

MASTER OF COMPUTER APPLICATIONS

SYLLABUS FOR CREDIT-BASED FLEXIBLE CURRICULUM

(Applicable for 2018-2019 onwards)



DEPARTMENT OF COMPUTER APPLICATIONS
NATIONAL INSTITUTE OF TECHNOLOGY
TIRUCHIRAPPALLI – 620 015
TAMIL NADU INDIA

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TAMIL NADU - INDIA

About us:

About us:

The Department of Computer Applications is one of the pioneering departments of the institution that offers the following degree programmes:

1. Three year Master of Computer Applications (MCA)
2. Two year Master of Science in Computer Science and
3. Two year Master of Technology in Data Analytics.

The Department of Computer Applications is one among the top five offering MCA courses in the country. It is committed to impart quality education in the sub-fields of IT, a field growing in leaps and bounds.

Vision:

Towards a school of Information Science and Technology conforming to international standards

Mission:

- To offer state-of-art education in Information Science and Technology
- To provide strong theoretical foundation complemented with extensive practical training
- To inculcate value-based, socially committed professionalism to the cause of overall development of students and society

MASTER OF COMPUTER APPLICATIONS

Objectives of the Programme:

1. Prepare graduates to become computer professionals with comprehensive knowledge and skills to produce software for emerging requirement
2. Prepare graduates to become continuous learner with aptitude for teaching and research with societal focus
3. Prepare graduates to become Consultant / Entrepreneurs in the IT and ITES industries with confidence in self-employment

The board of studies for Computer Applications Department includes the following members:

- **Chairman:**
Dr. S.R.Balasundaram, Professor
Head of the department

- **External Experts:**
 1. **Dr.V.S.Ananthanarayana , Dean(R&C)**
Professor, Department of IT
NIT K Surathkal
 2. **Mr.S.Parthasarathy,**
Vice-president
Systech Solutions Pvt. Ltd

- **Faculty Members:**
 1. Dr. N.P. Gopalan, Professor
 2. Dr. A.V. Reddy , Professor
 3. Dr. B. Ramadoss, Professor
 4. Dr.S.Nickolas, Professor
 5. Dr. Michael Arock, Professor
 6. Dr. P.J.A Alphonse, Professor
 7. Dr. S. Domnic , Associate Professor
 8. Dr. (Mrs) B.Janet , Assistant Professor
 9. Dr. (Mrs) S. Sangeetha, Assistant Professor
 10. Dr. (Mrs). R. Eswari, Assistant Professor
 11. Dr. U. Srinivasulu Reddy, Assistant Professor
 12. Dr. C.Sivaraj
 13. Dr. (Mrs). Adlin Suji
 14. Ms. Cynthia Devi
 15. Ms. Jenie Arock
 16. Mr.K.Vignesh

SEMESTER	SUBJECT CODE	SUBJECT NAME	L	T	P	C
I	CA711	Data Structures and Applications	3	0	0	3
	CA713	Mathematical Foundations of Computer Applications	3	0	0	3
	CA715	Computer Organization and Architecture	3	0	0	3
	CA717	Accounting and Financial Management	3	0	0	3
	CA719	Probability and Statistical Methods	2	1	0	3
	CA701	Data Structures Lab using C	0	0	4	2
	CA703	Business Communication	0	0	4	2
II	CA710	Design and Analysis of Algorithms	2	1	0	3
	CA712	Database Systems	3	0	0	3
	CA714	Operating Systems	3	0	0	3
	CA716	Object Oriented Programming	2	1	0	3
	CA718	Resource Management Techniques	3	0	0	3
	CA702	DBMS Lab	0	0	4	2
	CA704	OS Lab	0	0	4	2
III	CA721	Data Mining Techniques	2	1	0	3
	CA723	Python and R Programming	3	0	0	3
	CA725	Software Engineering	2	1	0	3
	CA727	Computer Networks	3	0	0	3
	CA729	Object Oriented Analysis and Design	2	1	0	3
	CA705	Networks Lab	0	0	4	2
	CA707	Data Mining Lab	0	0	4	2
IV	CA722	Organizational Behavior	3	0	0	3
	CA724	Information Security	3	0	0	3
	CA726	Distributed Technology	3	0	0	3
	CA728	Web Technology and Its Applications	3	0	0	3
	XXXX	Elective I	3	0	0	3
	CA706	Web Technology and Its Application Lab	0	0	4	2
	CA708	Information Security Lab	0	0	4	2
V	CA731	Artificial Intelligence	3	0	0	3
	CA733	Cloud Computing	3	0	0	3
	XXXX	Elective-II	3	0	0	3
	XXXX	Elective-III	3	0	0	3
	XXXX	Elective-IV	3	0	0	3
	CA709	Artificial Intelligence Lab	0	0	4	2
	CA749	Mini Project Work	0	0	4	2
VI	CA750	Project Work	-	-	-	10
		Mandatory Internship I – II Semester vacation Internship II – III Semester vacation	-	-	-	-
		Grand Total	70	5	40	105

L: LECTURE | T: TUTORIAL | P: PRACTICAL | C: CREDITS

LIST OF ELECTIVES

SUBJECT CODE	SUBJECT NAME	L	T	P	C
CA7A1	Business Intelligence	3	0	0	3
CA7A2	Unix and Shell Programming	3	0	0	3
CA7A3	Visual Programming	3	0	0	3
CA7A4	Software Architecture and Project Management	3	0	0	3
CA7A5	Business Ethics	3	0	0	3
CA7B1	Green Computing	3	0	0	3
CA7B2	Image Processing	3	0	0	3
CA7B3	Internet of Things	3	0	0	3
CA7B4	Marketing Management	3	0	0	3
CA7B5	Soft Computing	3	0	0	3
CA7B6	Advanced Database Technology	3	0	0	3
CA7B7	Modeling and Computer Simulation	3	0	0	3
CA7B8	Computer Vision	3	0	0	3
CA7C1	Human Computer Interaction	3	0	0	3
CA7C2	Bioinformatics	3	0	0	3
CA7C3	Deep learning	3	0	0	3
CA7C4	Multi-core Programming	3	0	0	3
CA7C5	MEAN Stack Web Development	3	0	0	3
CA7C6	Big Data Management	3	0	0	3
CA7C7	Evolutionary Computing	3	0	0	3
CA7C8	Social Network Analysis	3	0	0	3

L: LECTURE | T: TUTORIAL | P: PRACTICAL | C: CREDITS

SEMESTER-I

CA711 DATA STRUCTURES AND APPLICATIONS

Course Objective:

- To introduce different data structures; searching and sorting techniques and their applications.

Linear data Structures – Arrays, Records, Linked Lists – Singly, Doubly, Circular linked lists - Stack: Definition and examples, Representing Stacks - Queues: Definition and examples, priority queue, Deque, IRD, ORD – Applications of Stack, Queue and Linked Lists- Hashing.

Non-Linear data Structures - Binary Trees – Binary Tree Representations – node representation, internal and external nodes, implicit array representation - Operations on binary trees – Binary tree Traversals – Binary search trees- insertion, deletion, find. Graphs – Representation – Linked representation of Graphs – Graph Traversals.

Advanced data structures –Data structures for disjoint sets- AVL trees - Red-black trees – insertion and deletion – B-trees – Definition, insertion, deletion – Splay tree, Binomial heaps – operations.

Single source shortest path algorithms – Bellman-Ford algorithm and Dijkstra's algorithm- Transitive closure -Topological sort – Trie Structures.

Basic sorting techniques – selection sort, bubble sort, insertion sort - Merging and merge sort – Basic Search Techniques – linear search and binary search – recursive and non-recursive algorithms.

REFERENCES:

1. T.H. Cormen, C.E. Leiserson, R.L. Rivest and C.Stein, “Introduction to Algorithms”, 3rd Edition, MIT Press, 2009.
2. S. Lipschutz and G.A.V. Pai, “Data Structures”, Tata McGraw-Hill, 2010.
3. M.A.Weiss, “Data Structures and Problem Solving using Java”, 4th Edition, Addison Wesley, 2009.
4. D. Samanta, “Classic Data Structures”, 2nd Edition, PHI, 2009.
5. P. Brass, “Advanced Data Structures”, Cambridge University Press, 2008.

Outcomes:

Students will be able to

1. Write structured pseudo code for the given problem
2. Use linear and nonlinear data structures to solve real-time problems
3. Apply basic searching and sorting techniques in different application domains

CA713 MATHEMATICAL FOUNDATIONS OF COMPUTER APPLICATIONS

Objective:

- To learn the mathematical foundations applicable to computing.

Sets - Relations – Posets - Functions - Mathematical Inductions (Simple and strong) – Principles of Counting (Addition & Multiplication).

Graphs - Basic concepts - Isomorphism – complements - Matrix representation of graphs - Trees, Spanning trees, Minimal Spanning tree Algorithms - Euler graphs - Hamiltonian graphs.

Recurrence Relations and Generating Functions - Homogeneous and non-homogeneous recurrences and their solutions - solving recurrences using generating functions.

Mathematical Logic – Predicate Calculus – Scope – Binding – Resolution – Regular Grammars.

Finite Automata – Context-Free Grammars – Chomsky’s Normal form -Griebach Normal Form - Push-down Automata - Equivalence of CFL’s and PDA’s - Non-context free languages.

REFERENCES:

1. Thomas Koshy, “Discrete Mathematics with Applications”, Elsevier,2006.
2. NarsinghDeo, “Graph theory and applications to Engineering and Computer Science”, PHI, 1986.
3. Arthur Gill, “Applied Algebra for the Computer Sciences”, Prentice Hall,1976.
4. Michael Sipser, “Introduction to Theory of Computation”, PWS Publishing Co,1996.

Outcomes:

Students will be able to

1. Explain functions and related concepts and illustrate its direct application in Computer languages
2. Solve the problems using the concepts of Graphs, Trees
3. Deduce complex task by various Mathematical logic
4. Solve recurrence relations for a given problem

CA715 COMPUTER ORGANIZATION AND ARCHITECTURE

Objectives

- To understand the data representation in a digital computer and explain how operations are performed by computer circuits
- To study and analyze the internal components of a computer and evaluate the performance of CPU, memory and I/O operations
- Study and analyze the modern processor architecture

Number Systems - Binary Arithmetic - Boolean algebra - Map Simplifications - Gates - Combinational Circuits - Sequential Circuits.

Memory: Internal - External - Memory Organization - Associative - Cache – Virtual memory.

CPU: Arithmetic And Logic Unit - Instruction Sets - RISC - CISC - Instruction pipeline - Addressing modes and formats - Register organization - Control Unit Operation - Processor organization.

External Devices: I/O modules - Programmed I/O - Interrupt Driven I/O - Direct Memory Access - I/O Channels - Asynchronous Data Transfer.

Processors: Parallel – Multi-core – Mobile – Embedded – GPU and TPU.

REFERENCES:

1. William Stallings, "Computer Organization and Architecture", 10th Edition, PHI,2016
2. M. Morris Mano, Michael D. Ciletti, "Digital Design", 5th Edition, Pearson Education, 2013.
3. Hennessy J. and Patterson D., "Computer Architecture: A Quantitative Approach", 6th Edition, Morgan Kaufmann, 2017.

Outcomes:

1. Define binary number system and arithmetic operations. Design Boolean circuit for a given problem
2. Analyze the different types of memory and their organization
3. Describe the functional units of the CPU and its organization
4. Discover the working and organization of I/O Devices
5. Evaluate the different modern processor architecture

CA717 ACCOUNTING AND FINANCIAL MANAGEMENT

Objective:

- To learn the fundamentals of accounting and financial management

Assets – Liabilities – Types - Trading account – Accounting records and Systems – Limitations - Income statement – Preparation and Interpretation.

Depreciation – Methods - Inventory methods, Sources of working capital, Fund flows, Cash flows – Financial Statement analysis- Case studies.

Ratio analysis - Use of ratios in interpreting Trading Accounts and Financial Statements, Limitations – Management Accounting.

Variable costs – Fixed costs – Cost Volume Profit Analysis – Break even marginal and full costing contribution, Standard costing - Analysis of variance - Computer accounting and algorithms.

Characteristics of Budgets - Forecasting – Long term, Short term – Methods of capital investment decision making, Sensitivity Analysis, Cost of capital.

REFERENCES:

1. S.N. Maheswari and S.K. Maheswari, “An Introduction to Accountancy”, 11th Edition, Vikas Publishing, 2013.
2. Manmohan and Goyal, “Principles of Management and Accounting”, 5th Edition, SahityaBhawan, 1994.

Outcomes:

Students will be able to:

1. Prepare and analyse the final accounts of the firm
2. Prepare and analyse the funds & cash flow statements of the firm
3. Perform basic analysis of financial statements and write a report on the financial performance, conditions and effectiveness of the firm
4. Analyse and evaluate costing systems
5. Prepare different types of budgets and policies

CA719 PROBABILITY AND STATISTICAL METHODS

Objective:

- To learn the fundamentals of probability and statistical methods

Probability Spaces- Combinatorial methods (or) Counting techniques- Elementary Theorem – Conditional Probability – Bayes’ theorem- Probability Distributions and Probability Densities.

Mathematical Expectation: Expected value- Moments- Chebyshev’s theorem- Moment Generating functions-Product Moment-Conditional Expectation- Special Probability Distributions and Probability Densities- Functions of Random Variable. Multiple regression- Linear models- Logistic regression- Rates and Poisson regression- Nonlinear curve fitting – correlation.

Descriptive Statistics & Sampling Distributions: Population-Sampling- Measures of Central tendency, variations and position – Sampling distributions: Standard Normal Distribution- Chi-Square Distribution- t-Distribution –F-Distribution -The Central Limit Theorem.

Estimation: Point Estimation: the method of moments and the method of maximum likelihood estimation- Interval estimation: estimation of mean, estimation of difference of means, estimation of variance and estimation of ratio of variances.

Test of Hypothesis- Testing for Attributes – Mean of Normal Population – One-tailed and two-tailed tests, F-test and Chi-Square test – Analysis of Variance- Nonparametric test.

REFERENCES:

1. John.E.Freund, Irwin Miller, Marylees Miller “Mathematical Statistics with Applications “, 8th, Prentice Hall of India, 2014
2. Yannis viniotis, “Probability and Random Processes for electrical engineers”, McGraw-Hill International Edition, 1997.
3. Ross, Sheldon. M, “Introduction to Probability and Statistics for Engineers and Scientists”, Academic Press, 2009.

Outcomes:

Students will be able to

1. Explain basic probabilistic and statistical models and illustrate their related applications
2. Estimate the likelihood of events from population
3. Propose, test and evaluate hypothesis

CA701 DATA STRUCTURES LAB USING C

Exercises for learning basic features of C and exercises to implement various data structures for real world applications

Outcomes:

Students will be able to:

1. Write C programs for solving any problems.
2. Implement linear and nonlinear data structures to solve real-time problems
3. Perform searching and sorting techniques to different application domains
4. Implement different design strategies to solve complex problems

CA703 BUSINESS COMMUNICATION

Objective:

- Introduce the dynamics of Communication in the Business world.
- Help to familiarize and practice the different kinds of communication tools
- Give practice in the nuances of spoken communication
- Expose to the different forms of Business communication.

Communication in the Business World: Communication: Concepts and Goals – Theories of communication – Organizational and personal goals. Psychology of communication – Channels and Networks – Barriers to and cost of communication.

Listening and Speaking Practice: Message Planning – Purposive Listening – – Familiarizing to different accents and tones – Listening Practice - Oral Communication – Extempore speech practice – Presentation skills – Group Discussion Practice - Interview skills. Telephone strategies.

Writing practice: Business Correspondence – Different kinds of written communication in business Organizations - Marketing Language – Creativity and Appeal – Report writing practice.

Technology and Communication: Practice in telephone etiquette – Limitations & possibilities of E mail - Use of Power point- Role of mass media in business communication.

REFERENCES:

1. Simon Sweeney, “English for Communication”, 2nd Edition, CUP, 2003
2. Leo Jones and Richard Alexander, “New International Business English”, CUP, 2000.

Outcomes:

1. Students will be able to communicate in the business world using different communication tools

SEMESTER -II

CA710 DESIGN AND ANALYSIS OF ALGORITHMS

Pre Requisite: CA711, CA713

Course Objective:

- To learn about Complexity Analysis and various algorithmic design methodologies

Algorithms as technology – Analyzing and Designing algorithms – Asymptotic notations – Recurrences – Methods to solve recurrences – Heap Sort - Quick Sort – Sorting in linear time – Radix sort – Selection in linear time.

Divide and conquer methodology – Multiplication of large integers – Strassen's matrix multiplication – Greedy method – Prim's algorithm – Kruskal's algorithm – algorithm for Huffman codes.

Dynamic Programming – Elements – Matrix-chain multiplication –Computing a binomial coefficient – Floyd-Warshall algorithm – Optimal binary search tree – Memory functions.

Backtracking – N-Queens problem – Hamiltonian circuit problem – Subset sum problem – Branch and bound – Assignment problem – Knapsack problem – Traveling salesman problem.

NP-hard and NP-complete problems – Definitions and Properties – Reducibility – Cook's Theorem (without proof) – Clique decision problem – Node cover problem – K-coloring problem.

REFERENCES:

1. Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest and Clifford Stein, "Introduction to Algorithms", 3rd Edition, MIT Press, 2009.
2. Robert Sedgewick and Philippe Flajolet, "An Introduction to the Analysis of Algorithms", 2nd Edition, Addison-Wesley, 2013
3. Jon Kleinberg and ÉvaTardos, "Algorithm Design", Addison-Wesley, 2005.
4. George T. Heineman, Gary Pollice and Stanley Selkow, "Algorithms in a Nutshell", O'Reilly Media, 2008.
5. Sanjoy Dasgupta, Christos Papadimitriou and UmeshVazirani, "Algorithms", McGraw-Hill, 2006.
6. E.Horowitz, S.Sahni, and S.Rajasekaran, "Computer Algorithms", 2nd edition, Silicon Press, 2007.

Outcomes:

1. Students will be able to:
2. Analyze the complexity of polynomial algorithms.
3. Apply various design strategies for solving problems
4. Distinguish NP hard and NP complete problems from other problems

CA712 DATABASE SYSTEMS

Pre Requisites: CA711, CA713

Objective:

- To learn different database models and design of databases and to study query languages and transaction management

File System versus DBMS – Advantages – Database Languages – ER-Model: Entities Relationships – Additional Features of ER Model – Conceptual Design with ER Model.

Relational Model – Keys - Constraints – Querying – Views - Relational Algebra – Relational Calculus – SQL – QBE.

File Organization – Organization of records in files – Indexing – Ordered Indices - B + Tree Index files – Hashing – Static – Dynamic – Query Optimization – Transformation of Relational Expressions – Choice of evaluation plans.

Database Design – Pitfalls in Relational Database Design – Functional Dependencies – Decomposition – Normalization – I to V Normal Forms.

DB Tuning – Security – Transaction Management – Transactions – Transaction state – Concurrent executions – Serializability – Concurrency Control – Protocols – Crash Recovery.

REFERENCES:

1. Raghu Ramakrishnan and Johannes Gehrke, “Data Base Management Systems”, 3rd Edition, McGraw-Hill, 2003.
2. Silberschatz, Korth and Sudarshan, “Data Base System Concepts”, McGraw-Hill, 6th Edition, 2010.
3. C. J. Date, “An Introduction to Database Systems”, 8th Edition, Addison-Wesley, 2003.
4. R. Elmasri, S.B. Navathe, “Fundamentals of Database Systems”, 6th Edition, Pearson Education/Addison Wesley, 2011.

Outcomes:

Students will be able to:

1. Illustrate the features of DBMS & Models for designing databases
2. Describe the nuances of Data retrieval methods
3. Apply normalization techniques in DB design
4. Perform concurrency and Transaction Management operations

CA714 OPERATING SYSTEMS

Pre Requisite: CA715

Objective:

- To introduce basic concepts and features of OS with case study on different operating systems

Operating System concept- OS Structure –Services-System calls – Process management-Process Concept-Operations on process-Cooperating processes- Inter-process communication-Process scheduling-Scheduling algorithms-Threads- Multithreading models.

Process synchronization- critical-section problem – Synchronization hardware –Semaphores – Classic problems of synchronization – critical regions – Monitors Deadlock- Deadlock characterization – Methods for handling deadlocks – Recovery from deadlock.

Memory management-Buddy system-Paging-segmentation-Virtual Memory –Demand paging-Page replacement algorithms – Allocation of frames – Thrashing-Working set model.

Files and Directories - Files System structure- Implementation –File allocation methods-Free space management- Virtualization – Containers.

I/O systems – I/O interface –Kernel I/O subsystem. Disk scheduling algorithms- Disk management-Swap space management.

Protection and security -Case Study-Linux, Windows, Mac OS and Mobile OS.

REFERENCES:

1. Silberschatz, Galvin and Gagne, “Operating System Concepts”, 9th Edition, John Wiley & Sons Inc, 2013.
2. Andrew S. Tanenbaum, “Modern Operating Systems”, 4th Edition, Prentice-Hall of India, 2015.
3. SibsankarHaldar, Alex A.Aravind, “Operating systems”, Pearson Education, 2009.

Outcomes:

Students will be able to:

1. Use system calls to interact with OS
2. Synchronize multiple processes and handle issues in synchronization
3. Implement memory management techniques
4. Implement algorithms in secondary storage and file management techniques

CA716 OBJECT ORIENTED PROGRAMMING

Objective:

- To learn the basic principles of object-oriented programming paradigm using C++

Programming Paradigms - Introduction to OOP – Overview of C++ - Classes – Structures – Union – Friend Functions – Friend Classes – Inline functions – Constructors – Destructors – Dynamic Initialization of Objects - Static Members – Passing objects to functions – Function returning objects-Arrays of Objects, Object as Function Arguments.

Arrays – Pointers – this pointer – References – Dynamic memory Allocation – functions Overloading – Default arguments – Overloading Constructors – Pointers to Functions – Operator Overloading - Type Conversion.

Inheritance – Types - Derived Class Constructors- Issues in Inheritance – Virtual base Class – Polymorphism – Virtual functions – Pure virtual functions.

Class templates and generic classes – Function templates and generic functions – Overloading function templates – power of templates – Exception Handling – Derived class Exception – over handling generic functions – Exception handling Functions.

Streams – Formatted I/O with IOS class functions and manipulators –File I/O – Name spaces – Array based I/O – Error handling during file operations - Formatted I/O – STL: Overview- Container Classes Lists-Maps- Algorithms Using Functions and Objects-String Class - Sequence Containers, Iterators-Specialized Iterators - Associative Containers. Storing User-Defined Objects - Function Objects.

REFERENCES:

1. Stephen Prata, "C++ Primer Plus", 6th Edition ,Addison-Wesley Professional, 2011
2. Bjarne Stroustrup, "Programming: Principles and Practice Using C++, 2nd Edition, Addison-Wesley Professional, 2014
3. Andrew Koenig and Barbara E. Moo, "Accelerated C++: Practical Programming by Example", 1st Edition, Addison-Wesley Professional, 2000
4. Anderi Alexandrescu , "Modern C++ Design: Generic Programming and Design Patterns Applied " , 1st Edition , Addison-Wesely Professional , 2001
5. Bruce Eckel , "Thinking in C++: Introduction to Standard C++: Volume One" 2nd Edition PrenticeHall, 2000

Outcomes:

Students will be able to:

1. Identify classes with attributes and functions for given problem
2. Analyze the relationship between the classes link them using appropriate concepts
3. Design and implement abstract data types.
4. Devise generic classes capable of manipulating primitive and user defined data types.
5. Perform object oriented analysis on the given problem and design a complete system to solve it.

CA718 RESOURCE MANAGEMENT TECHNIQUES

Pre Requisite: CA713

Objective:

- To learn different resource management techniques

Linear programming problems: Formulation – Simplex method – Big M method – Two Phase method – Revised Simplex method-Primal Dual problems- Dual Simplex method.

Network Programming models: Transportation problem – Assignment problem -Dynamic programming: Multi-stage graph formulation– Stage coach problem- Resource allocation problem- Inventory problem.

Non-linear Programming: One dimensional unconstrained optimization – Fibonacci method – Golden section method – Quadratic approximation method – constrained optimization with Lagrangian multipliers.

Integer Programming: All integer programming problem – Mixed integer programming- Gomory Cutting plane method- Branch and Bound method- Zero-one integer programming problem-Balas-additive algorithm.

Queuing theory - notation and assumptions – characteristics of queue – Poisson input process – exponential service times – Queuing models – M/M/1 – M/M/C – M/M/1/N – M/M/C/N

REFERENCES:

1. H.A. Taha, “Operations Research: An Introduction”, 8th Edition, Pearson Education, 2008.
2. Swarup.K, Gupta and P.K Man Mohan, “Operations Research”, 14th Edition, Sultan Chand & Sons, 2009.
3. S.R.Yadav, A.K.Malik, “Operations Research”, Oxford University Press, First Edition, 2014

Outcomes:

Students will be able to:

1. Formulate and solve LP /NLP /DP Problems
2. Identify appropriate model for given inventory problems and solve the problems
3. Solve queuing problems using queuing models

CA702 DATABASE SYSTEMS LAB

Pre -requisite: CA 712

Exercises / case studies that require table design, normalization and query building.

Outcomes:

Students will be able to:

1. Design Database for real time applications
2. Implement database functionalities
3. Do project by applying database design techniques and queries

CA704 Operating System Lab

Pre-requisites: CA714

Exercises to learn various commands, system calls in operating system and understand the working principles of OS algorithms

Outcomes:

Students will be able to:

1. Work with various commands in operating systems
2. Work with system calls

SEMESTER-III

CA721 DATA MINING TECHNIQUES

Pre -requisites: CA712, CA719

Objective:

To introduce concepts of data mining techniques and its applications in knowledge extraction from databases

Data mining – Motivation – Importance - DM Vs KDD - DM Architecture - Data Types – DM Tasks –DM System Classification - Primitives of DM - Data Mining Query Language - DM Metrics - DM Applications - DM Issues – Social Implications of DM.

Data Preprocessing: Summarization - Data cleaning - Data Integration and Transformation - Data Reduction - Discretization and Concept Hierarchy Generation.

Mining Frequent Patterns – Frequent Item set Mining Methods. Classification: Classification by Decision Tree Induction – Bayesian Classification – Rule based Classification - Prediction– Accuracy and Error Measures.

Cluster Analysis – Types of Data in Cluster Analysis – Categorization of clustering Methods – Partition Methods - Outlier Analysis – Mining Data Streams – Social Network Analysis – Mining the World Wide Web.

Data Warehousing: OLTP Vs OLAP - Multidimensional Data Model -DW Architecture Efficient Processing of OLAP queries - Metadata repository – DWH Implementation – OLAM.

REFERENCES:

1. JiaweiHan, Micheline amber, "Data Mining: Concepts and Techniques", 3rd Edition, Elsevier India Private Limited, 2012.
2. Margaret H. Dunham, "Data Mining: Introductory and Advanced Topics", Pearson Education, 2012.
3. K.P.Soman, ShyamDiwakar, V.Ajay, "Insight into Data Mining Theory & Practice, Prentice
4. Hall India, 2012
5. G.H.Gupta, "Introduction to Data Mining with Case Studies", 2nd Edition, PHI.
6. Ralph Kimball, Margy Ross "The Data Warehouse Toolkit: The Complete Guide to Dimensional Modeling", 3rd Edition ,wiley , Jul 2013

Outcomes:

Students will be able to:

1. Explain the concepts in data mining and KDD, recognizing issues in Data Mining
2. Practice the preprocessing operations of Data
3. Define the methodologies in Data interpretation, transformation and reduction
4. Perform Association Rule Mining, Classify and Cluster the data sets into groups
5. Implement star schema through ETL tools

CA723 PYTHON AND R PROGRAMMING

Pre -requisites: CA716, CA719

Objectives:

- To acquire knowledge in Python and R programming
- To develop Python programs with conditionals and loops and data structures
- To learn how to design and program Python applications
- To learn how to build and package Python modules for reusability

INTRODUCTION TO PYTHON PROGRAMMING: Python interpreter and interactive mode; values and types variables, expressions, statements, tuple assignment, Order of operations, comments, debugging; modules and functions: function Calls, adding new functions, Definitions and Uses, flow of execution, parameters and arguments, Fruitful functions. Conditionals: Boolean values and operators, conditional (if), alternative (if-else), chained conditional (if-elif-else); Iteration: state, while, for, range, break, continue, pass; recursion; Strings: string slices, immutability, string functions and methods, string module; Lists as arrays.

LISTS, TUPLES, DICTIONARIES: Lists: Traversing a List, list operations, list slices, list methods, Map, Filter and Reduce, list loop, mutability, aliasing, cloning lists, list parameters; Dictionaries: operations and methods; advanced list processing - list comprehension; Tuples: tuple assignment, tuple as return value.

FILES, MODULES, PACKAGES: Files and exception: text files, reading and writing files, format operator; command line arguments, errors and exceptions, handling exceptions, modules, packages: PANDAS, NUMPY, SCIKIT-LEARN;

INTRODUCTION TO R PROGRAMMING: Introduction and Preliminaries, numbers and vectors, Objects, their modes and attributes, Ordered and unordered factors, Arrays and matrices, Lists and data frames, Grouping, loops and conditional execution, functions.

STATISTICAL MODELS, GRAPHICAL PROCEDURES, PACKAGES: Statistical models : Defining statistical models; formulae, Linear models, Generic functions for extracting model information, Analysis of variance and model comparison, Updating fitted models, Generalized linear models, Nonlinear least squares and maximum likelihood models; Graphical procedures: High-level and low-level plotting commands, graphics parameters and list, Dynamic graphics. Packages: Standard packages, Contributed packages and CRAN, Namespaces.

REFERENCES:

1. Allen B. Downey, ``Think Python: How to Think Like a Computer Scientist``, 2nd edition, Updated for Python 3, Shroff/O'Reilly Publishers, 2016.
2. Guido van Rossum and Fred L. Drake Jr, —An Introduction to Python – Revised and updated for Python 3.2, Network Theory Ltd., 2011.
3. William N. Venables, David M. Smith, An Introduction to R: A Programming Environment for Data Analysis and Graphics, 2nd edition, Network Theory Ltd, 2009.
4. John V Guttag, —Introduction to Computation and Programming Using Python``, Revised and expanded Edition, MIT Press , 2013.
5. Robert Sedgewick, Kevin Wayne, Robert Dondero, —Introduction to Programming in Python: An Inter-disciplinary Approach, Pearson India Education Services Pvt. Ltd., 2016.

6. Timothy A. Budd, —Exploring Python, Mc-Graw Hill Education (India) Private Ltd.2015.
7. Kun Ren, Learning R Programming, Packt Publishing Ltd, 2016.
8. Colin Gillespie, Robin Lovelace, and Efficient R Programming: A Practical Guide to Smarter Programming, "O'Reilly Media, Inc.", 2016.

Outcomes:

1. Problem solving and programming capability
2. Construct and execute basic programs in Python
3. Use external libraries and packages with Python
4. Construct and execute basic programs in R using elementary programming techniques
5. Use external R-packages in statistics and graphics

CA729 OBJECT ORIENTED ANALYSIS AND DESIGN

Pre-requisites: CA716, CA710

Objective:

- To learn the concepts of Object Oriented Analysis and Design; exposing the development of OOAD based applications

Object Model – Evolution, Elements – Nature of Classes and Objects – Relationships among Classes - Classification – Identification of classes and objects – Key abstractions and mechanisms – Basic and Advanced Modeling techniques.

Methodology – Modeling and UML – Rumbaugh’s Method – Booch Method – Jacobson et al Method – Comparisons – UML – Static-Dynamic Models – Diagrams –Use Cases.

Process of design, design principles, architectural patterns, design document, difficulties and risks in design - Frameworks: reusable subsystem. Design patterns – Singleton, observer, adapter, Façade, proxy with examples. - Pattern Categories - Relationships between patterns - Pattern descriptions – Patterns based Applications – Object Oriented Database.

Java - Features – Structure – Elements of Java – Array, String, String Buffer, Vectors –Methods – Object Oriented Features- Classes, Objects – Constructors – Package – Inheritance – Interface – Abstract Class - Special types of classes.

Applet Programming – AWT – Graphics - Event Handling – Exception Handling – Utilities and Collections – I/O Streams - Multithreaded Programming - Swings - J2EE Architecture.

REFERENCES:

1. Grady Booch et al, “Object-Oriented Analysis and Design with Applications”, 3rd Edition, Pearson Education, 2007.
2. Michael Blaha and James Rumbaugh, “Object-Oriented Modeling and Design with UML”, 2nd Edition, Pearson Education,2005.
3. PatricNaughton , Herbert Schildt, "Java 2 Complete Reference", Tata McGraw Hill, 1999.
4. Joshua Bloch, “Effective Java”, Addison-Wesley; 3rd Edition, 2018.
5. Bruce Eckel, “Thinking in Java”, Prentice Hall; 4th Edition, 2006.
6. Erich Gamma, Richard Helm, Ralph Johnson & John Vlissides, “Design Patterns: Elements of Reusable Object-oriented Software”, Pearson Education India, 2004.

Outcomes:

Students will be able to:

1. Define the fundamentals of OO approach
2. Design OO Application using design patterns
3. Solve real world problems by applying OOAD principle
4. Acquire expertise in Java Programming

CA725 SOFTWARE ENGINEERING

Pre -requisites: CA711, CA712, CA716

Objective:

- To impart concepts of a comprehensive study on the theories, processes, methods, and techniques of building high-quality software in cost-effective ways

Introductory concepts – The evolving role of software – Its characteristics, components and applications- A layered technology – the software process – Software process models – Software development Life cycle- Software process and project metrics – Measures, Metrics and Indicators- ethics for software engineers.

Software Project Planning – Project planning objectives – Project estimation – Decomposition techniques – Empirical estimation models - System Engineering- Risk management- Software contract management – Procurement Management.

Analysis and Design – Design concept and Principles, Methods for traditional, Real time of object oriented systems – Comparisons – Metrics- Quality assurance.

Testing fundamentals – Test case design – White box testing – Basis path testing – Control structure testing – Black box testing – Strategies: Unit testing integration testing – Validation Testing – System testing – Art of debugging – Metrics, Testing tools.

Formal Methods Clean-room Software Engineering – Software reuse – Reengineering – Reverse Engineering – standards for industry.

REFERENCES:

1. Rajib Mall, “Fundamentals of Software Engineering”, 4th Edition, PHI, 2014.
2. Roger S. Pressman, "Software Engineering-A practitioner’s approach", 7 th Edition, McGraw Hill, 2010.
3. Ian Sommerville, Software engineering, 10th Edition, Pearson education Asia, 2016.
4. Pankaj Jalote, “An Integrated Approach to Software Engineering”, Springer Verlag, 1997.
5. James F Peters, Witold Pedrycz, “Software Engineering – An Engineering Approach”, John Wiley and Sons, 2000.
6. Ali Behforooz, Frederick J Hudson, “Software Engineering Fundamentals”, Oxford University Press, 2009.
7. Bob Emery , “Fundamentals of Contract and Commercial Management “, Van Haren Publishing, Zaltbommel, 2013

Outcomes:

Students will be able to:

1. State the proven principles/techniques/tools, current standards, and best practices of software Engineering
2. Estimate cost, effort and risk involved in a project
3. Choose a suitable design model for software development
4. Develop a software using formal software engineering approaches
5. Describe the principles of re-engineering and reverse engineering

CA727 COMPUTER NETWORKS

Pre -requisites: CA714

Objective:

- To learn various network architectures and protocols and the functions of different layers in line with IEEE standards.

Building a network – Requirements – Network Architecture – OSI – Internet – Direct Link Networks LAN Technology – LAN Architecture – BUS/Tree – Ring – Star – Ethernet – Token Rings – Wireless Networks.

Error Detection and Correction – VRC – LRC - CRC- Checksum – Hamming Distance for Error Correction – simulator development to capture various packets flowing in the Data Link Layer.

Switching - Packet Switching – Switching and Forwarding – Bridges and LAN switches – Internetworking – Simple Internetworking – Routing - Selective routing protocol specification.

Reliable Byte Stream (TCP) – Simple Demultiplexer (UDP) – TCP Congestion Control – Congestion Avoidance Mechanisms – Streaming Protocol.

Domain Name Service (DNS) – Email - SMTP – MIME – HTTP – SNMP-TELNET-FTP.

REFERENCES:

1. Behrouz.A.Forouzan, “Data Communications and Networking”, 4th Edition, McGraw-Hill, 2004.
2. William Stallings, “Data and Computer Communications”, 9th Edition, Pearson, 2011.
3. Larry L. Peterson and Bruce S. Davie, “Computer Networks - A systems Approach”, 5th Edition, Harcourt Asia/Morgan Kaufmann, 2011.
4. James F. Kurose and Keith W. Ross, “Computer Networking - A Top Down Approach”, 5th Edition, Addison Wesley, 2009.
5. Andrew S. Tanenbaum, “Computer Networks”,5th Edition, Prentice Hall PTR,2012.

Outcomes:

Students will be able to:

1. List the functionalities of networking layers of both OSI and TCP/IP reference model
2. Explain design issues of DLL and techniques to resolve it
3. Describe the principles of switching and routing algorithms
4. Distinguish TCP and UDP related formats and procedures

CA705 NETWORKS LAB

Pre-requisites: CA727

- Exercises to practice installation and configuration to understand network architecture and build a network
- Exercises to implement network principles

Outcomes:

Students will be able to:

1. Install and configure networks
2. Build the network according to the requirement
3. Implement network principles

CA707 DATA MINING LAB

Pre-requisite: CA 721

Exercises to

- Understand the data sets and data preprocessing using ETL tools
- Demonstrate the working of algorithms for data mining tasks such association rule mining, classification, clustering and regression

Outcomes :

Students will be able to:

1. Work with ETL tools
2. Demonstrate the classification, clustering and etc. in large data sets.
3. Ability to add mining algorithms as a component to the existing tools.
4. Ability to apply mining techniques for realistic data.

SEMESTER-IV

CA728 WEB TECHNOLOGY AND ITS APPLICATIONS

Pre-requisites: CA716

Objective:

- To learn the concepts web technologies; develop and deploy effective web applications

Web essentials – W3C - Clients – Servers - Communication – Markup Languages – XHTML – Simple XHTML Pages Style Sheets – CSS.

Client side programming – Java script language – Java Script Objects – Host Objects Browsers And The DOM.

Server side programming – Java servlets – Basics – Simple Program – Separating Programming And Presentation – ASP/JSP - JSP Basics ASP/JSP Objects – Simple ASP/JSP Pages.

Representing Web data – Data Base Connectivity – JDBC – Dynamic Web Pages – XML – DTD – XML Schema – DOM – SAX – Xquery – JSON – WEB 3.0 - Building Web Applications - Cookies – Sessions – Open Source Environment – PHP – MYSQL – Case Studies.

Middleware Technologies – Ecommerce – Architectures – Technologies – Ajax – Advanced Web Technologies and Tools.

REFERENCES:

1. Jeffrey C Jackson, “Web Technology – A computer Science perspective”, Pearson Education, 2007.
2. Chris Bates, “Web Programming – Building Internet Applications, “Wiley India, 2006.

Outcomes:

Students will be able to:

1. Develop client side and server side applications
2. Design and develop enterprise applications
3. List the various middleware technologies and use them to develop applications

CA724 INFORMATION SECURITY

Pre-requisite: CA 713, CA727

Course Objectives

- To understand and apply the models of information security
- To study and analyze cryptographic and forensic methods
- Analyze and simulate the network and application security
- Explore the nature and logic behind security threats on the web as an ethical hacker

Information Security - Critical Characteristics of Information, NSTISSC Security Model, Components of an Information System, , Balancing Security and Access, Security SDLC.

Cryptography: Classical Cryptography, Symmetric Cryptography, Public Key (Asymmetric cryptography), Modern Cryptography. Forensics: DRM technology (including watermarking and fingerprinting), Steganography, Biometrics.

Network Security: Network Protocols, Wireless Security (WiFi, WiMAX, Bluetooth, cell phone), IDS and IPS, Network Intrusion Management.

Application Security: Software Security, Mobile Security, and Database Security.

Information Security Threats: Viruses, Worms and other malware, Email Threats, Web Threats, Identity Theft, Data Security Breaches, Ethical Hacking -Hacking Tools and Techniques.

REFERENCES:

1. W. Stallings, Cryptography and Network Security: Principles and Practice, 6th Edition, Prentice Hall, 2013
2. Neil Daswani, Christoph Kern, Anita Kesavan, " Foundations of Security: What Every Programme", APRESS, 2007.
3. Michael E Whitman and Herbert J Mattord, "Principles of Information Security",Vikas Publishing House,2003.

Outcomes :

1. Identify the information security models and their characteristics
2. Analyze the different types of cryptographic and forensic methods
3. Study the network security issues
4. Discover the layers of application security
5. Identify different threats and suggest fixes in data and cyber security.

Industrial component:

Expert Lectures on Security Related Issues from Ethical Hackers.

CA726 DISTRIBUTED TECHNOLOGY

Pre-requisites: CA727, CA712

Objective:

- To learn the various distributed objects and technologies.

Introduction- Different Forms of Computing- Architecture - Inter-process Communications: IPC Program Interface-Event Synchronization-Timeouts and Threading-Deadlocks and Timeouts-Data Representation- Data Encoding- Text-Based Protocols-Request-Response Protocols-Event Diagram - Sequence Diagram- Connection-Oriented Vs Connectionless IPC.

Client Server: Architecture – Types of Servers – Connection Oriented-Connectionless - Iterative-Concurrent and Stateful Servers. Distributed Computing: Paradigm – Architecture– Applications.

Socket API and Group Communication: Background-The Socket Metaphor in IPC-The Datagram Socket API-The Stream-Mode- Socket API- Sockets With Non-blocking I/O Operations- Secure Socket API. Group Communication – Unicasting- Multicasting and its types – Java Basic Multicast API - Reliable Multicast API.

Distributed Objects : Message Passing Vs Distributed Objects- An Archetypal Distributed Object Architecture- Distributed Object Systems-CORBA, COM and Web Services: CORBA Object Interface- Inter-ORB Protocols- Object Servers- Object Clients- CORBA Object References - CORBA Naming Service -Interoperable Naming Service- CORBA Object Services- Object Adapters- Java IDL.Web Services: SOAP-UDDI-WSDL-XML-RESTFUL WEB SERVICE.

Case Studies – A Distributed System In A Room – Geographically Distributed Nodes, Centralized Control. Site Replication for Disaster Protection- searching Heterogeneous and Distributed Databases-Distributed Database Case Study on Google’s Big Tables.

REFERENCES:

1. M. L. Liu, “Distributed Computing Principles and Applications”, Pearson Education 2004
2. Mark Hansen, “SOA using JAVA Web Services”, Prentice Hall 2007
3. Crichlow, “Distributed Systems: Computing over Networks”, PHI 2009
4. Tanenbaum, Sten, “Distributed Systems - Principles and Paradigms”, PHI 2006
5. Puder, “Distributed Systems Architecture - A Middleware Approach”, Science & Technology Books 2005.
6. Lynch, “Distributed Algorithms” Science & Technology Books 1996.
7. David Reilly & Michael Reilly, “Java Networking and Distributed Computing”, Addison Wesley, 2002.
8. Jim Farley, “Java Distributed Computing”, O'Reilly Media; 1st edition, 1998.

Outcomes:

Students will be able to:

1. Explain the principles and issues in Inter Process Communication
2. Use the concepts of client/server in developing applications

CA722 ORGANIZATIONAL BEHAVIOR

Pre-requisite: CA 703

Objective:

- To learn the leadership skills and group behavior

History of Management - The human relations movement - The Hawthorne studies - Models for organizational behavior – Management concepts.

Foundations of Individual Behavior - Personality – Meaning and development - Major determinants of Personality and Values -Theories of Personality – Perception and Individual Decision Making – sensation versus perception - Stress – Causes and effect of job stress - coping strategies for stress.

Foundations of Group Behavior - Understanding Work Teams – Team Communication – Team outcome- Basic Approaches to Leadership - Contemporary Issues in Leadership – Motivation Concepts - Motivation From Concepts to Applications –Work motivation – Attitude and Job Satisfaction - Power and Politics - Job design - Goal setting

Conflicts - Individual conflict, Interpersonal conflict, Inter-group conflict– Conflict Resolution - Negotiation

Foundations of Organization Structure - Organizational Culture – Feedback – performance Appraisal- Organizational Dynamics

REFERENCES:

1. Stephen P. Robbins , Timothy A. Judge, “Organizational Behavior”, 14th Edition, Pearson Education,2012.
2. Robert Kreitner, Angelo Kinicki, “Organizational Behavior”, 8th Edition, McGraw-Hill,2007.
3. Fred Luthans, "Organizational Behavior", McGraw Hill, 1997.
4. Keith Davis, "Human behavior at work: Human relations and Organizational Behavior", Tata McGraw Hill, 1982.
5. Rudrabasavaraj M.N. “Dynamic personnel Administration”, 3rd Edition, Himalaya Publishing House, 2011.

Outcomes:

Students will be able to:

1. Identify their personality type and behavioral pattern
2. Identify the basic skills of leadership
3. Apply the principles of conflict resolution and learn about group behavior
4. Adapt to the organization culture, structure and dynamics

Industrial Component:

A series of tutorials on Organization Development

CA706 WEB TECHNOLOGY AND ITS APPLICATIONS LAB

Pre-requisite: CA 728

Exercises / Case Studies on HTML, XML, PHP, JSP etc. – Designing Web Portals

Course Outcome

With HTML, XML, PHP, JSP, students will be able to

1. Develop client side and server side applications
2. Design and develop enterprise applications
3. Implement the various middleware technologies and use them to develop applications

CA708 INFORMATION SECURITY LAB

Pre-requisite: CA 724

Exercises to learn information security related programming using tools.

Outcomes:

Students will be able to:

1. Implement cryptography techniques to data
2. Simulate the various network security issues
3. Experiment with application security
4. Explore the nature and logic behind the various security threats on the web

SEMESTER-V

CA731 ARTIFICIAL INTELLIGENCE

Objectives:

- To know about basic concepts of NLP and Machine Learning
- To obtain a thorough knowledge of various knowledge representation schemes
- To have an overview of various AI applications
- To study about various heuristic and game search algorithms
- To know about various Expert System tools and applications

Introduction: Introduction to AI applications and AI techniques, Production systems, control strategies, reasoning - forward and backward chaining. Intelligent Agents: Definitions of a rational agent, reflex, model-based, goal-based, and utility-based agents, the environment in which a particular agent operates.

Searching Techniques and Game Playing: Breadth first search, depth first search, iterative deepening, uniform cost search, hill climbing, simulated annealing, genetic algorithm search, heuristic search, Best first search, A* algorithm, AO* algorithm, Minimax and game trees, refining minimax, Alpha – Beta pruning, constraint satisfaction.

Knowledge Representation: First order predicate calculus, resolution, unification, natural deduction system, refutation, logic programming, PROLOG, semantic networks, frame system, value inheritance, conceptual dependency, Ontologies. Planning: basic representation for planning, symbolic-centralized vs. reactive-distributed, partial order planning algorithm.

Machine learning: Introduction to different types of learning, Supervised and Unsupervised learning – Reinforcement learning- Basics of Neural network models.

Applications of Artificial Intelligence- Natural Language Processing, Speech recognition, Computer vision, Expert systems.

REFERENCE:

1. S. Russell and P. Norvig, Artificial Intelligence: A Modern Approach (3rd ed.), Pearson Education, 2010.
2. Elaine Rich and Kelvin Knight, Artificial Intelligence, Tata McGraw Hill, 2002.
3. Nils J Nilson, Artificial Intelligence: A New Synthesis, Morgan Kaufmann Publishers, Inc., San Francisco, California, 2000.
4. R. Akerkar, Introduction to Artificial Intelligence, Prentice-Hall of India, 2005.
5. Dan W. Patterson, Introduction to Artificial Intelligence and Expert Systems, Prentice Hall of India, 2006.
6. Nils J. Nilson, Principles of Artificial Intelligence, Narosa Publishing House, 2001.
7. W.F. Clocksin and C.S. Mellish, Programming in PROLOG, Narosa Publishing House, 5th edition, 2003.
8. Saroj Kaushik, Logic and Prolog Programming, New Age International Publisher, 2006.

Outcomes:

Students will be able to:

1. Know how to build simple knowledge-based systems
2. Apply knowledge representation and machine learning techniques to solve real-world problems
3. Apply Artificial Intelligence techniques to solve real-world problems

CA733 CLOUD COMPUTING

Pre-requisites: CA727, CA726

Objective:

- To learn the various concept of Distributed and Cloud computing and to study the Architecture and service models in Cloud computing.

Distributed Systems Models and Enabling Technologies: Scalable Computing – Technologies for Network-Based Systems – System Models for Distributed and Cloud Computing – Software Environments for Distributed and Clouds – Performance, Security and Energy Efficiency.

Virtualization concepts: Implementation Levels of Virtualization – Virtualization Structures - Tools and Mechanisms – Virtualization of CPU, Memory and I/O Devices – Virtual Clusters and Resource Management – Virtualization for Data-Center Automation, Introduction to Various Virtualization OS - VMware, KVM, Xen.

Service-Oriented Architecture for Distributed Computing: Services and SOA – Message-Oriented Middleware – Portals and Science Gateways – Discovery-Registries-Metadata - Workflow in SOA.

Cloud Computing and Service Models – Data-center Design and Interconnection Networks – Architectural Design of Compute and Storage Clouds – Public cloud Platforms – Inter-cloud Resource Management – Cloud Security and Trust Management.

Cloud Programming and Software Environments – Features of Cloud and Grid Platforms – Parallel and Distributed Paradigms – Programming Support of Google App Engine – Amazon AWS and Microsoft Azure - Emerging Cloud Software Environments.

REFERENCES:

1. Kai Hwang, Geoffrey C.Fox, and Jack J. Dongarra, "Distributed and Cloud Computing", Elsevier India Private Limited, 2012.
2. Foster and Kesselman, "The Grid : Blueprint for a New Computing Infrastructure", Morgan Kauffman publishers Inc.2004
3. Coulouris, Dollimore and Kindber, "Distributed System: Concept and Design", Fifth Edition, Addison Wesley, 2011.
4. Michael Miller, "Cloud Computing", Dorling Kindersley India,2009.
5. Anthony T. Velte, Toby J. Velte and Robert Elsenpeter, "Cloud computing: A practical Approach", McGraw Hill,2010.

Outcomes:

Students will be able to:

1. Acquire Knowledge on the features and development of Cloud Computing.
2. Define the principles of virtualization
3. Use various performance criteria to evaluate the quality of the cloud architecture
4. Identify the Service-Oriented Architecture for Distributed Computing workflow.

Industrial component:

Expert Lecture on current advancement in cloud and cloud support models.

CA709 ARTIFICIAL INTELLIGENCE LAB

Pre-requisite: CA 731

Exercises to

- Understand fundamentals of knowledge representation
- Acquire knowledge on the basic concepts and techniques of Machine Learning
- Gain knowledge on the basics of computational Intelligence techniques

Outcomes :

Students will be able to:

1. Apply knowledge representation and machine learning techniques to solve real world problems
2. Apply Computational Intelligence techniques to solve real-world problems

CA749 MINI PROJECT WORK

Pre-requisites: CA711, CA728, CA725

Outcomes:

Students will be able to:

1. Identify the problem related to the project work
2. Implement the case studies using the concepts and the techniques learnt in the curriculum

CA750 PROJECT WORK

Pre-requisites: CA711, CA728, CA725

SIX Months internal/external project work with submission of reports for the project work and viva-voce examination.

Outcomes:

Students will be able to:

1. Implement the solution for the chosen problem using the concepts and the techniques learnt in the curriculum.
2. Developing software applications
3. Record the research results for a given problem

ELECTIVES

CA7A1 BUSINESS INTELLIGENCE

Pre-requisite: CA721

Objective:

- To know the BI as expert information, knowledge and technologies efficient in the management of organizational and individual business.

Decision Support and Business intelligence - Changing Business environments and computerized decision support, managerial decision making and support for decision making - DSS concept and framework Business intelligence - Major tools and techniques of managerial decision support - BI architectures.

Essentials of Business Intelligence-Origins and drivers of business intelligence, successful BI implementation, characteristics of BI-Architecting the Data, Enterprise Data Model and its Benefits, Granularity of Data in Data Warehouse and Role of Metadata.

Advanced Data Warehousing principles- Data warehousing architectures, DW development, real time DW and DW Administration and security issues-Visualization of Dimension model-Star, snowflake and other advanced models-Aggregated Fact tables -Relational DBMS Support for Dimensional Modeling- Advanced Topics in Dimensional Modeling - Selecting a Modeling Tool - Populating Data Warehouse.

Dimensional modeling in BI environment - Dimensional Modeling - Modeling considerations - Dimensional model design life cycle - Case studies - Business Analytics and data Visualization - Business analytics overview, reports and queries, Advanced business analytics, data visualization, Real time BI, Business analytics and web intelligence - Structure of mathematical models for decision support and visual interactive simulation.

Business performance Management - Business Intelligence Applications: Marketing models, Logistic and production models and Data Development analysis.

REFERENCES:

1. E Turban, J E Aronson, Teng Pend Liang and Ramesh Sharda, "Decision Support and Business Intelligence Systems", 8th Edition, Pearson Education, 2009.
2. Dan Volitich, "IBM Cognos Business Intelligence", TMH,2008
3. Chuck Ballard, Dirk Herreman, Don Schau, Rhonda Bell,Eunsaeng Kim, Ann Valencic, "Data Modeling Techniques for Data Warehousing", IBM Corporation, 1999

Outcomes:

Students will be able to :

1. Explain the concepts of decision support and framework for Business Intelligence
2. Identify the practical implications and functions of BI
3. Design & construct data mart and data warehouse
4. Describe dimensional modelling and analytics involved in BI

CA7A2 UNIX AND SHELL PROGRAMMING

Pre-requisite: CA714

Objective:

To learn the UNIX operating system concepts and shell programming

Introduction – UNIX Environment –Structure – Accessing UNIX –Common Commands – Basic Editors: Concepts –Modes –Editor Commands.

File Systems: File names –File Types –Regular Files –Directories –File System Implementation - Operations Unique to directories and regular files –Security and File Permission.

Introduction to Shells: UNIX Session –Standard Streams –Redirection –Pipes –Command Line Editing -Job Control – Aliases –Variables -Shell/Environment Customization.

Filters: Concatenating –Sorting –Translating Characters – Duplicate Lines –Character Count – Comparing Files. Communications: User commands –Electronic mail –Remote Access – File Transfer.

C Shell Programming: Basic Scripts –Expressions –Decision Making Selections –Special Parameters –Argument Validation –Debugging Scripts –Signals –Scripting Techniques.

REFERENCES:

1. Behrouz A. Forouzan, Richard F. Gilberg, “UNIX and Shell Programming “, 9th Edition, Cengage Learning, 2009.
2. SumitabhaDas,“UNIX Concepts and Applications”,8th Edition, Tata McGraw Hill, 2008.
3. M G Venkateshmurthy: UNIX and Shell Programming, Pearson Education, 2005.
4. Maurice J. Bach, “The Design of the Unix Operating System”, Indian Edition, PHI Learning Private Limited, 2011.

Outcomes :

Students will be able to :

1. Explain the concepts of UNIX Operating System
2. Use various file and directory commands in UNIX Operating System
3. Write shell scripts for various tasks

CA7A3 VISUAL PROGRAMMING

Pre-requisite: CA716

Objective:

Understand the principles of graphical user interface design and develop desktop applications and web services using .NET

.NET Framework - Architecture, Common Language Runtime, Common Type System, Namespaces, Assemblies, Memory Management, Process Management, Class Libraries.

Visual programming principles – GUI Design - User-centered Design - Navigation - Accessibility - Structure – Elements- Visual hierarchy – Typography – Graphics – Animation – Creative design.

.NET - Declaration, Expression, Control Structures, Function, String, Array, Encapsulation, Class, Property, Indexer, Delegate, Inheritance, Interface, Polymorphism, Exception Handling, Modules, Graphics, File handling and Data Access.

.NET – Form- Event–Form Controls – Containers – Menus - Data controls - Printing – Reporting – Dialogs – Components - Single and Multiple Document Interfaces.

ASP.NET – Web Pages, Web Forms, Web Site Design, DataControls, ValidationControls, HTML, NavigationControls, LoginControls, Reports - Master Pages – Web Service Architecture - Basic Web Services – Web Reference – Standards.

REFERENCES

1. Matt J. Crouch, “ASP.NET and VB. NET Web Programming”, Pearson Education, 2006.
2. Kevin Hoffman, “Microsoft Visual C# 2005 Unleashed”, Pearson Education, 2006
3. SandeepChatterjee, Janes Webber, “Developing Enterprise Web Services: An Architect’s Guide”, Pearson Education, 2005
4. Wilbert O. Galitz, “The Essential Guide to User Interface Design: An Introduction to GUI Design Principles and Techniques”, Wiley Desktop Editions, 2007.

Outcomes:

Students will be able to :

1. Define the basics of .NET framework
2. Use components in .NET to solve various application related problems
3. Design and develop web applications with ASP.NET

Industrial Component:

A series of lectures on the latest trends and technology

CA7A4 SOFTWARE ARCHITECTURE AND PROJECT MANAGEMENT

Pre-requisite: CA725

Objective:

- To know the issues related to the design of complex software and to learn the project management concepts and the use of tools.

Software components - COTS and infrastructure - Software variability management-Software architecture design methods - Architecture evaluation and assessment methods - architectural styles.

Design Patterns - Evolution patterns - Software artifact evolution processes - Case studies - Java Beans.

Product, Process and Project – Definition – Product Life Cycle – Project Life Cycle Models.

Format Process Models And Their Use -Definition and Format model for a process – The ISO 9001 and CMM Models and their relevance to Project Management –Emerging Models - People CMM-Metrics – Configuration Management – Software Quality Assurance – Risk Analysis.

Engineering and People Issues in Project Management-Phases (Requirements, Design, Development, Testing, Maintenance, Deployment) –Engineering Activities and Management Issues in Each Phase – Special Considerations in Project Management for India and Geographical Distribution Issues.

REFERENCES:

1. Len Bass, Paul Clements, and Rick Kazman, "Software Architecture in Practice", 2nd Edition, Addison-Wesley Longman, Inc., Reading, MA, 2003
2. Richard N.Taylor, NenadMedvidovic, and Eric M.Dashofy, "Software Architecture: Foundations, Theory and Practice", Wiley India Edition, 2012
3. Mary Shaw, and David Garlan ,” Software Architecture in Practice: Perspectives on an Emerging Discipline", PHI Learning Private Limited,2010
4. Ramesh and Gopaldaswamy, "Managing Global Projects", Tata McGraw Hill,2001

Outcomes:

Students will be able to :

1. Explain various design and evaluation methods
2. Employ design patterns in the software architecture
3. Apply various phases of life cycle models
4. List various process models and describe issues related with quality assurance
5. Apply engineering activities involved in various project management phases

Industrial Component

Presentation of Case studies on the design & development of complex software and current practices of successful project management activities by professionals from leading industries

CA7A5 BUSINESS ETHICS

Pre-requisite: CA722

Objective:

- To introduce business ethics and its practices

Introduction to Business Ethics, Ethics, Morals and Values, Concepts of Utilitarianism and Universalism – Theory of rights, theory of Justice – Virtue ethics – ethics of care– Law and Ethics – The Nature of Ethics in management – Business Standards and Values – Value Orientation of the Firm.

Environmental Pollution and Society - Marketing Ethics (in Products, Pricing, Promotion and Place) and Consumer protection – Ethics in Human Resources management (Recruitment and promotion policies, Working Conditions, Down Sizing Workforce), Ethical issues at the top management, Ethics in financial markets and investor protection – Ethical responsibility towards competitors and business partners.

A Historical Perspective from Industrial Revolution to Social Activism – Current CSR practices of the firms in India and abroad. Conflicts in decision making from ethical and economic point of view - Ethical Dilemma - Solving ethical dilemma -Managerial integrity and decision making.

Personal Integrity and self-development – wisdom based leadership. History of Corporate form and models - Corporate Objective and goals, Ownership pattern – Issues in managing public limited firms – Agency problems.

REFERENCES:

1. M. G. Velasquez, “Business Ethics: Concepts and Cases”, 2005, Prentice Hall of India.
2. N. Minow and R. Monks, “Corporate Governance”, Wiley-Blackwell, 2008
3. E. Banks, “Corporate Governance: Financial Responsibility, Ethics and Controls”, 2004, Palgrave Macmillan, 2004
4. Laura P. Hartman & Joe DesJardins, Business Ethics: Decision-Making for Personal Integrity and Social Responsibility, NY: McGraw-Hill/Irwin, 2008.

Outcomes:

Students will be able to:

1. Define the principles of ethics and morals of business
2. Convey ethical response with respect to Competitors & Business Partners
3. Enhance the leadership skills with respect to decision making & business management

CA7B3 INTERNET OF THINGS

Objectives

- To understand the fundamentals of Internet of Things
- To learn about the basics of IOT protocols
- To build a small low cost embedded system using Raspberry Pi.
- To apply the concept of Internet of Things in the real world scenario

Introduction - Physical and Logical Design- Enabling Technologies - Levels & Deployment Templates - Domain Specific IOTs - NETCONF-YANG- IoT Platforms Design Methodology.

IoT Architecture ETSI , IETF , OGC architectures - IoT reference model - Domain model - information model - functional model - communication model - IoT reference architecture .

IoT Protocols - Protocol Standardization – Efforts – M2M and WSN Protocols – SCADA and RFID Protocols – Unified Data Standards – Protocols – IEEE 802.15.4 – BACNet Protocol – Modbus– Zigbee Architecture – Network layer –LowPAN - CoAP – Security.

Building IoT - RASPERRY PI- IoT Systems - Logical Design using Python – IoT Physical Devices & Endpoints - IoT Device -Building blocks -Raspberry Pi-Board - Linux on Raspberry Pi - Raspberry Pi Interfaces -Programming Raspberry Pi with Python - Other IoT Platforms - Arduino.

Case Studies And Real-World Applications - Real world design constraints - Applications - Asset management, Industrial automation, smart grid, Commercial building automation, Smart cities - participatory sensing - Data Analytics for IoT – Software & Management Tools - Cloud Storage Models & Communication APIs - Cloud for IoT - Amazon Web Services for IoT.

REFERENCES:

1. Adrian McEwen and Hakim Cassimally, “Designing the Internet of Things”, John Wiley & Sons, 2013.
2. Cuno Pfister, “Getting Started with the Internet of Things: Connecting Sensors and Microcontrollers to the Cloud”, Maker Media, 2011.

Outcomes:

Students will be able to:

1. Analyze various protocols for IoT
2. Develop web services to access/control IoT devices.
3. Design a portable IoT using Raspberry Pi
4. Deploy an IoT application and connect to the cloud.
5. Analyze applications of IoT in real time scenario

CA7B4 MARKETING MANAGEMENT

Pre-requisites: CA717, CA722

Objective:

To facilitate understanding of the conceptual framework of marketing and its applications in decision making under various environmental constraints.

Introduction to marketing, scope of marketing , core marketing concepts, new marketing realities, production concept, product concept, selling concept, marketing concept, Relationship Marketing, Integrated Marketing ,Performance Marketing, new 4P's.

Buying Behaviour: key psychological process, buying decision process, stages in buying process. Bases for Segmenting: Consumer, Business Markets, Market Targeting, Positioning.

Product : Levels , hierarchy , Classification of products, Major product decisions, Product line and product mix; Branding, brand equity, Product life cycle – strategic implications, New product development and consumer adoption process. Pricing: Objective of pricing decision, factors affecting price determination, pricing policies, developing pricing strategies, strategies for new products and existing products.

Promotion :Communication Process; Promotion mix – advertising, personal selling, sales promotion, publicity and public relations, direct marketing ; Determining advertising budget; Copy designing and testing; Media selection; Advertising effectiveness; Sales promotion – tools and techniques.

Market control: Annual plan control, sales analysis market share analysis, profitability control, marketing profitability analysis, efficiency control and strategic control. Trends in marketing, socially responsible marketing, internal marketing, green marketing, cause marketing, cause related marketing.

REFERENCES:

1. Philip Kotler,"Marketing Management", 15th Edition, Pearson Prentice Hall,2015
2. Ramaswamy V.S and Namakumari .S," Marketing Management: Planning, implementation and control", 5th Edition, Macmillan, New Delhi,2009
3. Michael J. Etzel, Bruce J. Walker, William J. Stanton, Ajay Pandit, "marketing – concepts and cases", special Indian edition, McGraw Hill
4. Zikmund d Amico, "The power of Marketing" , 7th edition, Sowth Western , Thomson Learning Publications, 2006.

Outcomes:

Students will be able to :

1. Define the fundamentals of marketing
2. List the issues related to buying and target marketing
3. Apply the new product development strategies
4. Use product promotional techniques
5. Familiar with trends in analysis & control in marketing

CA7B5 SOFT COMPUTING

Pre-requisites:CA711, CA719

Objective:

- To introduce the techniques of soft computing
- To explain the hybridization of soft computing systems which differ from conventional AI and computing in terms of its tolerance to imprecision and uncertainty.

Soft Computing and its Techniques, Soft Computing verses Hard Computing. Applications of Soft Computing in the current industry.

Neural Network (NN), Biological foundation of Neural Network, Neural Model and Network Architectures, Perceptron Learning, Supervised Hebbian Learning, Back-propagation, Associative Learning, Competitive Networks, Hopfield Network, Computing with Neural Nets and applications of Neural Network.

Fuzzy Sets, Operations on Fuzzy sets, Fuzzy Relations, Fuzzy Measures, Applications of Fuzzy Set Theory to different branches of Science and Engineering.

Neuro Fuzzy and Soft Computing, Adaptive Neuro-Fuzzy Inference System Architecture, Hybrid Learning Algorithm, Learning Methods that Cross-fertilize ANFIS and RBFN.

Coactive Neuro Fuzzy Modeling, Framework Neuron Functions for Adaptive Networks, Neuro Fuzzy Spectrum. Hybridization of other techniques.

REFERENCES:

1. J.S.R.Jang, C.T.Sun and E.Mizutani,Neuro-Fuzzy and Soft Computing, PHI,2004.
2. J. Freeman and D. Skapura,Neural Networks: Algorithms, Applications, and Programming Techniques, Addison-Wesley,1991.
3. G. J. Klir, and B. Yuan,Fuzzy Sets and Fuzzy Logic: Theory and Applications, Prentice-Hall,1995
4. S. Rajasekaran and G.A.V.Pai,Neural Networks, Fuzzy Logic and Genetic Algorithms, PHI,2003

Outcomes:

Students will be able to :

1. Explain the basics of soft computing and their suitable industry related applications
2. Apply neural network principles and algorithms for given problems
3. Apply the principles of fuzzy algorithms for real time applications

Industrial Component:

A series of tutorials on MATLAB.

CA7B6 ADVANCED DATABASE TECHNOLOGY

Pre-requisites: CA712,CA721

Objective:

- To learn advanced database models and design of databases

ER Model - Normalization – Query Processing – Query Optimization – Transaction Processing - Concurrency Control – Recovery - Database Tuning – Issues.

Parallel Databases: I/O Parallelism – Inter and Intra Query Parallelism – Distributed Database Features - Distributed Data Storage – Fragmentation – Distributed Query Processing – Distributed Transactions – Commit Protocols – Concurrency Control – Recovery.

Object Databases: Object Identity – Object structure – Type Constructors – Encapsulation of Operations – Methods – Persistence – Type and Class Hierarchies – Inheritance – Complex Objects – Object Database Standards, Languages and Design: ODMG Model – ODL – OQL – Object Relational and Extended – Relational Systems: Object Relational features in SQL/Oracle.

Rules – Knowledge Bases - Active and Deductive Databases – Image databases – Text/Document Databases - Multimedia Databases - Applications – XML Databases.

Enhanced Data Models - Client/Server Model - Data Warehousing and Data Mining - Web Databases – Mobile Databases – Location and Handoff Management – Mobile Transaction Models.

REFERENCES:

1. R. Elmasri, S.B. Navathe, “Fundamentals of Database Systems”, Sixth Edition, Pearson Education/Addison Wesley, 2007.
2. Thomas Cannolly and Carolyn Begg, “Database Systems, A Practical Approach to Design, Implementation and Management”, Sixth Edition, Pearson Education, 2015.
3. Henry F Korth, Abraham Silberschatz, S. Sudharshan, “Database System concepts”, Sixth Edition, McGraw Hill, 2013.
4. C.J.Date, A.Kannan and S.Swamynathan, “An Introduction to Database Systems”, Eighth Edition, Pearson Education, 2006.
5. V.S.Subramanian, “Principles of Multimedia Database Systems”, Harcourt India Pvt Ltd., 2001.
6. Vijay Kumar, “Mobile Database Systems”, John Wiley & Sons, 2006.

Outcomes:

Students will be able to:

1. Apply the principles of query optimization to a database schema
2. Design parallel and object database for real life application
3. Use distributed database management system

CA7B7 MODELING AND COMPUTER SIMULATION

Pre-requisites: CA713, CA719,CA723

Objective:

1. To understand the techniques of random number generations and testing randomness.
2. To design simulation models for various case studies like inventory, traffic flow networks, etc.
3. To practice on simulation tools and impart knowledge on building simulation systems.

Simulation and Simulation Software - Systems – Models – Types, Components, Steps in Modeling –Simulation of statistical queuing, manufacturing and material handling.

Useful Statistical Models – Discrete Distribution – Continuous Distributions – Poisson – Empirical Distribution – Manufacturing and Material Handling System – Models – Goals and Performances Measure – Issues – Queuing System – Characteristics – Transient and Steady-State Behaviour of Queues – Long-Run Measures – Infinite – Population Markovian Models.

Random Numbers - Generation of Pseudo Random Numbers – Mid-Square Method – Linear Congruential Generators – Generating Random Variates from Continuous and Discrete Probability Distributions. System dynamics and object oriented approach in simulation.

Generalization of Growth Models – System Dynamics Diagram – Decision Function – Multi Segment Model – Representation of Time Delays – Inventory and Flow Distribution Systems.

– World Model – Object Oriented Approach – Rule Based Approaches– Casual Loops – Flow Diagrams – Levels and Rates – Simple examples of Animation.

Analysis – Input – Output – Verification and Validation of Simulation Models – Comparison and Evaluation of Alternative System Design - Development of simulation models using simulation language.

REFERENCES:

1. Jerry Banks, John S. Carson II, Barry L. Nelson, David M. Nicol, “Discrete-Event System Simulation”, 5th Edition, Pearson Education, 2007.
2. Lawrence M. Leemis, Stephen K. Park, “Discrete-Event Simulation: A First Course”, Pearson Education, 2006.

Outcomes:

Students will be able to:

1. Practice simulation tools and build simulation systems
2. Assess the techniques of random number generations and testing its randomness
3. Design various simulation models for real time situation

CA7B8 COMPUTER VISION

Pre-requisites: CA713

Objective:

- To understand the fundamental concepts related to image processing, feature extraction, pattern analysis etc.
- To apply the concepts to solve computer vision problems of different fields.

Fundamentals of Image Formation, Transformation: Orthogonal, Euclidean, Affine, Projective, etc; Fourier Transform, Convolution and Filtering, Image Enhancement-Histogram Processing.

Edges - Canny, LOG, DOG; Line detectors (Hough Transform), Corners - Harris and Hessian Affine, Orientation Histogram, SIFT, SURF, HOG, GLOH.

Image Segmentation: Region Growing, Edge Based approaches to segmentation, Graph-Cut, Mean-Shift, Texture Segmentation; Object detection.

Motion analysis: Background Subtraction and Modeling, Optical Flow, KLT, Spatio-Temporal Analysis, Dynamic Stereo; Motion parameter estimation.

Object tracking, Mean shift tracking, Object categorization, content based image retrieval, action recognition.

Textbooks

1. Richard Szeliski, Computer Vision: Algorithms and Applications, Springer-Verlag London Limited 2011.
2. Computer Vision: A Modern Approach, D. A. Forsyth, J. Ponce, Pearson Education, 2003.

Outcomes:

Students will be able to:

1. Apply fundamental algorithms in Image Processing and analyse their applicability for real time problems.

CA7C1 HUMAN COMPUTER INTERACTION

Pre-requisites: CA716, CA725

Objective:

- To learn the concepts (basic to advanced levels) of user oriented aspects of product designs (physical to software); providing in depth study on Human Centric and Human oriented features in developing systems.

Importance of user Interface – definition, importance of good design. Benefits of good design. A brief history of Screen design. The graphical user interface – popularity of graphics, the concept of direct manipulation, graphical system, Characteristics, Web user – Interface popularity, characteristics- Principles of user interface. Design process – Human interaction with computers, importance of human characteristics human consideration, Human interaction speeds, and understanding business junctions.

Screen Designing : Design goals – Screen planning and purpose, organizing screen elements, ordering of screen data and content – screen navigation and flow – Visually pleasing composition – amount of information – focus and emphasis – presentation information simply and meaningfully – information retrieval on web – statistical graphics – Technological consideration in interface design.

Windows – New and Navigation schemes selection of window, selection of devices based and screen based controls. Components – text and messages, Icons and increases – Multimedia, colors, uses problems, choosing colors.

Software tools – Specification methods, interface – Building Tools. Interaction Devices – Keyboard and function keys – pointing devices – speech recognition digitization and generation – image and video displays – drivers.

HCI and related fields – Cognition Theory – A.I. – Accessibility Issues – Assistive Technologies - Technologies for HCI – Research Directions in HCI.

REFERENCES:

1. Wilbert O Galitz, “The essential guide to user interface design”, Wiley Dream Tech.
2. Ben Shneidermann, “Designing the user interface”, 3rd Edition, Pearson Education Asia.
3. Alan Dix, Janet Finlay, Gregory Abowd & Russell Beale, “Human-Computer Interaction”, 3rd Edition. Prentice Hall, 2004.
4. Julie A. Jacko (Ed), “The Human-Computer Interaction Handbook”, (3rd edition) CRC Press, 2012.
5. Jonathan Lazar, Jinjuan Heidi Feng, & Harry Hochheiser, “Research Methods in Human-Computer Interaction”, Wiley, 2010
6. PRECE, ROGERS, SHARPS, “Interaction Design”, WileyDreamtech.
7. SorenLauesen, ”User Interface Design”, Pearson Education

Outcomes:

To enable students to understand HCI principles and practice them in product designs

Industrial Component:

Providing exposure to HCI based software development products.

CA7C2 BIOINFORMATICS

Pre-requisite: CA7B5

Objective:

- To understand Genomic data acquisition and analysis, comparative and predictive analysis of DNA and protein sequence, Phylogenetic inference etc.

Introduction to bioinformatics, classification of biological databases, Biological data formats, application of bioinformatics in various fields. Introduction to single letter code of amino acids, symbols used in nucleotides, data retrieval – Entrez and SRS.

Introduction to sequence alignment, substitution matrices, scoring matrices – PAM and BLOSUM. Local and Global alignment concepts, dot plot, dynamic programming methodology, Multiple sequence alignment – Progressive alignment. Database searches for homologous sequences – FASTA AND BLAST versions.

Evolutionary analysis: distances - clustering methods – rooted and unrooted tree representation – Bootstrapping strategies.

Fragment assembly-Genome sequence assembly - Gene finding method, Gene prediction - Analysis and prediction of regulatory regions.

Concepts and secondary structure prediction – Probabilistic models: Markov chain, Hidden Markov Models -Gene identification and other applications.

REFERENCES:

1. Andreqas D. Baxevanis, B. F. Francis Ouellette, “Bioinformatics: A Practical Guide to the Analysis of Genes and Proteins”, John Wiley and Sons, 1998
2. Shanmughavel, P., “Principles of Bioinformatics”, Pointer Publishers, 2005.
3. Richard Durbin, Sean Eddy, Anders Krogh, and Graeme Mitchison, “Biological Sequence Analysis: Probabilistic Models of Proteins and Nucleic Acids”, Cambridge University Press, 1998.
4. Bishop M.J., Rawlings C.J. (Eds.), “DNA and protein sequence analysis: A Practical Approach”, IRL Press, Oxford, 1997.
5. Doolittle R.F. (Ed.), “Computer methods for macromolecular sequence analysis Methods in Enzymology”, Academic Press, 1996

Outcomes:

Students will be able to :

1. Describe user oriented aspects of product design
2. Analyze the screen designing principles
3. Apply HCI principles in product designs

CA7C3 DEEP LEARNING

Pre-requisites: CA727, CA731

Objective:

- To understand and apply the Machine learning principles
- To study the deep learning architectures
- Explore and create deep learning applications with tensor flow

The Neural Network – Limits of Traditional Computing – Machine Learning – Neuron – FF Neural Networks – Types of Neurons – Softmax output layers.

Tensor flow – Variables – Operations – Placeholders – Sessions – Sharing Variables – Graphs – Visualization.

Convolution Neural Network – Feature Selection – Max Pooling – Filters and Feature Maps – Convolution Layer –Applications.

Recurrent Neural Network – Memory cells – sequence analysis – word2vec- LSTM - Memory augmented Neural Networks – NTM—Application.

Reinforcement Learning – MDP – Q Learning – Applications.

REFERENCES:

1. Nikhil Buduma, Nicholas Locascio, “Fundamentals of Deep Learning: Designing Next-Generation Machine Intelligence Algorithms”, O'ReillyMedia, 2017.
2. Ian Goodfellow, Yoshua Bengio, Aaron Courville, ”Deep Learning (Adaptive computation and Machine Learning series”, MITPress, 2017.

Outcomes:

Students will be able to:

1. Analyze the architecture for Mobile computing platform
2. Identify and be able to use recent and advanced GSM architecture with emerging technologies
3. Explore, Evaluate different mobile computing methodologies
4. Apply the concepts of pervasive computing in real life problems

CA7C4 MULTI-CORE ARCHITECTURE

Pre-requisites: CA715, CA727

Objective:

- To learn different multi-core programming techniques.

Multi-core – Definition and hybrid architectures – The software developer’s viewpoint – the bus connection – from single core to multi-core – Four effective multi-core designs.

Challenges of multi-core programming – Sequential model – definition – Concurrency – Definition – challenges pertaining to software development – Processor architecture challenges – Operating system’s role.

Process – Definition – Process creation – working with process Environment Variables – killing a process – process- resources- synchronous and asynchronous processes – Multithreading – Comparing threads to processes – Architecture of a thread- creation and management of threads.

Communication and synchronization – synchronizing concurrency – Thread strategy approaches – Decomposition and encapsulation of work- Approaches to application design – PADL and PBS.

UML – modeling the structure of a system – UML and concurrent behavior – Basic testing types – Defect removal for parallel programs – Standard software engineering tests.

REFERENCES:

1. M. Herlihy and N. Shavit, “The Art of Multiprocessor Programming”, Morgan Kaufmann,2008.
2. D.B.Kirk and W.W.Hwu, “Programming Massively Parallel Processors: A Hands-on Approach”, Morgan Kaufmann,2010.
3. C.Huges and T.Huges, “Professional Multi-core Programming: Design and Implementation for C++ Developers”, Wrox, 2008.

Outcomes:

Students will be able to:

1. List the features of multi core systems and assess the challenges of multi core programming
2. Apply process techniques
3. Identify the approaches to application design
4. Describe the communication and fine issues

CA7C5 MEAN Stack Web Development

Pre-requisites: CA728

Objective:

- To create modern web applications and layout how to use the MEAN (Mongo, Express, AngularJS, and Node.js) set of tools
- To create a web application, from installation and setup of the tools to debugging and deploying app.

How Modern Web Architecture Is Changing - The Rise Of The Static App - Enter The Thick Client - Why Javascript Is A Good Choice For Modern Apps - What Is Angular.Js? - What Is Node.Js? - What Is Express? - What Is MongoDB? - Introducing The Social Networking Project - Creating A Static Mockup Of The Recent Posts Page - Angularizing The Page - Adding New Posts.

Building A Node.Js API - The Stock Endpoint - Creating Posts Via The API - MongoDB Models With Mongoose - Using Mongoose Models With The Post Endpoint - Integrating Node With Angular - \$Http - Reading Posts From The Api With \$Http - Serving Posts.Html Through Node - Saving Posts To The API With \$Http - Fixing The Post Ordering - Cleaning Up Server.Js - Cleaning Up Angular .

Introducing Grunt And Gulp - Gulp Hello World - Building Javascript With Gulp - Building CSS With Gulp - Gulp Dev Task - Other Gulp Plug-Ins - Building Authentication In Node.Js - Introducing Token Authentication – JSON-Web Token (Jwt) - Using BCrypt - Authentication With MongoDB.

Adding Routing And Client Authentication - Web Sockets - Pushing Notifications With Websockets – Web Sockets In Angular.Js – Architecture.

Testing - Protractor - Mocha For Node – Post Controller – Base Router – Testing Controllers – npm test – JSHint.

Karma – Bower – Heroku –Working of Heroku – MongoDB and Redis on Heroku – Single Server vs Multiserver – Fedora 2.0 – Multiserver migration.

REFERENCES:

1. Jeff Dickey, “Write Modern Web Apps with the MEAN Stack: Mongo, Express, AngularJS, and Node.js”, Peachpit Press, 2015.
2. Brad Dayley, Brendan Dayley, “Node.js, MongoDB and Angular Web Development”, Addison Wesley, 2017.
3. Amos Q. Haviv, Adrian Mejia,”Web Application Development with MEAN “, Kindle, June 15, 2017.

Outcomes:

Students will be able to

1. Get a complete knowledge on JavaScript-based application stack to build, test, and deploy web applications or mobile apps.

CA7C6 BIG DATA MANAGEMENT

Pre-requisites: CA712, CA721, CA726

Objective:

- To gain ability to design high scalable systems.

Big Data – Unstructured Data - Introduction to data analytics, big data analytics, big data management.

Data Management Techniques: Storage of large data – Analyze of large data –Extraction of business relevant, social relevant information.

Columnar databases - Map Reduce as a tool for creating parallel algorithms -Processing very large amounts of data.

Big Data applications -Columnar stores -Distributed databases –Hadoop -Locality Sensitive Hashing (LSH) –Dimensionality reduction –Data streams –Unstructured data processing, NoSQL-NewSQL.

Mining massive datasets - Socio-Business intelligence using big-data.

REFERENCES:

1. Michael Minelli, Michele Chambers, Ambiga Dhiraj ,“Big Data, Big Analytics”, John Willey , 2013.
2. Chris Eaton, Dirk Deroos, Tom Deutsch, George Lapis, Paul Zikopoulos, “Understanding Big Data: Analytics for Enterprise Class Hadoop and Streaming Data”, Tata McGraw Hill Education, 2012.

Outcomes:

Students will be able to:

1. Explain the concepts of big data analysis
2. Identify the various Big data management, processing techniques
3. Analyse performance of big data analysis in Hadoop environment

CA7C7 EVOLUTIONARY COMPUTING

Pre-requisites: CA7B5, CA719

Objective:

To provide evolutionary Computation and global optimization techniques.

Evolutionary computing: Biological foundation of Evolutionary computing, Introduces evolutionary algorithms, a class of stochastic, population-based algorithms inspired by natural evolution theory, capable of solving complex problems for which other techniques fail.

Genetic Algorithms (GA): Biological foundation of GA, General steps in GA, Genetic Operations: cloning, crossover and mutation, Encoding and Selection techniques, Mathematical foundation and Schemata, Holland Schemata theorem, design and implementation of GA, issues in implementation of GA, applications of GA, Classifier systems, Genetic programming, new trends in GA. Applications of GA.

Swarm Intelligence (SI): Biological foundation of SI, SI Techniques: Ant Colony Optimization (ACO) and Particle Swarm optimization (PSO). General steps in ACO, the "Invisible Manager" (Stigmergy), the Pheromone, Ant Colonies and Optimization, Ant Colonies and Clustering, Applications of Ant Colony Optimization. Applications of ACO.

PSO: Social Network Structure: The Neighborhood Principle, PSO Algorithm, Fitness Calculation, Convergence, PSO System Parameters, Particle Swarm Optimization versus Evolutionary Computing and Applications of PSO.

Mimetic algorithm, Firefly Algorithm, multi objective algorithms.

REFERENCES:

1. M. Mitchell, An introduction to Genetic Algorithms, Prentice-Hall, 1998.
2. D. E. Goldberg, "Genetic Algorithms in Search, Optimization, and Machine Learning," Addison Wesley, 1989.
3. R. Eberhart, P. Simpson and R. Dobbins, Computational Intelligence - PC Tools, AP Professional, 1996.

Outcomes:

Students will be able to:

1. Describe the Evolutionary algorithms and solve complex problem using evolutionary algorithms.
2. Identify the issues in design and implementation of genetic algorithm.
3. Explain the concepts of Swarm Intelligence techniques.
4. Describe the social network structure.

CA7C8 SOCIAL NETWORK ANALYSIS

Pre-requisites: CA713, CA721

Objective:

To introduce the concepts and methods of social network analysis.

Social network concepts – Development of social network and analysis - Online social networks – Social Network Data - Issues and challenges.

Linked-based and structural analysis - Content-based analysis - Static and dynamic analysis
Mathematical Representation of social networks.

Social networking systems and API - Statistical Analysis of Social Networks- Community Detection in Social Networks - Node Classification in Social Networks -Evolution in Dynamic Social Networks.

Social Influence Analysis -Link Prediction in Social Networks -Data Mining in Social Media
Text Mining in Social Networks - Social Tagging -Building social services.

Tools for Social network analysis: UCINET – PAJEK– NETDRAW – StOCNET - SPlus - R – NodeXL- SIENA and RSIENA - Real-world networks (Facebook graph, Twitter networks, etc.)

REFERENCES:

1. Christina Prell, Social Network Analysis: History, Theory and Methodology, SAGE Publications Ltd, Publication Year, 2011.
2. David Easley and Jon Kleinberg, “Networks, Crowds, and Markets: Reasoning About a Highly Connected World”, 2010.
3. Stanley Wasserman and Katherine Faust, “ Social Network Analysis: Methods and Applications”, Cambridge University Press, 1994.
4. Carrington and Scott (eds). The SAGE Handbook on Social Network Analysis SAGE, First Edition 2011.

Outcomes:

Students will be able to:

1. Describe the issues and challenges in social network functions
2. Mathematically represent social networks for analysis
3. Use various tools for social network analysis