Course Structure and Syllabus

of

Master in Computer Application

(From the Session 2018-19)

INDIRA GANDHI INSTITUTE OF TECHNOLOGY, SARANG
(An Autonomous Institute of Government of Odisha)
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INDIRA GANDHI INSTITUTE OF TECHNOLOGY, SARANG
Course Structure and Syllabus for MCA
SECOND YEAR

Third Semester				Fourth Semester			
Theory				**Theory**			
Course Code	**Course Name**	**L-T-P (Periods/ Week)**	**Credits**	**Course Code**	**Course Name**	**L-T-P (Periods/ Week)**	**Credits**
CAC301	Design & Analysis of Algorithms	3-0-0	3	CAC401	Python Programming	3-0-0	3
CAC302	OOPs using Java (Core)	3-0-0	3	CAC402	Compiler Design	3-0-0	3
CAC303	Formal Language & Automata Theory	3-0-0	3	CAC403	Software Engineering	3-0-0	3
CAC304	Database Management System	3-0-0	3	CAS401	Quantitative Techniques	3-0-0	3
CAC305	Computer Networks & Security	3-0-0	3		**Programme Elective-I (Any one)**	3-0-0	3
CAS301	Applied Probability & Statistics	2-0-0	2	CAE401	Embedded Systems/		
				CAE402	Parallel and Distributed Systems /		
				CAE403	Real Time Systems/		
				CAE404	Machine Learning		
					Programme Elective-II (Any One)	3-0-0	3
				CAE405	Data Mining & Data Warehousing /		
				CAE406	Distributed Database/		
				CAE407	Soft Computing		
	Total (Theory)	**17**	**17**		**Total (Theory)**	**18**	**18**
Practical/ Sessional				**Practical/ Sessional**			
CAJ301	Internship Evaluation	0-0-2	2	CAC404	Python Programming Lab	0-0-3	3
CAC306	Design & Analysis of Algorithms Lab	0-0-3	3	CAC405	Software Engineering Lab	0-0-3	3
CAC307	OOPs using Java (Core) Lab	0-0-3	3	CAJ401	Seminar	0-0-3	3
CAC308	Database Management System Lab	0-0-3	3				
CAC309	Computer Networks & Security Lab	0-0-3	2				
Total (Practical/ Sessional)		**14**	**13**	**Total (Practical/ Sessional)**		**9**	**9**
TOTAL		**31**	**30**	**TOTAL**		**27**	**27**
TOTAL SEMESTER CREDITS: 30				TOTAL SEMESTER CREDITS: 27			
TOTAL CUMULATIVE CREDITS: 82				TOTAL CUMULATIVE CREDITS: 109			

INDIRA GANDHI INSTITUTE OF TECHNOLOGY, SARANG

SYLLABUS for 2nd Year MCA

3rd Semester

CAC301	Design and Analysis of Algorithms	3-0-0	Credit-3

Course Objectives: Student should be able to

- Define algorithm formally and informally
- Explain elementary and advanced data structures
- Explain the different algorithms for solving typical problems
- Describe the process of algorithm design and analysis
- Explain the complexity of algorithms
- Design recursive and non-recursive algorithms for, say, computing a Fibonacci number
- Explain P, NP and NP-completeness.

Module-I **(10 Hours)**

Introduction: Role of Algorithms in Computing, Analyzing Algorithms, Designing Algorithms, Asymptotic Notation, Standard Notations and Functions. Advance data structure linear vs nonlinear data structure. Recurrences, solution of recurrences by substitution, recursion tree and Master methods.

Module-II **(10 Hours)**

Hashing: Review of Hashing, Hash Function, Collision Resolution Techniques in Hashing, Separate Chaining, Open Addressing, Linear Probing, Quadratic Probing, Double Hashing, Rehashing, extendible Hashing.

Heap Structure: Min-Max heap, Binomial heaps, Search and Tree Structure: Binary Search Tree, AVL Tree, Priority Queue, Lower bounds for sorting.

Module-III **(12 Hours)**

Divide and Conquer:(Quick sort ,Merge sort, Strassen's algorithm for Matrix). **Dynamic Programming**: (LCS, Floyd-Warshall Algorithm, Matrix Chain Multiplication). **Greedy Algorithm**: (Single Source Shortest Path, Knapsack problem, Minimum Cost Spanning Trees (Kruskal's and Prim's algorithm) The Huffman coding algorithm,). **Geometric Algorithm**: (Convex hulls, Segment Intersections, Closest Pair). **Internet and Network flow Algorithm**: (Text pattern matching(Naive and Rabin-Krap algorithm) Flow Network, cut, Ford-Fulkerson method). **Graph Algorithm**:(Breadth First search, Depth First search). **Backtracking:** – n-Queens problem Hamiltonian Circuit Problem – Subset Sum Problem-Branch and Bound **Discrete Fourier Transform (DFT):** In complex field, DFT in modulo ring. Fast Fourier Transform algorithm.

Module-IV **(8 Hours)**

Polynomial Time, Polynomial-Time Verification, NP Completeness & reducibility, NP Completeness proofs, Cook's theorem, Approximation algorithm, Vertex cover algorithm, Traveling Sales man problem.

Text Book

1. Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest and Clifford Stein, "Introduction to Algorithms", 3rd Edition , PHI Learning Private Limited, 2012.

Reference Books

1. Anany Levitin, " Introduction to the Design and Analysis of Algorithms", 3rd Edition, Addison-Wesley Longman, 2011.
2. S.Sridhar,"Design and Analysis of Algorithm",OXFORD university press,2015
3. E. Horowitz, S. Sahani and Dinesh Mehta, "Fundamentals of Data Structures in C++", 2nd Ed,University Press.
4. Mark Allen Weiss, "Data Structures & Algorithm Analysis in C/C++", Pearson Edu. India.
5. Adam Drozdex, "Data Structures and algorithms in C++", Thomason learning.
6. Alfred V. Aho, John E. Hopcroft and Jeffrey D. Ullman, "Data Structures and Algorithms", Pearson Education, Reprint 2006.

CAC302	OOPs Using JAVA (Core)	3-0-0	Credit-3

Course Outcomes

1. knowledge of the structure and model of the Java programming language, (knowledge)
2. use the Java programming language for various programming technologies (understanding)
3. develop software in the Java programming language, (application)
4. evaluate user requirements for software functionality required to decide whether the Java programming language can meet user requirements (analysis)
5. propose the use of certain technologies by implementing them in the Java programming language to solve the given problem (synthesis)
6. choose an engineering approach to solving problems, starting from the acquired knowledge of programming and knowledge of operating systems. (evaluation)

Course Objectives

1. Gain knowledge about basic Java language syntax and semantics to write Java programs and use concepts such as variables, conditional and iterative execution methods etc.
2. Understand the fundamentals of object-oriented programming in Java, including defining classes,

objects, invoking methods etc ,exception handling mechanisms, inheritance, packages and interfaces
3. Understand the principles of multithreading, Applet etc.
4. Develop java based software application using awt,swing,event driven interfaces and jdbc.

Module – I **(10 Hours)**

Introduction:-Object oriented programming, Features, Pillars and Advantages of OOP ,java, Features of java, advantages of java over C and C++,JDK,JRE,JVM, Byte code

Fundamentals of Programming:- Data Types, variable, Modifiers, Typecasting,

Operators and their precedence, Decision making and looping, one dimension arrays and its application in searching and sorting process ,multi dimension arrays and matrix operations ,Receive input using Scanner class, Buffer Reader, Command line arguments..

Objects and classes:-class, object, methods, parameter passing, Constructor, object passing, constructor overloading, nested classes, static, final, this keyword

Module - II **(08 Hours)**

Inheritance:- simple and multilevel inheritance, Using Super to Call Super class constructor, Method overriding ,Dynamic method Dispatch, Using Abstract Classes, Using final with inheritance.

Packages &Interfaces : Packages, Access Protection, Importing package, Interface, Implementing Interfaces, variables in Interfaces, Interfaces can be extended.

Exception Handling: Exception and its types, Error, Exception handling, Using try & catch, Multiple catch, throw , throws, finally, Java's Built in exceptions, user defined exception.

Module - III **(10 Hours)**

Multi-Threading: Java Thread Model, Thread Priorities, Creating a thread, Creating Multiple threads, Using is Alive ( ) and join ( ), wait () & notify ( ),Deadlock, Synchronization

String Handling: String constructors, String length, Character Extraction, String Comparison, Modifying a string.

Applets: Basics, Architecture, Skeleton, The HTML APPLET Tag, Passing parameters to

Applets, Applet context and show documents ().

Module – IV **(12 Hours)**

AWT: AWT Classes window fundamentals, component, container, panel, Window, Frame , Canvas, Creating

a frame window in an Applet , working with Graphics ,Control Fundamentals , Layout managers, Handling Events by Extending AWT components .Core java API package, reflection, Remote method Invocation (RMI)

Swing: J applet, Icons & Labels, Text fields, Buttons, Combo boxes, Tabbed panes, Scroll panes, Trees, Tables.

Event Handing and JDBC: Delegation Event model, Event Listener Interfaces, jdbc

JavaFX: Graphics, User Interface Components, Effects, Animation, and Media, Application Logic, Interoperability, JavaFX Scene Builder 2

Text Books:

1. Programming in Java. Second Edition. OXFORD HIGHER EDUCATION. (SACHIN MALHOTRA/SAURAV CHOUDHARY)
2. CORE JAVA For Beginners. (RashmiKanta Das), Vikas Publication

Reference Books:

1. JAVA the Complete Reference (9th Edition) Herbalt Schelidt.
2. Programming with Java*:* Bhave&. Patekar, Pearson Education.
3. Big Java: Horstman, Willey India

CAC303	Formal Language and Automata Theory	3-0-0	Credit-3

Module 1 **(10 Hours)**

Alphabet, languages and grammars. Production rules and derivation of languages. Chomsky's hierarchy of languages and Grammars. Regular grammars, regular expressions and finite automata (deterministic and nondeterministic). Closure and decision properties of regular sets. Pumping lemma of regular sets. Minimization of finite automata. Left and right linear grammars. DFA/NFA to regular expression and vice versa using Arden's Formula.

Module 2 **(10 Hours)**

Context free grammars and pushdown automata. Chomsky and Griebach normal forms. Parse trees, Cook, Younger, Kasami, and Early's parsing algorithms. Ambiguity and properties of context free languages. Pumping lemma, Ogden's lemma, Parikh's theorem. Deterministic pushdown automata, closure properties of deterministic context free languages.

Module 3 **(10 Hours)**

Turing machines and variation of Turing machine model, Turing computability, Type 0 languages. Linear bounded automata and context sensitive languages. Primitive recursive functions. Cantor and Gödel numbering. Ackermann's function, mu-recursive functions, reclusiveness of Ackermann and Turing

computable functions.

Module 4 **(10 Hours)**

Church Turing hypothesis. Recursive and recursively enumerable sets.. Universal Turing machine and un-decidable problems. Un-decidability of Post correspondence problem. Valid and invalid computations of Turing machines and some un-decidable properties of context free language problems.

Time complexity class P, class NP, NP completeness.

Text Books:

1. Introduction to Automata Theory, Languages and Computation: J.E. Hopcroft and J.DUllman, Pearson Education, 3rd Edition.
2. Introduction to the theory of computation: Michael Sipser, Cengage Learning

Reference Books:

1. Automata Theory: Nasir and Srimani , Cambridge University Press.
2. Introduction to Computer Theory: Daniel I.A. Cohen, Willey India, 2nd Edition.

CAC304	Database Management System	3-0-0	Credit-3

Module I: **(10 Hours)**

Introduction to database Systems, advantages of database system over traditional file system, Basic concepts & Definitions, Database users, Database Language, Database System Architecture, Schemas, Sub Schemas, & Instances, database constraints, 3-level database architecture, Data Abstraction, Data Independence, Mappings, Structure, Components & functions of DBMS, Data models.

Module II: **(10 Hours)**

Entity relationship model, Components of ER model, Mapping E-R model to Relational Schema. Storage Strategies**:** Detailed Storage Architecture, Storing Data, Magnetic Disk, RAID, Other Disks, Magnetic Tape, Storage Access, File & Record Organization, File Organizations & Indexes, Order Indices, B+ Tree Index Files, Hashing, Data Dictionary.

Module III: **(10 Hours)**

Relational Algebra (RA), Tuple Relational Calculus (TRC) and Domain Relational Calculus (DRC), Relational Query Languages: SQL and QBE. Database Design: Database development life cycle (DDLC), Automated design tools, Functional dependency and Decomposition, Join strategies, Dependency Preservation & lossless Design, Normalization, Normal forms: 1NF, 2NF, 3NF, and BCNF, Multi-valued Dependencies,

4NF & 5NF. Query processing and optimization: Evaluation of Relational Algebra Expressions, Query optimization, Query cost estimation.

Module IV: (10 Hours)

Transaction processing and concurrency control: Transaction concepts, properties of transaction, concurrency control, locking and Timestamp methods for concurrency control schemes. Database Recovery System: Types of Data Base failure & Types of Database Recovery, Recovery techniques. Fundamental concepts on Object-Oriented Database, Object relational database, distributed database, Parallel Database, Data warehousing & Data Mining, Big Data and NoSQL.

Text Books:

1. Database System Concepts by Sudarshan and Korth ,6th edition, McGraw-Hill Education.
2. Fundamentals of Database System by Elmasari &Navathe, Pearson Education.
3. Fundamentals of Database Management System by Gillenson, Wiley India.

References Books:

1. Database Management Systems by Ramakrishnan, McGraw-Hill Education.
2. Database management system by leon & leon, Vikas publishing House.
3. Database System: Concept, Design & Application by S.K.Singh, Pearson Education.
4. An introduction to Database System – Bipin Desai, Galgotia Publication

CAC305	**Computer Networks & Security**	**3-0-0**	**Credit-3**

Module 1 (10 Hours)

Introduction: Networks, General Principles of Network Design - Line Configurations, Topologies, Network Architecture & Standardization, TCP/IP and OSI Models, Layer Architecture.

Physical Layer: Data, Digital & Analog Signals, Throughput, Bandwidth, Bit rate, Baud Rate, Data rate Measurement-Nyquist formula & Shannon capacity, Digital and Analog Conversions and Transmission, Multiplexing and Switching, Transmission Media.

Module 2 (10 Hours)

Data Link Layer: Error detection and Correction, Data Link Control, Elementary Data Link Protocols - HDLC, PPP, Sliding Window Protocols, Protocol Verification, MAC Sub-layer, Multiple Access Protocols, Ethernet, Wireless LANs, Network devices - Repeater, Hubs, Bridges, Switches, Routers, Gateways,

Backbone networks and Virtual LANs, Wireless WANs, Virtual Circuit Networks - Frame Relay and ATM.

Module 3 **(10 Hours)**

Network Layer: Network Layer Design Issues, Logical Addressing, Internet Protocols - IPv4, IPv6, Address Mapping, Error Reporting and Multicasting, Delivery, Forwarding, Routing Algorithm.

Transport Layer: Transport Service, Elements of Transport Protocols, Process to Process Delivery - UDP, TCP, Congestion Control, Congestion Control Algorithms, Quality of Service.

Module 4 **(10 Hours)**

Application Layer: DNS, DDNS, Remote Logging, E-Mail, File transfer, WWW and HTTP, SNMP, Multimedia.

Network Security: Security Goals, Symmetric & Asymmetric Key Encryptions, Digital Signature, Key Management, IPSec, SSL/TLS, PGP, VPN, Firewalls

Text Books:

1. Behrouz A. Forouzan, "Introduction to Data Communications and Networking", Fourth Edition, 2007, McGraw-Hill Education (India), New Delhi.
2. Andrew S. Tanenbaum, "Computer Networks", Fourth Edition, 2003, PHI Learning Pvt. Ltd., / Pearson Education Inc., New Delhi.

Reference Books:

1. Natalia Olifer & Victor Olifer, "Computer Networks: Principles, Technologies and Protocols", First Edition, 2006, Wiley India Pvt. Ltd., New Delhi.
2. James F. Kurose, Keith W. Ross, "Computer Networking: A Top-Down Approach Featuring the Internet", 4th Edition (2008), Pearson Education Inc., New Delhi.
3. Wayne Tomasi, "Introduction to Data Communications and Networking", First Edition, 2005, Pearson Education Inc., New Delhi

CAS301	Applied Probability & Statistics	2-0-0	Credit -2

Module –I **(15 Hours)**

Introduction to probability, conditional probability, Baye's rule, random variable, discrete probability distribution, continuous probability distribution, joint probability distribution, mean of a random variable, variance and covariance, mean and variance of linear combination of random variables, Chebyshev's theorem

Module –II **(15 Hours)**

Discrete uniform distribution, Binomial and multinomial distribution, hypergeometric distribution, negative

Binomial distribution, geometric distribution, Poisson distribution and the Poisson process, continuous uniform distribution, normal distribution, areas under the normal curve, application of the normal distribution, normal approximation to the binomial distribution, gamma and exponential distribution, application of the exponential and gamma distribution, chi-squared distribution, lognormal distribution, Weibull distribution, moments and moment generating function.

Module –III **(15 Hours)**

Random sampling, sampling distribution, Central Limit Theorem, sampling distribution of S^2, $t-$distribution, $F-$distribution, classical methods of estimation, prediction interval, tolerance limits, maximum likelihood estimation, hypothesis testing, one and two tailed tests, Goodness of fit test, simple linear regression model, properties of least square estimators, correlation. pure birth process and pure death process, application to Queueing model.

Text Books: Probability & Statistics for Engineers & Scientists *"WALPOLE MYERS MYERS YE"* 7TH Editions.

Ch.2,3,4,5,6,7(7.3),8(8.1,8.3-8.8),9(9.3,9.6,9.15),10(10.1-10.3,10.14),11(11.1-11.4)

Reference Books: Probability Statistics & Queueing Theory *"P.Kandasamy K.Thilagavathi K.Gunavathi"*

CAC306	Design and Analysis of Algorithms Lab	0-0-3	Credit-3

1. Using a stack of characters, convert an infix string to postfix string.
2. Implement insertion, deletion, searching of a BST.
3. Implement binary search and linear search in a program
4. (a) Write a program to demonstrate Masters Theorem.
   (b) Take different input instances for both the algorithm and show the running time.
5. Implement Hashing function in a program.
6. Implement a heap sort using a Max/Min heap.
7. (a) Implement a heap sort using a Binomial heap.
   (b) Write a program on Heap sort based on priority sorting.
8. (a) Write a program on Quick sort algorithm.

(b) Write a program on merge sort algorithm.

9. Implement AVL tree in a program.
10. Implement Strassen's matrix multiplication algorithm.
11. Using dynamic programming implement LCS.
12. (a) Implement DFS/ BFS for a connected graph.

    (b) Implement Dijkstra's shortest path algorithm using BFS.
13. (a) Implement MST using Kruskal/Prim algorithm.

    (b) Write a program to implement Huffman's algorithm.
14. Write a program to find the shortest path in a given graph using Floyd-Warshall algorithm.
15. Write a program to find the shortest path in a given graph using Bellman -Ford algorithm
16. Write a program to find Optimal solution for a Knap Sack Problem using Greedy Method.
17. Write a program to implement Rabin-Krap algorithm.
18. Write a program to implement Ford-Fulkerson algorithm.
19. Find out the solution to the N-Queen problem.
20. Implement any scheme to find the optimal solution for the Travelling Salesperson problem and then solve the same problem instance using any approximation algorithm and determine the error in the approximation.

CAC307	**OOPs Using Java (Core) Lab**	**0-0-3**	**Credit-3**

1. Introduction, Compiling & executing a java program, Data types & variables, decision control structures: if, nested if etc.
2. Loop control structures: do, while, for etc and arrays.
3. Classes and objects.
4. Data abstraction & data hiding, inheritance, polymorphism.
5. Interfaces and inner classes, packages
6. Threads, exception handlings
7. Design GUI Applications using Swing, AWT
8. Develop java based software using Swing, event models and JDBC
9. Draw different types of diagram, scrolling, blinking text etc using Applet

CAC308	Database Management System Lab	0-0-3	Credit-3

1. Use of SQL syntax: creation, insertion, and SQL queries with where clause.
2. (Use of SQL syntax: deletion, updating, and SQL queries using where clause.
3. (Use of SQL syntax: join statements and SQL queries including where clause.
4. PL/SQL on procedures and functions.
5. PL/SQL on functions.
6. (PL/SQL on database triggers.
7. PL/SQL on packages.
8. PL/SQL on data recovery using check point technique.
9. Concurrency control problem using lock operations.
10. Programs on ODBC using either VB or VC++.

CAC309	Computer Networks and Security Lab	0-0-3	Credit-2

1. Study of Network simulators like NS2, NS3.
2. Implementation (simulation) of Stop and Wait Protocol and Sliding Window Protocol.
3. Implementation (simulation) of ARP /RARP protocols.
4. Implementation (simulation) of PING and TRACEROUTE commands
5. Write a program to implement RPC (Remote Procedure Call)
6. Implementation (simulation) of Sub-netting.
7. Applications using TCP Sockets like Echo client and echo server, Chat
8. Implementation (simulation) of TCP and UDP Sockets like DNS, SNMP, File Transfer
9. Simulation of Congestion Control Algorithms.
10. Simulation of different routing algorithms.

INDIRA GANDHI INSTITUTE OF TECHNOLOGY, SARANG

SYLLABUS for 2nd Year MCA

4th Semester

CAC401	Python Programming	3-0-0	Credit-3

Course Objective

Student should be able to

1. Building robust applications using Python programming language's features.
2. Understanding the usage of Python libraries.
3. Building multithreaded, platform-independent and GUI based python applications for business problems.

Module 1. **(10 Hours)**

The concept of data types; variables, assignments; immutable variables; numerical types; arithmetic operators and expressions; comments in the program; understanding error messages; Conditions, boolean logic, logical operators; ranges; Control statements: if-else, loops (for, while); Functions; Strings and text files; manipulating files and directories, String manipulations: subscript operator, indexing, slicing a string. os and sys modules; text files: reading/writing text and numbers from/to a file; creating and reading a formatted file (csv or tab-separated);

Module 2. **(10 Hours)**

Lists, tuples, and dictionaries; basic list operators, replacing, inserting, removing an element; searching and sorting lists; dictionary literals, adding and removing keys, accessing and replacing values; traversing dictionaries; Design with functions: hiding redundancy, complexity; arguments and return values; formal vs actual arguments, named arguments.

Module 3. **(10 Hours)**

Simple Graphics and Image Processing: "turtle" module; simple 2d drawing - colors, shapes; digital images, image file formats, image processing: Simple image manipulations with 'image' module (convert to bw, greyscale, blur, etc). Classes and OOP: classes, objects, attributes and methods; defining classes; design with classes, data modeling; persistent storage of objects; inheritance, polymorphism, operator overloading (_eq_, _str_, etc); abstract classes; exception handling, try block

Module 4. **(10 Hours)**

Graphical user interfaces; event-driven programming paradigm; tkinter module, creating simple GUI; buttons, labels, entry fields, dialogs; widget attributes - sizes, fonts, colors layouts, nested frames.

Text Books:

1. T.R. Padmanabhan, Programming with Python, Springer, 1st Ed., 2016.
2. Kenneth Lambert, Fundamentals of Python: First Programs, Cengage Learning,, 1st Ed., 2012.
3. Reema Thareja,"Python Programming ",Oxford university press,3rd ed. 2017

Reference Books:

1. John V Guttag. "Introduction to Computation and Programming Using Python", Prentice Hall of India
2. R.Nageswara Rao,"Core Python Programming", dreamtech3.Wesley J. Chun. "Core Python Programming -Second Edition", Prentice Hall
3. Michael T. Goodrich, Roberto Tamassia, Michael H. Goldwasser, "Data Structures and Algorithms in Pyhon", Wiley
4. Luke Sneeringer, "Professional Python", Wrox7."Hacking Secret Ciphers with Python", Al Sweigart, URL-https://inventwithpython.com/hacking/chapters
5. Programming Python by Mark Lutz, O'Reilly.
6. Python in a Nutshell by Alex Martelli, O'Reilly.

Course outcomes:

1. Write python programs that solve simple business problems.
2. Create python applications that are robust and multithreaded.
3. Write simple GUI interfaces for a program to interact with users, and to understand the event-based GUI handling principles in python.

CAC402	Compiler Design	3-0-0	Credit- 3

Module 1 **(10 Hours)**

Introduction to Compilers: Compilers and translators, Phases of compiler design, cross compiler, Bootstrapping, Design of Lexical analyser, LEX programming. Syntax Analysis: Specification of syntax of programming languages using CFG, Top-down parser, design of LL (1) parser, bottom-up parsing technique, LR parsing algorithm, Design of SLR, LALR, CLR parsers. YACC programming.

Module 2 **(10 Hours)**

Syntax directed translation: Study of syntax directed definitions & syntax directed translation schemes, implementation of SDTS, intermediate notations: postfix, syntax tree, TAC, translation of expression, controls structures, declarations, procedure calls, Array reference. Storage allocation & Error Handling: Run time

storage administration, stack allocation, symbol table management, Error detection and recovery: lexical, syntactic, semantic.

Module 3 **(10 Hours)**

Code optimization: Important code optimization techniques, loop optimization, control flow analysis, data flow analysis, Loop invariant computation, Induction variable removal, Elimination of Common sub expression.

Module 4 **(10 Hours)**

Code generation – Problems in code generation, Simple code generator, Register allocation and assignment, Code generation from DAG, Peephole optimization.

Text Books:

1. Alfred V. Aho, Monica S. Lam, Ravi Sethi, Jeffrey D. Ullman, "*Compilers: Principles, Techniques, and Tools*", Pearson Education Inc., New Delhi.
2. Compiler Design by Dr. O. G. Kakde, University Science Press.

Reference Books:

1. Compiler Design by K. Muneeswaran, Oxford University Press
2. Lex and Yacc by Johan R. levine, Tonny Mason, et. al. O" Reilly and Assosiates.
3. "Compilers Design in C" Allen I. Holub, PHI eastern economy edition 2003.
4. Kenneth C. Louden, "Compiler Construction: Principles and Practices", First Edition, 1997, CENGAGE Learning India Pvt. Ltd., New Delhi.
5. G. Sudha Sadasivam, "Compiler Design", 2008, SCITECH Publications (India) Pvt. Ltd, Chennai.
6. David Galles, "Modern Compiler Design", 2006, Dreamtech /Pearson Education Inc., New Delhi.

CAC403	Software Engineering	3-0-0	Credit-3

Course Outcomes

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

1. Understand the advantages of various SDLC models.
2. Gain knowledge on project management approaches as well as cost and schedule estimation strategies.
3. Perform formal analysis on specification.
4. Use UML diagram for analysis and design.
5. Architect and design using architectural style and design patterns.

Module I **(10 Hours)**

Software Process Models:

Software Product, Software crisis, Handling complexity through Abstraction and Decomposition, Overview of software development activities, Process Models, Classical waterfall model, iterative waterfall model, prototyping mode, evolutionary model, spiral model, RAD model, Agile models: Extreme Programming. Requirement Gathering and Analysis, Functional and Non-functional requirements, Software Requirement Specification (SRS), IEEE 830 guidelines, Decision tables and trees.

Module II **(10 Hours)**

Software Project Management:

Software Project Management: Responsibilities of a Software project manager, project planning, Metrics for project size estimation, Project estimation techniques, Empirical estimation techniques, COCOMO models, Scheduling, Organization &team structure, Staffing, Risk management, Software configuration management.

Module III **(10 Hours)**

Structured Analysis & Design:

Overview of design process: High-level and detailed design, Cohesion and coupling, Modularity and layering, Function–Oriented software design: Structured Analysis using DFD Structured Design using Structure Chart, Basic concepts of Object Oriented Analysis & Design. User interface design, Command language, menu and iconic interfaces. Coding and Software Testing Techniques: Code Review, Testing: - Unit testing, Black-box Testing, White-box testing, Cyclomatic complexity measure, coverage analysis, mutation testing, Debugging techniques, Integration testing, System testing, Regression testing.

Module IV **(10 Hours)**

Software Reliability and Software Maintenance:

Basic concepts in software reliability, reliability measures, reliability growth modeling, Quality SEI CMM, Characteristics of software maintenance, software reverse engineering, software reengineering, software reuse.

Text Books:

1. Fundamentals of Software Engineering, Rajib Mall, PHI, 2014.
2. Software Engineering, A Practitioner‟s Approach, Roger S. Pressman, TMG Hill.

Reference Books:

1. Software Engineering, I. Somerville, 9th Ed. , Pearson Education.

CAE401	Embedded Systems	3-0-0	Credit- 3

Course Objectives:

The course is designed to provide a concrete knowledge on Embedded systems. Students shall be able to know about different concepts and techniques for developing Embedded devices. It will also help the students to efficiently implement the programming on Microcontroller boards which can be used for doing specific tasks at Real-Time environment.

MODULE I **(6 Hours)**

Hardware Concepts: Application and characteristics of embedded systems, Overview of Processors and hardware units in an embedded system, General purpose processors, Microcontrollers, ARM-based Systems on a Chip (SoC), Application-Specific Circuits (ASICs), Levels of hardware modelling, VHDL, Sensors, A/D-D/A converters, Actuators, Interfacing using UART, USB, CAN bus, SRAM and DRAM, Flash memory.

MODULE II **(12 Hours)**

Real-Time Operating Systems: Real-Time Task Scheduling: Some important concepts, Types of real-time tasks and their characteristics, Task scheduling, Clock-Driven scheduling, Hybrid schedulers, Event-Driven scheduling, Earliest Deadline First (EDF) scheduling, Rate monotonic algorithm (RMA). Commercial Real-time operating systems: Time services, Features of a Real-time operating system, Unix-based Real-time operating systems, POSIX-RT, A survey of contemporary Real-time operating systems, Microkernel-based systems.

MODULE III **(12 Hours)**

Embedded Application: Development: Embedded system development life cycle, State charts, General language characteristics , Embedded programming using C, Hardware/Software Co-design, Hardware/software partitioning, Testing embedded systems, Design for testability and Self-test. Devices and device drivers: I/O devices, Serial peripheral interfaces,IIC, RS232C, RS422, RS485, Universal serial bus, USB Interface, USB Connector IrDA, CAN, Bluetooth, ISA, PCI, PCI -X and advance busses, Device drivers.

MODULE IV **(10 Hours)**

ARM: ARM pipeline, Instruction Set Architecture ISA: Registers, Data Processing Instructions, Data Transfer Instructions, Multiplications instructions, Software interrupt, Conditional execution, branch instruction, Swap instruction, THUMB instructions. Devices and device drivers: I/O devices, Serial peripheral interfaces,IIC, RS232C, RS422, RS485, Universal serial bus, USB Interface, USB Connector IrDA, CAN, Bluetooth, ISA,

PCI, PCI -X and advance busses, Device drivers.

Text Books:

1. "Embedded system architecture, programming and design" By Raj Kamal, TMH
2. Frank Vahid and Tony Givargis, Embedded Systems Design – A unified Hardware /Software Introduction, John Wiley, 2002.
3. David E.Simon, An Embedded Software Primer, Pearson Education Asia, First Indian Reprint 2000

Reference Books:

1. "Hardware software co-design of Embedded systems" By Ralf Niemann, Kulwer Academic.
2. "Embedded real time system programming" By Sriram V Iyer, Pankaj Gupta, TMH.

Course Outcomes:

CO1: Identify different types of Embedded Devices.

CO2: Understand concepts used during development of Embedded Devices.

CO3: Understand the concepts of Device Drivers.

CO4: Learn the programming concept for creating and implementing features on ARM board.

CO5: Understand basic interfacing techniques to communicate Embedded Devices with Real world objects having Real-Time Output.

CAE 402	Parallel and Distributed Systems	3-0-0	Credit-3

Course Learning Objectives:

The objective of course, is to provide a comprehensive introduction to parallel algorithms and parallel programming, with strong emphasis on the design of parallel algorithms and their rigorous analysis. Exposure to parallel programming is provided through programming assignments using MPI. Throughout the course, the design of algorithms is interlaced with the programming techniques useful in coding them.

Module – I **(8 Hours)**

Introduction to parallel computing.

Parallel programming platforms: Trends in microprocessor Architectures, Limitations of memory system

performance, Dichotomy of parallel computing platforms, physical organization of parallel platforms, communication costs in parallel machines, Routing mechanisms for interconnection network, Impact of process processors mapping and mapping techniques.

Module – II **(10 Hours)**

Principles of parallel algorithm design: Preliminaries, Decomposition techniques, Characteristics of tasks and interactions, Mapping techniques for load balancing, Methods for containing. Interactions overheads, Parallel algorithm models. Basic communication operations: One-to-All Broadcast and All-to-One Reduction, All-to-All broadcast and reduction All-Reduce and prefix sum operations, scatter and gather, All-to-All personalized communication, circular shift, Improving the speed of some communication operation.

Module – III **(12 Hours)**

Analytical modeling of parallel programs: Performance metrics for parallel systems, Effect of granularity of performance, scalability of parallel system, Minimum execution time and minimum cost-optimal execution time, Asymptotic analysis of parallel programs, other scalability metrics. Programming using the message passing paradigm:

Principle of message – Passing programming, Send and receive operations, The message passing interface, Topologies and embedding, Overlapping communication with computation, collective communication and computation operations, Groups and communicators.

Module – IV **(10 Hours)**

programming Shared address space: Thread, POSIX, Thread Basics: Creation and Termination, Controlling Thread and Synchronization Attributes, Thread Cancellation

Dense matrix algorithm:

Matrix-vector multiplication, Matrix-matrix algorithm, Solving a system of linear equations.

Sorting: Bubble sort, Quick Sort

Text Book:

1. Introduction to Parallel Computing, Second Edition, Ananth Gram, Anshul Gupta, George Karypis, Vipin Kumar Person Education.
2. Parallel computing Theory and Practice, Second Edition, Michael J. Quinn, TMH.

Course Outcomes

1. Understand in a general sense the architecture of high performance computers.
2. Understand how the architecture of high performance computers affects the speed of programs run on HPCs.
3. Understand how memory access affects the speed of HPC programs.
4. Understand Amdahl's law for parallel and serial computing.
5. Understand the importance of communication overhead in high performance computing.
6. Understand some of the general types of parallel computers.
7. Understand how different types of problems are best suited for different types of parallel computers.
8. Understand some of the practical aspects of message passing on MIMD machines.

CAE 405	Data Mining & Data Warehousing	3-0-0	Credit-3

Module 1: **(10 Hours)**

The Compelling Need for data warehousing: Escalating Need for strategic information, failures of Past decision-support systems, 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 Defining the business requirements: Dimensional analysis, information packages – a new concept, requirements gathering methods, requirements definition: scope and content.

Module 2: **(10 Hours)**

OLAP in the Data Warehouse: Demand for Online analytical processing, need for multidimensional analysis, fast access and powerful calculations, limitations of other analysis methods, OLAP is the answer, OLAP definitions and rules, OLAP characteristics, major features and functions, general features, dimensional analysis, hypercube, Drill-down and roll-up, slice-and-dice or rotation, OLAP models, overview of variations, the MOLAP model, the ROLAP model, ROLAP versus MOLAP, OLAP implementation considerations.

Module 3: **(14 Hours)**

Data Mining Basics: What is Data Mining, Data Mining Defined, The knowledge discovery process, OLAP versus data mining, data mining and the data warehouse, Major Data Mining Techniques, Cluster detection, decision trees, memory-based reasoning, link analysis, neural networks, genetic algorithms, moving into data mining, Data Mining Applications, Benefits of data mining, applications in retail industry, applications in telecommunications industry, applications in banking and finance.

Module 4: **(6 Hours)**

Applications of Data mining, Social Impacts of Data mining, Tools, Mining the World Wide Web, Spatial Data Mining,

Multimedia Data Mining, Text Mining.

Text Book:

1. Jiawei Han, Micheline Kamber, and Jian Pei, "Data Mining Concepts and Techniques", Third Edition, Elsevier.
2. Vikram Pudi & P. Radha Krishna, Data Mining, Oxford University Press.
3. Reema Thareja, Data Warehousing, Oxford University Press.

Reference Books:

1. Alex Berson and Stephen J. Smith "Data Warehousing, Data Mining & OLAP", Tata McGraw – Hill Edition, Tenth Reprint 2007.
2. K.P. Soman, ShyamDiwakar and V. Ajay "Insight into Data mining Theory and Practice", Easter Economy Edition, Prentice Hall of India, 2006.
3. G. K. Gupta "Introduction to Data Mining with Case Studies", Easter Economy Edition, Prentice Hall of India, 2006.
4. Pang-Ning Tan, Michael Steinbach and Vipin Kumar "Introduction to Data Mining", Pearson Education, 2007.

CAE 407	Soft Computing	3-0-0	Credit-3

MODULE-1

Introduction to Soft computing, Introduction to Fuzzy logic, Neural network and Evolutionary Computing,

MODULE-2 (Fuzzy Logic)

Basic Fuzzy logic Theory, Crisp and fuzzy sets, Fuzzy membership functions. Operation on fuzzy sets. fuzzy relations, Fuzzy propositions, Fuzzy implification. Fuzzy inferences, Zadehs compositional rule of inference, Defuzzyfication Techniques:, fuzzy logic controller, mamdani and Takagi and sugeno architecture.

MODULE-3 (Neural Network)

Introduction To ANN, Single layer networks, perceptron; Activation function; Adaline-its training and capabilities, weights learning, Multilayer perceptrons; error back propagation; Generalized delta rule; Radial basis function networks and least square training algorithm, kohenen self organizing map and learning vector quantaization networks; Recurrent neural network; simulated anneling neural network; ANFIS.

MODULE-4(Genetic Algorithm)

Concept of GA,GA operators: Encoding, GA operators: Selection-I,GA Operators: Selection-II,GA Operators: Crossover-I,GA Operators: Crossover-II,GA Operators: Mutation .Basic evolutionary Programming concept Application, Hybrid evolutionary algorithm.

TEXT BOOK

1. J.S.R Jang, C.T.Sun and E.Mizutani,"Neuro-fuzzy and soft computing". PHI Pvt Ltd.

REFERENCE BOOKS

1. F.O Karry and C de silva, " soft computing and intelligent system Design-Theory ,Tools and Application ",Pearson Education.
2. .V,Keeman ,"Learning and soft computing", Pearson education India.

CAS 401	Quantitative Techniques	3-0-0	Credit-3

Module 1 **(10 Hours)**

Introduction to Operation Research - Concepts, genesis, Art of modeling, components of model, Types of OR models, effect of data availability on modeling, Computations in OR, Phases of OR study.

Linear Programming (LP)- Concepts, Formulation of model, Graphical solution, Maximization / Minimization Simplex Algorithm, Use of slack / surplus / artificial variables, BigM and Two phase method – Nature & type of solutions, Interpretation of optimal solution. Dual problem – relation between primal and dual, Dual simplex method – Interpretation of dual variables, Revised Simplex Method.

Module 2 **(10 Hours)**

Transportation & Assignment problems - Concepts, formulations of models, Solution procedures, Optimality checks, Balanced/Unbalanced, Maximum/Minimum problems, Prohibited case – degeneracy.

Network Analysis - Network Definition, Minimal spanning tree problem, shortest route problem, Maximal flow problem concepts and solution algorithm as applied to problems. Project planning and control by PERT/CPM network, Probability assessment in PERT network.

Module 3 **(10 Hours)**

Queuing Models - Concepts relating to Queuing systems, types of queuing system (use of six character code), Basic elements of Queuing Model, Role of Poison & Exponential Distribution, Concepts of Birth and Death process, Steady state measures of performance, M/M/1 model with and without limitation of q-size M/G/1, single channel with Poisson arrival rate and general service time.

Module 4 **(10 Hours)**

Computer Modeling& Simulation - Use of Computer in modeling real life situations, Distribution functions, Random number generation, Selection of input probability distribution, Design of simulation models Experimental design, output analysis variance reduction techniques. Introduction to simulation languages Programming tools for developing simulation models.

Text Books:

1. Operation Research, Kanti Swaroop, S. Chand and Sons Publications.

Reference Books:

1. Operation Research by V. K. Kapoor, S Chand and Sons
2. Operation Research by Paneer Selvam, PHI
3. Operations Research by Hillier & Lieberman, TMH
4. Problems in Operations Research by P.K. Gupta, D.S. Hira, S. Chand Publications.

CAE 403	Real Time Systems	3-0-0	Credit 3

MODULE-1 **12Hrs**

Introduction: What is real time, Applications of Real-Time systems, A basic model of Real-time system, Characteristics of Real-time system, Safety and Reliability, Types of Real-time tasks, timing constraints, Modelling timing constraints Real-Time Task Scheduling: Some important concepts, Types of Real-time tasks and their characteristics, Task scheduling, Clock-Driven scheduling, Hybrid schedulers, Event-Driven scheduling, Earliest Deadline First (EDF) scheduling, Rate monotonic algorithm (RMA). Some issues Associated with RMA. Issues in using RMA practical situations.

MODULE-2 **12Hrs**

Handling Resource Sharing and dependencies among Real-time Tasks: Resource sharing among real-time tasks. Priority inversion. Priority Inheritance Protocol (PIP),Highest Locker Protocol (HLP). Priority Ceiling Protocol (PCP). Different types of priority inversions under PCP. Important features of PCP. Some issues in using are source sharing protocol. Handling task dependencies. Scheduling Real-time tasks in multiprocessor and distributed systems: Multiprocessor task allocation, Dynamic allocation of tasks. Fault tolerant scheduling of tasks. Clock in distributed Real-time systems, Centralized clock synchronization

MODULE-3 **8Hrs**

Commercial Real-time operating systems: Time services, Features of a Real-time operating system, Unix as a Real-time operating system, Unix-based Real-time operating systems, Windows as a Real-time operating system, POSIX-RT, A survey of contemporary Real-time operating systems. Benchmarking real-time systems.

MODULE-4 **8Hrs**

Real-time Databases: Example applications of Real-time databases. Review of basic database concepts, Real-time databases, Characteristics of temporal data. Concurrency control in real-time databases. Commercial real-time databases. Real time Communication: Basic concepts, Examples of applications, Real-time communication in a LAN and Real-time communication over packet switched networks.

Text Book: 1. Real-time Systems Theory and Practice by Rajib Mall, Pearson Publication,2008.
References:
1. Jane W. S. Liu, Real-Time Systems, Pearson Education, 2000.
2. C.M. Krishna and K.G. Shin, Real-Time Systems, TMH
3. C. Siva Ram Murthy, G. Manimaran, “Resource management in real-time systems and networks”, PHI, 2009.

CAE 404	Machine Learning	3-0-0	Credit 3

MODULE-1 **10Hrs**

Overview and Introduction to Bayes Decision Theory: Machine intelligence and applications, pattern recognition concepts classification, regression, feature selection, supervised learning class conditional probability distributions, Examples of classifiers bayes optimal classifier and error, learning classification approaches. Linear machines: General and linear discriminats, decision regions, single layer neural network, linear separability, general gradient descent, perceptron learning algorithm, mean square criterion and widrow-Hoff learning algorithm; multi-Layer perceptrons: two-layers universal approximators, back-propagation learning, on-line, off-line error surface, important parameters.

MODULE-2 **10Hrs**

Learning decision trees: Inference model, general domains, symbolic decision trees, consistency, learning trees from training examples entropy, mutual information, ID3 algorithm criterion, C4.5 algorithm continuous test nodes, confidence, pruning, learning with incomplete data. Instance-based Learning: Nearest neighbor classification, k-nearest neighbor, nearest neighbor error probability.

MODULE-3 **10Hrs**

Machine learning concepts and limitations: Learning theory, formal model of the learnable, sample complexity, learning in zero-bayes and realizable case, VC-dimension, fundamental algorithm independent concepts, hypothesis class, target class, inductive bias, occam's razor, empirical risk, limitations of inference machines, approximation and estimation errors, Tradeoff. Machine learning assessment and Improvement: Statistical model selection, structural risk minimization, bootstrapping, bagging, boosting.

MODULE-4 **10Hrs**

Support Vector Machines: Margin of a classifier, dual perceptron algorithm, learning non-linear hypotheses with perceptron kernel functions, implicit non-linear feature space, theory, zero-Bayes, realizable infinite hypothesis class, finite covering, margin-based bounds on risk, maximal margin classifier.

Text Books:

1. E. Alpaydin, Introduction to Machine Learning, Prentice Hall of India, 2006
2. T. M. Mitchell, Machine Learning, McGraw-Hill, 1997.

CAE 406	Distributed Database	3-0-0	Credit 3

Course Objectives: The aim of this module is to build on the previous background of database systems and enhance the understanding of the theoretical and practical aspects of the database technologies, showing the need for distributed database technology to tackle deficiencies of the centralized database systems and finally introducing the concepts and techniques of distributed database including principles, architectures, design, implementation and major domain of applications.

MODULE-1 **10 Hrs**

Data Fragmentation; Replication; and allocation techniques for DDBMS; Methods for designing and implementing DDBMS, designing a distributed relational database; Architectures for DDBMS: cluster federated, parallel databases and client server architecture.

MODULE-2 **10Hrs**

Overview Of Query Processing: Query processing problem; Objectives of Query Processing; Complexity of Relational Algebra operations; characterization of Query processors; Layers of Query Processing. Introduction To Transaction Management: Definition of Transaction, Properties of Transaction, types of transaction; Distributed Concurrency Control: Serializability theory; Taxonomy of concurrency control mechanisms; locking bases concurrency control algorithms.

MODULE-3 **10Hrs**

Fundamental Object concepts and Object models; Object distribution design; Architectural issues; Object management; Distributed object storage; Object query processing.

MODULE-4 **10Hrs**

Distributed Object/component-based DBMS; Database Interoperability including CORBA; DCOM and Java RMI; Distributed document-based systems; XML and Workflow management.Parallel Database; Mobile database; Multimedia Database; Spatial Database and Web Databases.

Text Books:

1. Distributed Databases -Principles and Systems; Stefano Ceri; Guiseppe Pelagatti; Tata McGraw Hill; 1985.
2. Principles of Distributed Database Systems; M. Tamer Özsu; and Patrick Valduriez Prentice Hall.

References:

1. Distributed Database Management Systems-A Practical Approach, Saeed K Rahimi, Frank S Haug, Wiley Publication,2010.

CAC 404	Python Programming Lab	0-0-3	Credit-3

LIST OF PROGRAMS:

1. Compute the GCD of two numbers.
2. Find the square root of a number (Newton's method)
3. Exponentiation (power of a number)
4. Find the maximum of a list of numbers
5. Linear search and Binary search
6. Selection sort, Insertion sort
7. Merge sort
8. First n prime numbers
9. Multiply matrices
10. Programs that take command line arguments (word count)
11. Find the most frequent words in a text read from a file

12. Simulate elliptical orbits in Pygame.
13. Simulate bouncing ball using Pygame.

CAC 405	Software Engineering Lab	0-0-3	Credit-3

Use of Rational Rose 2.0 /Higher

1. To know about Phases in software development project, overview, need, coverage of topics
2. To assign the requirement engineering tasks
3. To perform the system analysis : Requirement analysis, SRS
4. To perform the function oriented diagram : DFD and Structured chart
5. To perform the user‟s view analysis : Use case diagram
6. To draw the structural view diagram : Class diagram, object diagram
7. To draw the behavioral view diagram : Sequence diagram, Collaboration diagram
8. To draw the behavioral view diagram : State-chart diagram, Activity diagram
9. To draw the implementation view diagram: Component diagram
10. To draw the environmental view diagram : Deployment diagram