SHRI G.S. INSTITUTE OF TECHNOLOGY & SCIENCE, INDORE
DEPARTMENT OF COMPUTER ENGINEERING
B.TECH./ II YEAR (4YDC)
SEMESTER- A
July-Dec 2023
CO 24009: Computer Architecture

COURSE OBJECTIVES: The main objective of this course is to compare various architectures of Computers and their components like memory etc. and to develop the skills of the students to write the assembly language programs for various instructions

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 and justify the importance of parallel architecture

Lecture Plan

Sr. No.	**Topics Covered**	**No. of lectures**
1	Introduction of Course	**1**
2	Difference Between Computer Architecture and Organisation	**1**
3	History of Computer Architecture and Different types of architecture	**1**
4	Von Neumann Model: ProcessorOrganization- ALU, Control Unit and its comparison with Haward architecture	**1**
5	Memory Hierarchy and System Bus	**1**
6	I/O Operation and Instruction Execution process	**1**
7	Arithmetic and Logical Operations	**2**
8	Memory Organization its features, functions and utility	**1**
9	Cache Memory	**1**
10	Cache mapping Techniques(Direct,Set Associative,Fully Associative)	**3**
11	Cache(Read and Write operation,Calculation of Effective access time)	**2**
12	Instruction Formats	**2**

13	Addressing Modes	**1**
14	Instruction Types, Flow of Control	**1**
15	RISC v/s CISC	**1**
16	Memory mapped I/O and I/O mapped I/O	**1**
17	I/O Techniques: Programmed I/O, Concept of Interrupts, Interrupt driven I/O and DMA	**2**
18	(i)I/O Device Interfaces (ii)I/O Processors (iii)Serial and Parallel Communication (iv)Computer Buses	**2**
19	Concept of Hardwired and Micro Programmed Control	**1**
20	Design of the Micro Architecture Level(MicroInstruction,MicroOperations etc)	**1**
21	On-chip Parallelism- Instruction Level Parallelism	**1**
22	Instruction Pipeline,Pipeline Phases	**2**
23	Pipeline Hazards	**2**
24	On-chip Multithreading, Multicore Processor Architecture	**1**

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CO 24057: Object Oriented Programming Systems

COURSE OBJECTIVES: The objective of 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.

Lecture Plan

Sr. No.	Topics Covered	No. of lectures
1	UNIT-1 Introduction to object oriented programming, Comparison of procedure oriented & object oriented programming.	01
2	Features of object oriented programming, Merits and demerits of OO Methodology.	01
3	Features of JAVA, Concept of JRE and JVM, Elements of OOPS.	02
4	Object model, IO processing.	01
5	UNIT- 2 Concept of Objects: State, Behavior & Identity of an object.	02
6	Classes: identifying classes and candidates for Classes Attributes and Services.	01
7	Access modifiers, Static members of a Class, Scope and Lifetime, Instances, Message passing.	02
8	Construction and destruction of Objects, Types of constructors, Copy constructor.	03
9	UNIT- 3 Inheritance: purpose and its types, 'is a' relationship.	02
10	Association and its types, Aggregation.	02

11	Concept of interfaces: how it is used in java.	02
12	Abstract classes: introduction and usage.	02
13	UNIT- 4 Introduction to polymorphism, real world applications.	01
14	Method Overriding, implementation in java.	02
15	Method Overloading, and its implementation.	02
16	Static and runtime Polymorphism and its comparison.	01
17	UNIT- 5 Introduction to Strings, various methods of String class, packages for using strings in java.	01
18	Introduction to exceptions, Types of Exceptions, Exceptional handling, try, catch, throw, throws and finally with their usage, user defined exceptions.	03
19	Introduction to multithreading, its benefits and different stages of threads, implementation using Runnable interface and by extending Thread class.	03
20	Data collections, iterators, arraylist, etc.	04
21	Case study like: ATM, Library management system.	02
	Total number of lectures	**40**

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B.TECH. III YEAR (4YDC)
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CO34298: Artificial Intelligence

COURSE OBJECTIVES: To enable students to learn the basic concepts, theories, applications and state-of-the-art techniques of artificial intelligence.

COURSE OUTCOMES:
After completing the course student should be able to:
1. Describe fundamentals of Artificial Intelligence (AI) and its foundations.
2. Apply formal methods of knowledge representation, logic and reasoning for problem solving.
3. Apply basic principles of AI in solutions using inference, perception, knowledge representation, and learning concept.
4. Demonstrate awareness and understanding of various applications of AI techniques in intelligent agents, expert systems and other machine learning models.

Lecture Plan

Sr. No.	Topics Covered	No. of lectures
1	UNIT1-Introduction: Basics, the Foundations of AI	01
2	Intelligent Agents	01
3	Problem Solving by Searching	01
4	Problem spaces and search	01
5	Uninformed strategies	01
6	Informed Strategies	03
7	Adversarial Search	02
8	UNIT 2-Knowledge-Based Agents	03
9	First Order Logic and Inference	02
10	Semantic Networks, Categories	02
11	UNIT3- Quantifying Uncertainty	02
12	Baye’s Rule and Naive Bayes	02
13	Probabilistic Reasoning	02
14	Bayesian Networks	02

15	Temporal Models	02
16	UNIT 4- Features and Roles of Expert Systems	02
17	Knowledge Representation in Expert Systems	02
18	Natural Language Processing	02
19	UNIT 5- Introduction to Neural Networks	01
20	Introduction to Fuzzy Systems	01
21	Introduction to Genetic Algorithm, Computer-Vision, Robotic	02
	Total number of lectures	**40**

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CO34002: Theory of Computation

COURSE OBJECTIVES:

This course will help students to learn several formal mathematical models of computation along with their relationships with formal languages and grammars. Students will also learn about solvable and unsolvable problems.

COURSE OUTCOMES:

After completing the course student should be able to:

1. Compare and analyze different theoretical computational models, languages and grammars.
2. Design and construct finite automata, pushdown automata and Turing machine for various problems.
3. Identify limitations of some computational models and possible methods of proving them.
4. Describe the concept of computable and non-computable problems.

Lecture Plan

Sr. No.	Topics	No. of Lectures
1	Discussion on Course Objective, Course outcomes, syllabus, CW evaluation and Theory Exam details, Introduction to Theory of Computation	1
2	Review of Sets, Graphs, Trees, Mathematical formal proofs including proof by induction and by contradiction	1
3	Introduction to Languages: Alphabet, String, Empty String, Substring, Closure of Alphabet, Formal Language, Operations on Languages	1
4	Introduction to Grammar, Formal Structure, String generation, Language generated by a grammar, sentential form, derivation, Introduction to Automata, Types of automata	1
5	Introduction to Finite Automata (FA), Representation of FA- Transition Function, Transition Graph, Transition Table, Example problems	1
6	Examples of FA, Deterministic Finite Automata (DFA): definition and concepts, examples, Problem Solving	1
7	Problem Solving Session	1

8	Non-deterministic Finite Automata (NFA), Representation and examples, Difference between NFA and DFA, NFA to DFA	**1**
9	Minimizing a DFA with examples, Discussion on Regular Expression: concepts and Representation, examples	**1**
10	Regular Expressions (REs), REs to NFA, FA to RE, Problem Solving	**1**
11	Regular Grammars (RGs) and Languages, Right Linear and Left Linear Regular Grammar, RG to FA, FA to RG, Equivalence of FA, RE and RG, examples	**1**
12	FA as Transducers, Mealy and Moore Machines: Representation and examples	**1**
13	Closure Properties of Regular Languages with proofs and examples	**1**
14	Pumping Lemma for Regular Languages: Identifying non-RLs, Applications of Regular Expressions and Finite Automata	**1**
15	Problem solving Session	**1**
16	Introduction to Push Down Automata (PDA) and Context Free Language (CFL), Examples	**1**
17	Context Free Grammar (CFG), Left most and Right most derivations, Derivation Trees, relation between derivation trees and sentential forms	**1**
18	Parsing and Ambiguity in CFG, Examples and Problem Solving	**1**
19	Normal forms of CFGs – Chomsky Normal Form (CNF), Griebach Normal Form (GNF), Simplification of CFG: Removing Useless, ⋏ and Unit Productions	**1**
20	Converting CFG to CNF and GNF Forms, Problem Solving	**1**
21	CFG to Non-deterministic PDA (NPDA), NPDA to CFGs, examples	**1**
22	Deterministic PDA (DPDA), Difference between DPDA and NPDA	**1**
23	Problem Solving on DPDA and NPDA	**1**
24	Pumping Lemma for CFGs, Closure Properties of CFLs with proofs and examples	**1**
25	Decidable and Undecidable Properties of CFLs, CYK Algorithm	**1**
26	Application of CFGs and PDA	**1**

27	Problem Solving Session	**1**
28	Introduction to Turing Machines: Formal definition, concepts and examples	**1**
29	Turing Machine as acceptor, recognizing a Language, Turing Machine for RLs and CFLs	**1**
30	Problem Solving on Turing Machines	**1**
31	Turing Machine as Transducers, examples	**1**
32	Types of Turing Machines- Universal TMs, Multi-tape TMs, Semi-infinite tape TM, TM with stay option, Linear Bounded Automata (LBA) etc.	**1**
33	Context Sensitive Languages (CSLs), Recursive and Recursively Enumerable Languages, Unrestricted Grammars with examples	**1**
34	Problem Solving Session	**1**
35	Applications of Turing Machines, Problem Solving	**1**
36	Chomsky Hierarchy	**1**
37	Some Problems That Cannot Be Solved by Turing Machines, Concept of Solvability and Unsolvability	**1**
38	Church’s Thesis, The Turing Machine Halting Problem	**1**
39	Complexity Theory – P and NP problems, Post’s Correspondence Problem	**1**
40	Introduction to Petri Nets	**1**

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CO 34014: Agile Software Methodology

COURSE OBJECTIVES: To enable students to understand the fundamental principles of Software Project Management and be familiar with the process and techniques used for software project management.

COURSE OUTCOMES: After completing the course student should be able to:
1. Demonstrate basic concepts and issues of software project management.
2. Demonstrate Planning, Execution and Evaluation of software projects.
3. Apply mechanisms for monitoring, tracking and risk management of software projects. 4. Design activities necessary to perform quality management and successful completion of Software Projects.

Lecture Plan

Sr. No.	Topics Covered	No. of lectures
1	Fundamentals of Software Engineering Concepts and Process	1
2	Software Development Life Cycle, Important Steps and Effort Distribution	2
3	Prototype Model, Incremental Model	1
4	Spiral Model, RAD	1
5	The Genesis of Agile, Introduction and background, Agile Manifesto and principles	1
6	Agile development Lifecycle, Agile Development Methods: Adaptive Software Development (ASD), Dynamic Systems Development Methods (DSDM)	2
7	Extreme Programming (XP): XP lifecycle, Feature Driven development	1
8	Lean Software Development, Kanban	1
9	Agile project management	1
10	Test Driven Development, Key Principles, Examples, and Tools & Techniques for each Agile development methods	1
11	Impact of Agile Processes in Requirement Engineering Requirements Elicitation and Management	1

12	Agility in Design, Agile Architecture, Agile Design Practices	**1**
13	Role of Design Principles, Agile Product Development	**1**
14	Automated build tools, Continuous Integration, Continuous Deployment, Refactoring, Team Dynamics and Collaboration	**1**
15	Introduction to Scrum, Agile Principles - Sprints Introduction, User Stories and Product Backlog	**1**
16	Estimation, Velocity, Burndown chart, Sprint Zero	**1**
17	Roles - Team Management and Structures, Product Owner, ScrumMaster / Team Lead, Implementation Team Members	**1**
18	Planning in Scrum - Planning, Planning Stakeholders, Planning Types	**1**
19	Sprint phases/meeting - Sprint Planning, Sprint Review, Sprint Retrospective, Product Demo, Daily Scrum calls	**1**
20	Agile Testing Principles, Practice and Processes	**1**
21	Difference between Testing in Traditional and Agile Approaches, Agile testing methods, techniques and tools	**2**
22	Estimating Test Efforts, Agile Metrics and Measurements	**1**
23	Agile Control: the 7 control parameters; Product Quality	**1**
24	Agile approach to Risk, Agile Approach to Configuration Management	**2**
25	Agility and Quality Assurance, Case study using any one of the framework	**2**

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CO44251: Deep Learning

COURSE OBJECTIVES: Introduce deep learning fundamentals and major algorithms, the problem settings, and their applications to solve real world problems.

COURSE OUTCOMES:
After completing the course student should be able to:
1.Describe in-depth about theories, fundamentals, and techniques in Deep learning.
2.Identify the on-going research in computer vision and multimedia field.
3.Evaluate various deep networks using performance parameters.
4.Design and validate deep neural network as per requirements.

Lecture Plan

Sr. No.	Topics Covered	No. of lectures
1	CO's, Assessment policies, Scope of subject, What is covered? And what is not covered? Introduction to deep learning, Basics of DL, History of DL, Evolution of DL	1
2	Introduction to Artificial Neural Network, Biological neuron.	1
3	McCulloch Pitts Neuron models, implementing different logical gates using McCulloch Pitts Neuron.	1
4	Activation Functions, Loss Functions.	1
5	Perceptron, Multilayer neural networks.	1
6	Gradient Descent, Momentum Based, Nesterov, Mini-Batch, Stochastic, Adaptive learning.	1
7	AdaGrad, RMSProp, Adam, comparison between all variants of GD	1
8	Sigmoid neuron, Back-propagation algorithm, back-propagation calculus, initialization.	1
9	Training rules of Back propagation, issues in back-propagation.	1
10	Batch Normalization techniques, Eigen value, Eigenvalue Decomposition, PCA.	1
11	Autoencoders and relation to PCA, different types of autoencoders	1

12	Under complete autoencoder, over complete autoencoder, Regularization in autoencoders	**1**
13	Denoising auto encoders, Sparse autoencoders	**1**
14	Contractive autoencoders	**1**
15	Regularization: Bias Variance Tradeoff, L2 regularization	**1**
16	Early stopping, Dataset augmentation, Parameter sharing and tying,	**1**
17	Injecting noise at input, Ensemble methods, Dropout	**1**
18	Introduction to Convolutional Neural network - motivation behind it, its applications.	**1**
19	Working of CNN- convolution layer, padding, pooling, stride.	**1**
20	Case Study of Alexnet,LeNet, AlexNet, ZF-Net,	**1**
21	VGGNet, GoogLeNet, ResNet	**1**
22	Visualizing Convolutional Neural Networks, Comparison between all the above networks, Recent Trends in Deep Learning Architectures.	**1**
23	Guided Backpropagation, Deep Dream, Deep Art	**1**
24	Recurrent Neural Networks, motivation, types of RNN, applications of RNN	**1**
25	Backpropagation through time (BPTT), Limitation of BPTT, Solution to it	**1**
26	Vanishing and Exploding Gradients,Truncated BPTT, GRU, LSTMs	**1**
27	Encoder Decoder Models, BLEU score	**1**
28	Introduction to Generative Models, architecture, working of discriminator and generator, Types of generative models, its applications in various fields.	**1**
29	Implementation of generative models on MNIST Hand written dataset	**1**
30	Restrictive Boltzman Machines(RBMs)	**1**