OBJECTIVES:

1. To gain mathematical and verbal reasoning skills in preparation for various competitive examinations.

OUTCOMES:

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

1. Solve problems in the given areas of objective arithmetic using simple methods and tricks.
2. Solve verbal reasoning problems of the given types.
3. Improve the speed of calculations while solving such problems.

Unit	Course Content	L	P	T
1	**Objective Arithmetic:** Number – H.C.F. & L.C.M. of Numbers – Decimal Fractions – Simplification.	2	-	4
2	**Objective Arithmetic:** Average – Percentage – Profit & Loss – Simple Interest.	2	-	4
3	**Objective Arithmetic:** Calendar – Clocks – Heights and Distances.	2	-	4
4	**Verbal Reasoning:** Series – Analogy – Classification - Coding & Decoding – Number, Ranking and Time Sequence Test.	2	-	4
5	**Verbal Reasoning:** Logical Sequence of Words – Situation Reaction Test – Verification of Truth of the Statement.	2	-	4
Total		**10**	**-**	**20**

TEXT BOOKS

1. Dr. R. S. Aggarwal, *A Modern Approach to Verbal Reasoning (Fully Solved)*, Revised Edition, S. Chand and Company Ltd., Reprint 2010.

2. Dr. R. S. Aggarwal, *Objective Arithmetic*, S. Chand and Company Ltd., Reprint 2010.

SAR2: Analytical Reasoning II

OBJECTIVES:

1. To gain mathematical and verbal reasoning skills in preparation for various competitive examinations.

OUTCOMES:

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

1. Solve problems in the given areas of objective arithmetic using simple methods and tricks.
2. Solve verbal reasoning problems of the given types.
3. Improve the speed of calculations while solving such problems.

Unit	Course Content	L	P	T
1	**Objective Arithmetic:** Square Root and Cube Root – Problems on Numbers – Chain Rule.	2	-	4
2	**Objective Arithmetic:** Time & Work – Alligation or Mixture – Compound Interest – Stock & Shares.	2	-	4
3	**Objective Arithmetic:** Linear Equations in Two Variables – Quadratic Equations - Arithmetic and Geometric Progressions.	2	-	4
4	**Verbal Reasoning:** Blood Relations – Puzzle Test – Direction Sense Test.	2	-	4
5	**Verbal Reasoning:** Data Sufficiency – Eligibility Test – Assertion and Reason.	2	-	4
Total		**10**	**-**	**20**

TEXT BOOKS

1. Dr. R. S. Aggarwal, *A Modern Approach to Verbal Reasoning (Fully Solved)*, Revised Edition, S. Chand and Company Ltd., Reprint 2010.

2. Dr. R. S. Aggarwal, *Objective Arithmetic*, S. Chand and Company Ltd., Reprint 2010.

SAR3: Analytical Reasoning III

OBJECTIVES:

1. To gain mathematical and verbal reasoning skills in preparation for various competitive examinations.

OUTCOMES:

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

1. Solve problems in the given areas of objective arithmetic using simple methods and tricks.
2. Solve verbal reasoning problems of the given types.
3. Improve the speed of calculations while solving such problems.

Unit	Course Content	L	P	T
1	**Objective Arithmetic:** Problems on Ages – Ratio and Proportion – Partnership.	2	-	4
2	**Objective Arithmetic:** Pipes and Cisterns – Time and Distance – Problems on Trains - Boats and Streams.	2	-	4
3	**Objective Arithmetic:** Area – Volume and Surface Areas – Trigonometry.	2	-	4
4	**Verbal Reasoning:** Logic – Statement: Arguments - Statement: Assumptions - Statement: Courses of Action.	2	-	4
5	**Verbal Reasoning:** Statement: Conclusions – Deriving Conclusions from Passages – Theme Detection – Cause and Effect Reasoning.	2	-	4
Total		**10**	**-**	**20**

TEXT BOOKS

1. Dr. R. S. Aggarwal, *A Modern Approach to Verbal Reasoning (Fully Solved)*, Revised Edition, S. Chand and Company Ltd., Reprint 2010.

2. Dr. R. S. Aggarwal, *Objective Arithmetic*, S. Chand and Company Ltd., Reprint 2010.

OQCC: Quality Control Circles (Theory)

OBJECTIVES:

1. To develop the skill to solve problems using a systematic approach, both as an individual and in a team.

OUTCOMES:

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

1. Understand the importance, functions and structure of quality control circles.
2. Identify problems and formulate them in a formal, structured manner.
3. Understand and use the various problem solving tools.
4. Understand and implement the process of PDCA to solve problems.
5. Gain an understanding of leadership and motivation.

Unit	Course Content	L	P	T
1	**Introduction:** Introduction to Quality Circles - Objectives of Quality Circles - Benefits of Quality Circles.	2	-	4
2	**Structure:** Structure of Quality Circles - Quality Circle Meetings - Roles of facilitators, coordinators and leader.	2	-	4
3	**Problem Identification:** Brainstorming - Problem identification.	2	-	4
4	**Data Collection:** Tools – PDCA.	2	-	4
5	**Problem Solving:** Problem solving and presentation - Leadership and Motivation.	2	-	4
Total		**10**	**-**	**20**

SUGGESTED READING

1. Reference materials from QCFI, Chennai Chapter.

2. Reference materials from Port Trust of Madras.

OQCCP: Quality Control Circles (Presentation)

OBJECTIVES:

1. To work as a part of a Quality Control Circle.
2. To identify and solve problems.
3. To develop team spirit and leadership qualities.
4. To acquire presentation skills.

OUTCOMES:

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

1. Function as a part of a Quality Control Circle.
2. Identify and solve problems in a team as part of QCC.
3. Understand the importance of team work and leadership in a QCC.
4. Learn to make presentations of solved problems to an audience, effectively and within a stipulated time.

Every student would be member of a Quality Circle and will be evaluated for a project presentation.