RAJIV GANDHI PROUDYOGIKI VISHWAVIDYALAYA, BHOPAL

New Scheme Based On AICTE Flexible Curricula

Computer Science and Design, III-Semester

SD301COMPUTER ARCHITECTURE

Objectives:

The main objective of this course is to give understanding aboutvarious architectures of Computers and their components, functioning of the computer system; to introduce various parallel architectures and recent trends in computer architectures.

COURSE OUTCOMES:

After completing the course student should be able to:

1. Illustrate architecture of a computer, its components and their interconnection.
2. Describe execution of instruction in a computer.
3. Identify the addressing modes used in macro instruction.
4. Design programs in assembly language.
5. Understand the importance of parallel architecture.

Syllabus

Unit I:

Review of Digital Logic Circuits, Digital Logic Components and Data representation.Computer Arithmetic**:** Integer and Floating Point Arithmetic operations.

Computer Organization v/s Architecture,Milestonesin Computer Architecture, Basic Structure of Computer System, Components of Computer System- CPU; Memory; System Bus- Bus width, Bus Operations; I/O subsystem. CPU Organization: General Register Organization- Memory Register, Instruction Register; Control Word, Stack Organization; ALU, Control Unit.

Unit II:

(A) Machine Language Level/Instruction Set Architecture (ISA) level: Instruction Set- Machine Instruction Characteristics, Types of operands, Types of operations**;** Instruction Types, Instruction Formats, Addressing Modes; Registers, Program Counter; Instruction Execution Cycle: Fetch and Execution cycle; Interrupts and Traps, Sources of interrupts, Interrupt identification and priorities, Interrupt servicing. Case Study of 8086 Microprocessor.

(B) Control Unit: Hardwired Control Unit; Micro-programmed Control Unit- Micro Instructions, Micro Instruction Formats, Micro Instruction Control, Micro program sequencer, Execution of Micro Instructions.

Unit III:

Memory Organization: Memory Hierarchy, Main memory-RAM, ROM; Memory Technologies; Memory Addresses, Memory Address Map; Flash Memory; Associative Memory, Cache Memory: Cache Structure and Design, Mapping Schemes, Replacement Algorithms, Improving Cache Performance; Concept of L1, L2, L3 Cache. Secondary Memory –Magnetic Tape, Magnetic Disk, Optical Disks, Solid State Disk.

Unit IV:

I/O Organization: Data Transfer- Serial, Parallel, Synchronous, Asynchronous Modes of Data Transfer, I/O Techniques- Programmed I/O, Interrupt driven I/O, Direct Memory Access (DMA); External Interconnection Standards **(**I/O Interfaces): PCI Bus, PCI Express, SCSI Bus, USB; I/O Channels and I/O Processors; I/O Instructions**.**

Unit V:

Parallel Architectures: On-chip parallelism, Thread level parallelism, Instruction level parallelism; Multicore Processor Architecture; Processor level parallelism; Overview of Pipelining, Vector Processing and Array Processing. RISC vs CISC Architectures. Introduction to ARM processor and its architecture. Introduction to Assembly Language Programming. Case study of architectures: Intel, AMD.

TEXT BOOKS RECOMMENDED:

1. William Stallings, "Computer Organization and architecture", Pearson.
2. Tannenbaum and Austin, "Structured Computer Organization", PHI.
3. Michael J. Flynn "Computer Architecture: Pipelined and Parallel Processor Design

REFERENCE BOOKS:

1. V. Carl Hamacher, "Computer Organization", McGraw Hill.
2. John P. Hayes, "Computer Architecture and Organization", TMH
3. Morris Mano, "Computer System Architecture", PHI.
4. David A. Patterson and John L. Hennessy, "Computer Organization and Design: The Hardware/Software Interface", Fourth Edition, Morgan Kauffman

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Computer Science and Design, III-Semester

SD302Discrete Structure

Objective-Course Objective: To enable a student to learn the basic concepts of discrete elements such as sets, combinatorics, relations, functions, graphs, trees and their applications in diverse domains.

Syllabus

Unit I:

Set Theory: Definition, countable and uncountable sets, Venn Diagrams, operations on sets. Relation: Definition, types of relation, composition of relations, representation of relation, Equivalence relation, and Partial ordering relation. Function: Definition, type of functions, one to one, into and onto function, inverse function, composition of functions, recursively defined functions, pigeonhole principle. Theorem proving Techniques: Mathematical induction, Proof by contradiction. Counting theory. Integer theory.

Unit II:

Propositional Logic: Proposition, First order logic, Basic logical operation, truth tables, tautologies, Contradictions,Well-formed formula. Algebra of Proposition, logical implications, logical equivalence, predicates, Normal Forms, Universal and existential quantifiers.

Unit III:

Algebraic Structures: Definition, Properties, types: Semi Groups, Monoid, Groups, Abelian group, properties of groups, Subgroup, cyclic groups, Co-sets, factor group, Permutation groups, Normal subgroup, Homomorphism and isomorphism of Groups, Rings and Fields.

Posets, Hasse Diagram and Lattices: Introduction, ordered set, Hasse diagram of partially, ordered set, isomorphic ordered set, well ordered set, properties of Lattices, bounded and complemented lattices.

Unit IV:

Graph Theory: Introduction and basic terminology of graphs, Planer graphs, Multigraphs and weighted graphs, Isomorphic graphs, Paths, Cycles and connectivity, Shortest path in weighted graph, Introduction to Eulerian paths and circuits, Hamiltonian paths and circuits, Graph coloring, chromatic number, Isomorphism and Homomorphism of graphs.

Unit V:

Combinatorics: Introduction, Permutation and combination, Binomial Theorem, Multinomial Coefficients Recurrence Relation and Generating Function: Introduction to Recurrence Relation and Recursive algorithms, Linear recurrence relations with constant coefficients, Homogeneous solutions, Particular solutions, Total solutions , Generating functions , Solution by method of generating functions, discrete probability.

TEXT BOOKS RECOMMENDED:

1. Kenneth H. Rosen, “Discrete Mathematics and its Applications”, 7th Edition,McGraw Hill, 2017.
2. Liu C.L., “Elements of Discrete Mathematics”, McGraw-Hill
3. J.P. Tremblay and R. Manohar, “Discrete Mathematical Structures with Applications to Computer Science”, First Edition, McGraw-Hill, 2017.

REFERENCE BOOKS:

1. Kolman, Busby, Ross and Rehman, “Discrete Mathematical Structures”, Sixth Edition, Pearson Education, 2015.
2. NarsinghDeo, “Graph Theory with Applications to Engineering and Computer Science”, First Edition, Dover Publications, 2016.
3. Seymour Lipschutz, Marc Laras Lipson, “Discrete Mathematics”, Schaum's Outlines, Third Edition, 2017.

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Computer Science and Design, III-Semester

SD303 Data Structures

Course Objectives:

To introduce the fundamental concept of data structures and to emphasize the importance of data structures in developing and implementing algorithms.

Expected Course Outcome:

After learning the course, student should be able to-

1. Explain the basic concepts of data structures and its terminology.
2. Describe basic concepts about stacks, queues, linked lists, trees, graphs and theirimplementation.
3. Apply data structures to efficiently organize the data for improving performance of thesystem.
4. Design and implement algorithms using the data structuresfor solving real world problems.

Syllabus:

Unit 1:Data Structures: Introduction to data structures. Concepts of Data and Information, Classification of Data structures, Abstract Data Types, Implementation aspects: Memory representation. Data structures operations and its cost estimation. Introduction to linear data structures- Arrays, Linked List: Representation of linked list in memory, different implementation of linked list: Circular linked list, doubly linked list, etc. Application of linked list: polynomial manipulation etc.

Unit 2: Stacks& Queues: Stacks as ADT, Different implementation of stack, multiple stacks. Application of Stack: Conversion of infix to postfix notation using stack, evaluation of postfix expression, Recursion. Queues: Queues as ADT, Different implementation of queue, Circular queue, Concept of Dqueue and Priority Queue, Queue simulation, Application of queues.

Unit 3:Tree: Definitions - Height, depth, order, degree etc. Binary Search Tree - Operations, Traversal, Search. AVL Tree, Heap, Applications and comparison of various types of tree; Introduction to forest, multi-way Tree, B tree, B+ tree, B* tree and red-black tree.Application of the tree

Unit 4: Graphs: Introduction, Classification of graph: Directed and Undirected graphs, etc, Representation, Graph Traversal: Depth First Search (DFS), Breadth First Search (BFS), Graph algorithm: Minimum Spanning Tree (MST)-Kruskal, Prim's algorithms. Dijkstra's shortest path algorithm; Comparison between different graph algorithms. Application of graphs.

Unit 5: Sorting & Searching: Introduction, Sort methods like: Bubble Sort, Quick sort. Selection sort, Heap sort, Insertion sort, Shell sort, Merge sort and Radix sort; comparison of various sorting techniques. Searching: Basic Search Techniques: Sequential search, Binary search, Comparison of search methods. Hashing & Indexing. Case Study: Application of various data structures in operating system, DBMS etc.

Text Books

1. AM Tanenbaum, Y Langsam& MJ Augustein, “Data structure using C and C++”, Prentice Hall India.
2. Robert Kruse, Bruse Leung, “Data structures & Program Design in C”, Pearson Education.

Reference Books

1. Aho, Hopcroft, Ullman, “Data Structures and Algorithms”, Pearson Education.
2. N. Wirth, “Algorithms + Data Structure = Programs”, Prentice Hall.
3. Jean – Paul Trembly , Paul Sorenson, “An Introduction to Structure with application”, TMH.
4. Richard, GilbergBehrouz, Forouzan ,“Data structure – A Pseudocode Approach with C”, Thomson press.

SuggestedListofExperiments:

1. Write a program that uses functions to perform the following operations on linked list and all its variations i) Creation ii) Insertion iii) Deletion iv) Traversal.
2. Using the above linked list operations build the application like: polynomial arithmetic etc.
3. Write a program that implement stack (its operations) using Arrays and Linked list.
4. Using the above stack operations build the application like: evaluation and conversion of expression etc.
5. Write a program that implement Queue (its operations) and all its variations using Arrays and Linked list.
6. Write a program that uses functions to perform the following operations on tree and all its variations i) Creation ii) Insertion iii) Deletion iv) Traversal.
7. Using the above tree operation build the application like: dictionary etc.
8. Write a program that uses functions to perform the following operations on graph and all its variations i) Creation ii) Insertion iii) Deletion iv) Traversal.
9. Using the above graph operations build the application like: map etc.
10. Write a program that implements the following sorting algorithms- i) Bubble sort ii) Selection sort iii) Quick sort iv) Insertion sort v) Merge sort vi)Heap sort etc.
11. Design the data structures to solve some real world problems like image operations etc.

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Computer Science and Design, III-Semester

SD304 Design Processes & Perspectives

Objectives:

- Understand design thinking for graphics
- Understanding to decide on visual compositions
- Learn the concepts of Design for Interactive Media.
- Develop the modern web pages using the HTML and CSS features with different layouts as per need of applications.
- Use the JavaScript to develop the dynamic web pages.
- Use server side scripting with PHP to generate the web pages dynamically using the database connectivity.
- Develop the modern Web applications using the client and server side technologies and the web design fundamentals.

UNIT – I Design thinking for Graphics: Role of Graphic Design in Society-Elements of Graphic design: Basic elements-relational elements- Intentional Elements–Principles of Graphic Design-Implications and Impact of Graphic Design –Graphic Design Process: Design thinking Definition – Design thinking stages

UNIT – II Inspecting and deciding visual elements for design thinking: Define the problem – Research the problem: Identifying drivers - Information gathering-Target groups – Idea Generation for the problem - Basic design directions-Questions and answers-Themes of thinking – Brainstorming Deciding elements to design - Sketching and Drawing - Lines, shapes, Negative space/white space, Volumes, Value, Color, Texture- Color: Colors Theories-Color wheel - Color Harmonies or Color Schemes- Color Symbolism – Font - Layout

UNIT – III Basic Syntax of HTML, Elements, Attributes, heading, paragraph, styles, formatting, comments, colors, links, images, tables, lists, forms, media. Cascading Style Sheets: Introduction to CSS, Syntax, Selectors, Box Model, Inline, internal and External CSS, colors, borders, margin, padding z-index.

UNIT IV The Basics of JavaScript: JavaScript : Client side scripting with JavaScript, variables, functions, conditions, loops and repetition, Pop up boxes, Advance JavaScript: Javascript and objects, JavaScript own objects, the DOM and web browser environments, Manipulation using DOM, forms and validations, DHTML : Combining HTML, CSS and Javascript, Events and buttons

UNIT V PHP&MYSQL: PHP and MySQL: Basic commands with PHP examples, Connection to server, creating database, selecting a database, listing database, listing table names, creating a table, inserting data, altering tables, queries, deleting database, deleting data and tables, PHP myadmin and database bugs

Text Book(s):

1 Design Thinking for Visual Communication, Gavin Ambrose, Bloomsbury Publishing, Edition 1, 2017

2 Advertising Design by Medium A Visual and Verbal Approach, Robyn Blakeman, Taylor and

Francis, Edition 1, 2022
3 Learning Web Design, Jennifer Niederst Robbins, O' Reilley, 5th Edition, 2018
4. Developing Web Applications, Ralph Moseley and M. T. Savaliya, Wiley-India
5. Web Technologies, Black Book, dreamtech Press
6. HTML 5, Black Book, dreamtech Press 4.Web Design, Joel Sklar, Cengage Learning

Reference Book(s):

1 David Raizman; History of Modern Design, Prentice Hall,2004
2 Handbook of Design Thinking, Christian Mueller-Roterberg, Amazon kindle, 2018

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Computer Science and Design, III-Semester

SD305 Object Oriented Programming & Methodology

COURSE OBJECTIVES: The objective of the course is to develop programming skills of students, using object oriented programming concepts, learn the concept of class and object using Java and develop real world applications.

COURSE OUTCOMES:

After completing the course student should be able to:

1. Explain various concepts of object oriented terminology.
2. Define and implement the concepts of data encapsulation, abstraction, inheritance and polymorphism.
3. Design and execute quality programs using exception handling.
4. Solve the real world business problems as per specifications.

COURSE CONTENTS:

UNIT-I

Introduction to Object Oriented Thinking & Object Oriented Programming: Comparison with Procedural Programming, features of Object oriented paradigm– Merits and demerits of OO methodology; Object model; Elements ofOOPS, IO processing, Primitive Data Type, Type Conversion, Control Statement, Loops, Arrays.

UNIT-II

Encapsulation and Data Abstraction-Concept of Objects: State, Behavior & Identity of an object; relationship between objects. Classes :identifying classes and candidates for Classes Attributes and Services, Access modifiers, Static members of a Class, Instances,Message passing,andConstructionanddestructionofObjects.

UNIT-III

Relationships – Inheritance: concept of reusability, purpose and its types: ‘is-a’ relationship; ‘has-a’ relationship; Association, Composition, Aggregation. Concept of interfaces and Abstract classes. Super class.

Polymorphism: Introduction, polymorphic behavior, Method Overriding & Overloading, static and runtime Polymorphism.Virtual Function, friend function, Static function, friend class. Final class and methods.

Strings, regular expressions, Exceptional handling, debugging,IntroductionofMulti-threadingandDatacollections.Garbage collector and virtual machine, Case studylike:ATM, Weather monitoring system,Librarymanagementsystem etc.

TextBooks

1. TimothyBudd,“AnIntroductiontoObject-OrientedProgramming”,AddisonWesleyPublication.
2. CayS.HorstmannandGaryCornell,“CoreJava:VolumeI,Fundamentals”,PrenticeHallpublication.

ReferenceBooks

1. G.Booch,“ObjectOrientedAnalysis&Design”,AddisonWesley.
2. JamesMartin,“PrinciplesofObjectOrientedAnalysisandDesign”,PrenticeHall/PTR.
3. PeterCoadandEdwardYourdon,“ObjectOrientedDesign”,PrenticeHall/PTR.
4. Herbert Schildt,“Java2:TheCompleteReference”,McGraw-HillOsborneMedia.

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Computer Science and Design, III-Semester

SD306 Python Lab

Module1: Introduction to python language, Basic syntax, Literal Constants, Numbers,Variable and Basic data types,String, Escape Sequences, Operators and Expressions,EvaluationOrder,Indentation,Input,Output,Functions,Comments.

Module2: Data Structure**:** List, Tuples, Dictionary, DataFrame and Sets, constructing,indexing,slicingandcontentmanipulation.

Module3: Control Flow:Conditional Statements - If, If-else, Nested If-else. IterativeStatement-For,While,Nested Loops.Controlstatements-Break,Continue,Pass.

Module4: Object oriented programming:Class and Object, Attributes, Methods, ScopesandNamespaces,Inheritance,Overloading,Overriding,Datahiding**,**Exception:Exception Handling,Exceptclause,Tryfinallyclause,UserDefinedExceptions.

Module5: Modules and Packages**:** Standard Libraries: File I/0, Sys, logging, Regularexpression,DateandTime,Networkprogramming,multi-processingandmulti-threading.

References

1. Mark Lutz, Learning Python, 5th Edition, O'Reilly Media publication
2. TimothyA.Budd, Exploringpython,McGraw-HillEducation.
3. AllenB.Downey , ThinkPython,O'ReillyMedia,Inc.