SHRI G.S. INSTITUTE OF TECHNOLOGY & SCIENCE,INDORE
DEPARTMENT OF COMPUTER ENGINEERING

B.TECH IInd year (4YDC)

SEMESTER- A

CO24009: 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.	CO's, Assessment policies, Scope of subject, What is covered? And what is not covered? Introduction to computer architecture, milestones in computer architecture.	**1**
2.	Von neumen model: processor organization - ALU, CU, System bus,	**1**
3.	Von neumen model: Memory, I/O.	**1**
4.	Multilevel model of computer system	**1**
5.	Types of system buses- data bus, control bus, address bus	**1**
6.	Instruction Execution cycle, steps.	**1**
7.	Introduction to assembly language.	**1**
8.	Review of combinational circuits	**1**
9.	Review of Sequential circuits	**1**
10.	Introduction to memory organization- hierarchy, properties	**1**

11.	Main memory, RAM memory, implementation	**1**
12.	Associative memory, working	**1**
13.	Cache memory, characteristics,Cache mapping techniques	**1**
14.	Cache mapping techniques - GATE numerical,Cache Write policies	**1**
15.	Instruction formats, Addressing modes	**1**
16.	Addressing modes,Instruction types	
17.	RICS architecture, CISC architecture, comparison between RISC vs CISC	**1**
18.	Introduction to I/O mapping techniques, interface unit, device controller	**1**
19.	Programmed I/O, Interrupts, Interrupt driven I/O	**1**
20.	Memory mapped I/O and I/O mapped I/O	**1**
21.	DMA, need, working of DMA, Modes of DMA	**1**
22.	Serial & Parallel Communication,Computer Bus	**1**
23.	Concept of Hard wired & Micro Programmed Control unit	**1**
24.	Micro instructions, Instruction fetch & queuing	**1**
25.	Micro instruction control	**1**
26.	Design of micro architecture level	**1**
27.	On-chip parallelism- arithmetic pipelining	**1**
28.	Instruction pipelining, Instruction pipelining -GATE Numericals	**1**
29.	Hazards of pipelining- data hazard & its solutions	**1**
30.	Control hazards & its solutions, Hazards of pipelining- GATE Numericals	**1**
31.	Multi core Processor introduction and architecture	**1**

SHRI G.S. INSTITUTE OF TECHNOLOGY & SCIENCE, INDORE
DEPARTMENT OF COMPUTER ENGINEERING
B.TECH. II YEAR (4YDC)
SEMESTER-A
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.

DETAILED LECTURE PLAN:

Unit		Topic	No of Lectures
1		**Introduction to Object Oriented Thinking & Object Oriented Programming**	**05**
	1.1	Introduction to object oriented programming, Comparison of procedure oriented & object oriented programming.	01
	1.2	Features of object oriented programming, Merits and demerits of OO Methodology	01
	1.3	Features of JAVA, Concept of JRE and JVM, Elements of OOPS	02
	1.4	Object model, IO processing	01

2		**Encapsulation**	**08**
	2.1	Concept of Objects: State, Behavior & Identity of an object	02
	2.2	Classes: identifying classes and candidates for Classes Attributes and Services	01
	2.3	Access modifiers, Static members of a Class, Scope and Lifetime, Instances, Message passing	02
	2.4	Construction and destruction of Objects, Types of constructors, Copy constructor	03
3		**Inheritance and Data Abstraction**	**08**
	3.1	Inheritance: purpose and its types, ‘is a’ relationship	02
	3.2	Association and its types, Aggregation	02
	3.3	Concept of interfaces: how it is used in java	02
	3.4	Abstract classes: introduction and usage	02
4		**Polymorphism**	**06**
	4.1	Introduction to polymorphism, real world applications	01
	4.2	Method Overriding, implementation in java	02
	4.3	Method Overloading, and its implementation	02
	4.4	Static and runtime Polymorphism and its comparison	01

5		**Exception Handling , Multithreading & Collections**	**13**
	5.1	Introduction to Strings, various methods of String class, packages for using strings in java	01
	5.2	Introduction to exceptions, Types of Exceptions, Exceptional handling, try, catch, throw, throws and finally with their usage, user defined exceptions	03
	5.3	Introduction to multithreading, its benefits and differents stages of threads, implementation using Runnable interface and by extending Thread class	03
	5.4	Data collections, iterators, arraylist, etc.	04
	5.5	Case study like: ATM, Library management system.	02

SHRI G.S. INSTITUTE OF TECHNOLOGY & SCIENCE, INDORE
DEPARTMENT OF COMPUTER ENGINEERING
B.TECH. IIIrd year (4YDC)
SEMESTER- A
CO34014: Agile Software Methodology

COURSE OBJECTIVES:

1. Understand the differences between conventional and agile approaches.
2. Learn the background and origins of various agile concepts and methodologies.
3. Learn about Scrum development.
4. Understand frameworks and practices used by agile teams.
5. Learn about agile ways of gathering requirements, estimation, release planning, performance metrics, and scaling.

COURSE OUTCOMES:

1. Describe the fundamental principles and practices associated with software development process models.
2. Compare and contrast agile software development model with traditional development models.
3. Apply techniques and skills to build and mentor agile projects for effective software development using scrum.
4. Adapt existing agile testing techniques and knowledge to implement agile 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	1
3	Prototype Model, Incremental Model, Spiral, RAD	3
4	The Genesis of Agile, Introduction and background, Agile Manifesto and principles, Agile development Lifecycle	2
5	Agile Development Methods: Adaptive Software Development (ASD), Dynamic Systems Development Methods (DSDM)	1
6	Extreme Programming (XP): XP lifecycle, Feature Driven development, Lean Software Development, Kanban	2
7	Agile project management, Test Driven Development, Key Principles, Examples, and Tools & Techniques for each Agile development methods	2
8	Impact of Agile Processes in Requirement Engineering Requirements Elicitation and Management, Agility in Design, Agile Architecture, Agile Design Practices	2
9	Role of Design Principles, Agile Product Development, Automated build tools, Continuous Integration, Continuous Deployment, Refactoring, Team Dynamics and Collaboration	2
10	Introduction to Scrum, Agile Principles - Sprints Introduction, User	2

	Stories and Product Backlog, Estimation, Velocity, Burndown chart, Sprint Zero	
11	Roles - Team Management and Structures, Product Owner, ScrumMaster / Team Lead, Implementation Team Members	1
12	Planning in Scrum - Planning, Planning Stakeholders, Planning Types (Portfolio, Product and Sprint)	1
13	Sprint phases/meeting - Sprint Planning, Sprint Review, Sprint Retrospective, Product Demo, Daily Scrum calls	2
14	Agile Testing Principles, Practice and Processes, Difference between Testing in Traditional and Agile Approaches	2
15	Agile testing methods, techniques and tools, Estimating Test Efforts, Agile Metrics and Measurements	2
16	Agile Control: the 7 control parameters; Product Quality, Agile approach to Risk	1
17	Agile Approach to Configuration Management, Agility and Quality Assurance	1
18	Case study using any one of the framework	3

SHRI G.S. INSTITUTE OF TECHNOLOGY & SCIENCE, INDORE DEPARTMENT OF COMPUTER ENGINEERING
B.TECH (III Year)
SEMESTER- A
CO 34002: SUBJECT NAME: 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 Covered	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, Examples	1
6	Examples of FA, Deterministic Finite Automata (DFA): definition and concepts, examples, Problem Solving	1
7	Non-deterministic Finite Automata (NFA), Representation and examples, Difference between NFA and DFA, NFA to DFA	1
8	Minimizing a DFA with examples, Discussion on Regular Expression: concepts and Representation, examples	1
9	Regular Expressions (REs), REs to NFA, FA to RE, Problem Solving	1
10	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
11	FA as Transducers, Mealy and Moore Machines: Representation and	1

	examples	
12	Closure Properties of Regular Languages with proofs and examples	**1**
13	Pumping Lemma for Regular Languages: Identifying non-RLs, Applications of Regular Expressions and Finite Automata	**1**
14	Problem solving Session	**1**
15	Introduction to Push Down Automata (PDA) and Context Free Language (CFL), Examples	**1**
16	Context Free Grammar (CFG), Left most and Right most derivations, Derivation Trees, relation between derivation trees and sentential forms	**1**
17	Parsing and Ambiguity in CFG, Examples and Problem Solving	**1**
18	Normal forms of CFGs – Chomsky Normal Form (CNF), Griebach Normal Form (GNF),Simplification of CFG: Removing Useless, ʌ and Unit Productions	**1**
19	Converting CFG to CNF and GNF Forms, Problem Solving	**1**
20	CFG to Non-deterministic PDA (NPDA), NPDA to CFGs, examples	**1**
21	Deterministic PDA (DPDA), Difference between DPDA and NPDA	**1**
22	Problem Solving on DPDA and NPDA	**1**
23	Pumping Lemma for CFGs, Closure Properties of CFLs with proofs and examples	**1**
24	Decidable and Undecidable Properties of CFLs,CYK Algorithm	**1**
25	Application of CFGs and PDA	**1**
26	Problem Solving Session	**1**
27	Introduction to Turing Machines: Formal definition, concepts and examples	**1**
28	Turing Machine as acceptor, recognizing a Language, problem solving	**1**
29	Turing Machine for RLs and CFLs, Problem Solving	**1**
30	Turing Machine as Transducers, examples	**1**
31	Types of Turing Machines- Universal TMs, Multi-tape TMs, Semi-infinite tape TM, TM with stay option, Linear Bounded Automata (LBA) etc.	**1**
32	Context Sensitive Languages (CSLs), Recursive and Recursively Enumerable Languages	**1**
33	Unrestricted Grammars with examples	**1**
34	Applications of Turing Machines, Problem Solving	**1**
35	Chomsky Hierarchy	**1**
36	Some Problems That Cannot Be Solved by Turing Machines,Concept of Solvability and Unsolvability	**1**
37	Church's Thesis, The Turing Machine Halting Problem	**1**
38	Complexity Theory – P and NP problems, Post's Correspondence Problem	**1**
39	Introduction to Petri Nets	**1**
40	Problem Solving Session	**1**

Lecture Plan for CO 34005: Database Management Systems
JULY2024-OCTOBER2024

Total Number of Lectures: 37 (3 lectures+1 Tutorial)/week
Name of Instructors: Dr. Vandan Tewari
Pre Requisite of this course is good understanding of data structures, and operating systems

COURSE OBJECTIVE: The objective of this course is to enable students in developing a high level understanding of the concepts of Database management systems in contrast with traditional data management systems with emphasis on skills to apply these concepts in building, maintaining and retrieving data from structured databases which form the backbone of all major applications today – tightly or loosely coupled, intranet or internet based, financial, social, administrative, and so on.

Course Outcomes : After completing the course student should be able to:	
CO1	Compare & Contrast between traditional data processing and Database Management systems, its application and can describe design of a database at various levels.
CO2	Design a database using Entity Relationship diagram and other design techniques.
CO3	Apply fundamentals of relational model to model & implement a sample Database Management System for a given domain.
CO4	Query Database Management systems using SQL ; evaluate and optimize queries and apply concepts of transaction management

UNIT I: (No of Lectures: 12) < Introduction to Databases their Architecture & Data Models >

S.No.	**CONTENTS**	**Additional Resources**
Lect 1-2	Basic Concept, what is DBMS? Why do we need it? Basic DBMS Architecture, database languages View of data- Data abstraction, Data Integrity, universe of discourse.	**https://www.coursera.org/learn/introduction-to-relational-databases**
Lect 3-4	Instances and schemas, Data Independence. The three schema design, various type of data models, Database vs. conventional File systems/ data processing. Schemas and Instances, Database Users, overall system architecture, Database design. Disadvantages of a database.	
Lect 5-8	Requirement analysis, design issues, Introduction to ER Model & ER Diagram, ER Model: Basic Concepts: Type of Attributes, and Design issues: Cardinalities & Participation Constraints. Extended ER Model, Modeling using ER diagram and Case Study	**Use any in the list to make some free ER Diagrams Check this: https://clickup.com/blog/erd-tools/**
Lect 9-11	Introduction to Relational model, domains, attributes & keys, comparison of ER model & Relational model	
Lect 12	Reduction of ER model to tables (Relations)	

UNIT II (No. of Lectures:09) < Database languages & Query >

S.No.	CONTENTS	**Additional Resources**
Lect 13-14	Relational algebra: Queries with select, project, renaming, and joins; union intersection, difference & division operations	

Lect 15-16	SQL, The Structured Query Language, Various parts of SQL, Basic structure, the select from/where clause, DDL Vrs DMS & DCL statements.	https://www.postgresql.org/docs/current/index.html https://www.w3schools.com/MySQL/default.asp
Lect 17-18	String operations, ordering, set operations, aggregate functions ,Null values usage & Nested sub queries set membership, set comparison, test for empty relation	
Lect 19	Test for absence of duplicate tuples, derived relations, and DML statements.	
Lect 20-21	Exercises on SQL Queries, Introduction to PL / SQL, Triggers, Cursors, Stored procedures.	

UNIT III (No. of Lectures: 10) < Integrity Constraints , Normalization & Physical Database Design>

S.No.	CONTENTS	Additional Resources
Lect 22-23	What are Integrity constraints? Why are they needed? Integrity constraints in ER model. Domain constraints, Referential Integrity. Effect of update operations on relations. Functional dependencies(F.D.),Trivial F D.	
Lect 24-25	Armstrong's axioms, closure of attribute sets. Algorithm for attribute closure calculation, significance of attribute closure & exercise on it. Closure of set of F.Ds,	
Lect 26	Canonical cover and computation of key, equality of set of FDs.	
Lect 27-29	Problems with relational database design, Introduction to normalization.1 NF, 2 NF, and 3 NF.3 NF vs. BCNF, attribute preservation & Loss less join decomposition, Denormalization.	
Lect 30	Physical DB Design: Type of file Organizations, Introduction to Hashing: Internal / External hashing, Collision resolution, Extendible hashing, RAID	https://www.postgresql.org/docs/current/static/storage.html https://dev.mysql.com/doc/refman/8.0/en/mysql-indexes.html
Lect 31	Indexing Techniques: primary & clustering indices, Secondary Index & Multilevel Index Tree Structured Index, B & B+ Trees, and Search Trees.	

UNIT IV (No. of Lectures:05) < Query Processing & Transaction Management >

S.No.	CONTENTS	Additional Resources
Lect 32	Query Processing, Implementation of Select and join operations, Introduction to Query Optimization. Transactions, Operations, Properties (ACID) of transaction, Major actions of transactions.	https://www.postgresql.org/docs/16/geqo-pg-intro.html
Lect 33	Concurrent Execution of Transaction; various types of anomalies arising out of them. Schedules, recoverability of schedule, serial schedule, serialisable schedule.	https://www.geeksforgeeks.org/sql-transactions/

Lect 34	Result equivalence & Conflict equivalence. Recovery Procedure, Structures for recovery procedures. Log with deferred updates & logging. .	
Lect 35	Conflict serializability, serialization graph. Lock based concurrency control, 2PL protocol, strict 2PL & conservative 2PL.	
Lect 36-37	Deadlocks, Prevention & detection with & without time stamps, wait for graphs. Transaction Support in SQL.	

UNIT V (No of Lectures 01) < Case Study >

Lect 38	Case Study of DBMS. Introduction to NOSQL databases	

Text Books:

1.R. Elmasri & S. Navathe, " Fundamentals of Data base System" Pearson Education, 7e or later

2.H.F. Korth & A Silberschatz, "Database System Concepts" McGraw Hill, 7/e or later.

Reference Books:

1. C.J. Date," An introduction to database System, Addison Wesley, 6/e.

Online Resources:

1. https://www.w3schools.com/sql
2. https://www.geeksforgeeks.org/30-days-of-sql-from-basic-to-advanced-level/
3. The Complete SQL Bootcamp @Udemy
4. Introduction to Databases and SQL Querying@Udemy
5. Database Management Systems By Prof P.P.Das @ Swayam Portal Registrations will open later.

Instructions to students:

1. You are advised to attend classes sincerely & maintain proper attendance, do not join late in Lectures. Pl maintain discipline in the class .
2. You will be given unscheduled online quizzes/design tests in this course, which will be evaluated, **Do not try to copy/Cheat** else you will be given zero in entire evaluation.
3. There will be two scheduled tests and an open book test, which will be considered for evaluation.
4. You can contact us for your problems regarding subject matter by sending message on Subject Whatsapp group: DBMS 24 or by scheduling a in person meeting.
5. For DBMS Lab, you are advised to become comfortable with MYSQL/PostgreSQL/ORACLE LIVE
6. All need to join **Google classroom DBMS2024** as extra classes/tutorials/ lab demonstrations may be done online if required.
7. **Read the assigned chapter from the textbook before the lecture to understand the basic idea & terminologies used.**

TENTATIVE SCHEDULE of Evaluation and Class Activities (Theory)

S. No.	Name of Activity	Marks	Tentative Week
1.	Class Activity-1: Designing an ER Diagram for a given Domain description (PEER-Reviewed) and discussing solutions	10	Week 2
2.	Class Activity-2: Conversion of ER Diagram to Relational tables with identification of Keys. (PEER-Reviewed) and discussing solutions	10	Week 3
3.a	Mid Term Test-1 : OPEN BOOK EXAM	20	As per Institute Calendar
b	Discussion on Solution of Test1	-	Next Lecture after Test
4.	QUIZ-1	10	Week 3

5.	Class Activity-3: Problem on Normalization (PEER-Reviewed)	10	Week6
6.	Class Activity-4: Problem of Concurrency in Transactions (PEER-Reviewed)	10	Week8
7.	QUIZ-II	10	Week 6
8.a	Mid Term Test-2 : Traditional Exam	20	As per Institute Calendar
b	Discussion on Solution of Test2	-	Next Lecture after Test
*	Remedial Test (If required for selected students)	10	As time permits.

TENTATIVE SCHEDULE of Evaluation in Practical lab

S. No.	**Name of Activity**	**Marks**	**Tentative Lab Turn**
1.	Assignment1: Simple SQL Queries on pre prepared and populated University and Railway database.	10	III
2.	Quiz-1	10	III
3.	Assignment2: Nested SQL Queries on pre prepared and populated University and Railway database.	10	V
4.	Quiz-2	10	V
5.	Assignment3: Complex SQL Queries on self prepared and populated commercial order database.	10	VII
6.	Assignment 4: Triggers/cursors/Stored Procedures	10	IX
7.	Quiz-3	10	IX
8.	MINI PROJECT (Team of Four/Five)(4 submissions) Requirement Analysis ER Diagram Conversion to Relational Model Complete Implementation	30	 III IV V X

SHRI G.S. INSTITUTE OF TECHNOLOGY & SCIENCE, INDORE
DEPARTMENT OF COMPUTER ENGINEERING
B.TECH. IV YEAR (4YDC)
SEMESTER- A
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**