



Shri Vaishnav Vidyapeeth Vishwavidyalaya, Indore
Shri Vaishnav Institute of Information Technology
 Choice Based Credit System (CBCS) in the light of NEP-2020
 B.Tech CSE with Specialization in FullStack Development & Blockchain (in
 association with IBM)
SEMESTER-VII (2023-2027)

COURSE CODE	CA TE GO RY	COURSE NAME	TEACHING & EVALUATION SCHEME					L	T	P	C R E D I T S
			THEORY			PRACTICAL					
			END SEM University Exam	Two Term Exam	Teache rs Assess ment*	END SEM Univer sity Exam	Teac hers Asses sme nt*				
BTIBMA702N	DCC	AngularJS	60	20	20	30	20	3	0	2	4

Legends: L - Lecture; T - Tutorial/Teacher Guided Student Activity; P – Practical; C - Credit; ***Teacher Assessment** shall be based following components: Quiz/Assignment/ Project/Participation in Class, given that no component shall exceed more than 10 marks.

COURSE OBJECTIVES:

The student will have ability to:

1. Gain a comprehensive understanding of AngularJS, a single-page application (SPA) development framework.
2. Master core AngularJS concepts like components, directives, services, and data binding.
3. Develop proficiency in building dynamic and interactive web applications using AngularJS

COURSE OUTCOMES:

Upon completion of the subject, students will be able to:

1. Explain the fundamental principles and architecture of AngularJS.
2. Create well-structured AngularJS applications using components, directives, and services.
3. Implement two-way data binding to seamlessly connect models and views.

SYLLABUS

UNIT I **10 HOURS**

Introduction to AngularJS:

Overview of AngularJS, Benefits and use cases of AngularJS, AngularJS Architecture and Core Concepts, Setting up the Development Environment, Basic Directives and Data Binding, Controllers and \$scope, Expressions and Filters, Hands-on: Building a Simple, AngularJS Application.

UNIT II **8 HOURS**

Modules and Services:

AngularJS Modules, Dependency Injection, Services and Factories, Built-in Services (e.g., \$http, \$q), Custom Services, Promises and Async Operations, Hands-on: Creating and Using AngularJS Services.

UNIT III **9 HOURS**

Directives and Components, and Forms:

Concept of directives and components, Also learn built- in directives (ngIf, ngFor, ngClass, etc.) and Custom Directives. Components in AngularJS, Component Lifecycle Hooks, Communication Between Components, Working with Forms in AngularJS, Two-way Data Binding, Form Validation Techniques, Custom Validation, Handling Form Submission, Dynamic Forms, Hands-on: Creating and Validating Forms in AngularJS

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UNIT IV		7 HOURS
Routing, State Management, and Data Flow: ConceptsvAngularJS Routing, Configuring Routes, Nested Routes and Route Parameters, Resolving Data for Routes, Lazy Loading Modules, Route Guards and Security, Managing Application State in AngularJS, Services for State Management, One-way Data Flow and Flux Architecture, State Management Libraries (e.g., NgRx)		
UNIT V		8 HOURS
Watson API Integration, Testing, and Deployment: Working with RESTful APIs, Using \$http and \$resource for API Calls, Handling API Responses, Error Handling and Retry Strategies, WebSockets and Real-time Data, Introduction to Testing in AngularJS, Unit Testing with Jasmine and Karma, Best Practices for Testing AngularJS Applications, Hands-on: Integrating an AngularJS Application with a Backend API, Writing Tests, and Deploying an AngularJS Application.		
TEXTBOOKS:		
1.	B. Minnick, IBM Watson: Building Intelligent Apps. Indianapolis, IN, USA: IBM Press, 2017.	
2.	J. Hurwitz, M. Kaufman, and A. Bowles, Cognitive Computing and Big Data Analytics. Hoboken, NJ, USA: Wiley, 2015.	
REFERENCE:		
1.	"ng-book: The Complete Book on AngularJS" by Ari Lerner.	
2.	"AngularJS Essentials" by Rodrigo Branas.	
3.	"Getting MEAN with Mongo, Express, Angular, and Node" by Simon Holmes.	
4.	"Building Single Page Applications in .NET Core 3: Jumpstart Coding with AngularJS and Bootstrap" by Michele Aponte.	
5.	"ng-book: The Complete Book on AngularJS" by Ari Lerner.	
LIST OF PRACTICALS		
1.	Two-Way Data Binding in AngularJS Create a simple app showing real-time bindingusing ng-model.	
2.	AngularJS Interactive Calculator Uses controllers, two-way binding, dropdown operations & event handling (ng-click).	
3.	To-Do List Application Add, mark complete, and delete tasks using ng-repeat, ng-click, & two-way	

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	binding.
4.	Registration Form with Validation Uses ng-required, ng-pattern, \$touched, \$invalid, and form validation rules.
5.	AngularJS Dashboard Using Built-in Filters Shows use of filters like uppercase, lowercase, currency, number, date, orderBy, and search filtering
6.	Basic AngularJS Music Player Play local audio files using HTML5 <audio> and AngularJS controls
7.	CRUD Operations (Student Management Portal) Create, Read, Update, Delete using AngularJS & arrays (ng repeat, ng-model, controller logic).
8.	AngularJS Routing Routing using ngRoute (ng-view, \$routeProvider) with pages: Home, Red, Green, Blue.
9.	AngularJS Component Lifecycle Hooks Demonstrates \$onInit(), \$onChanges(), \$postLink(), \$onDestroy() with components.
10	Form States (\$pristine, \$dirty, \$touched, \$valid, etc.) Real-time form state tracking using AngularJS Form Controller.

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BTCS711	DCC	Introduction to Quantum Computing	60	20	20	30	20	3	0	2	4

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COURSE OBJECTIVES:

The student will have ability:

1. To introduce the fundamental principles of quantum mechanics as applied to computing.
2. To develop proficiency in the linear algebraic representation of quantum states and operations.
3. To analyze and design quantum circuits and basic quantum algorithms.
4. To understand complex quantum algorithms like Shor's and Grover's and their implications for cryptography.
5. To explore quantum query complexity and the theoretical limits of quantum speedup.

COURSE OUTCOMES:

Upon completion of the subject, students will be able to:

1. Explain the concepts of quantum "weirdness" and represent quantum states using Dirac notation and linear algebra.
2. Design and simulate quantum circuits using basic gates (Hadamard, CNOT, and Phase) and measurement principles.
3. Implement and analyze fundamental quantum algorithms such as Deutsch-Jozsa, Simon's, and Quantum Fourier Transform.
4. Evaluate the efficiency of Grover's Search and Quantum Walks compared to classical randomized computation.
5. Assess the impact of quantum computing on modern security (Shor's algorithm) and understand the limits of quantum query complexity.

SYLLABUS

UNIT I

9 HOURS

Introduction and Mathematical Foundations: - Overview of Quantum Computing; Quantum Weirdness: Mach-Zehnder Interferometer; Linear Algebraic Formulation: Kat-Bra notation, deterministic vs. randomized vs. quantum states; Cubits and Composite Systems (Tensor products).

UNIT II

9 HOURS

Quantum Operations and Circuits: - Operations in Quantum Computing: Unitary matrices and Semi definite matrices; Basic Gates: Pauli gates, Hadamard, Phase, and CNOT; Circuit representation; Projectors and

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Measurements; Principle of Deferred Measurement; Swap Circuits.

UNIT III

9 HOURS

Fundamental Quantum Algorithms: - Classical vs. Quantum Circuits; The Deutsch and Deutsch-Jozsa Algorithms; Simon's Algorithm; Quantum Fourier Transform (QFT): Mathematical derivation and circuit implementation.

UNIT IV

9 HOURS

Advanced Algorithms and Random Walks: - Applications of QFT: Phase Estimation and Shor's Algorithm (Period finding and Factoring); Grover's Search Algorithm: Amplitude amplification and optimality; Randomized computation; Discrete-time Quantum Walks.

UNIT V

9 HOURS

Query Complexity and Future Trends: - The Query Model: Classical vs. Quantum complexity; Approximate degree; Total functions: Polynomial separation; Partial functions: For relation problem; Aaronson-Amboina's conjecture; Introduction to Quantum Security and Post-Quantum Cryptography.

TEXTBOOKS:

1. M. A. Nielsen and I. L. Chuang, *Quantum Computation and Quantum Information: 10th Anniversary Edition*. Cambridge, UK: Cambridge University Press, 2010.
2. P. Kaye, R. Laflamme, and M. Mosca, *An Introduction to Quantum Computing*. Oxford, UK: Oxford University Press, 2007.

REFERENCE:

1. J. S. Desharnais, *Quantum Mechanics for Engineers*. New York, NY, USA: McGraw-Hill, 2013.
2. E. Rieffel and W. Polak, *Quantum Computing: A Gentle Introduction*. Cambridge, MA, USA: MIT Press, 2011.
3. https://onlinecourses.nptel.ac.in/noc26_cs06/preview

LIST OF PRACTICALS

1. **Qubit Visualization:** Representing single qubit states on the Bloch Sphere and performing rotations.

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- Entanglement:** Implementing the Bell States and verifying entanglement via measurement.
- Circuit Design:** Building a 3-qubit Adder circuit using basic quantum gates.
- Deutsch-Jozsa:** Implementation of the Deutsch-Jozsa algorithm to determine if a function is constant or balanced.
- Teleportation:** Implementing the Quantum Teleportation protocol.
- Bernstein-Vazirani:** Solving the "hidden bitstring" problem in a single query.
- Grover's Search:** Implementing a 2-qubit and 3-qubit search for a specific marked state.
- QFT & Phase Estimation:** Visualizing the effect of the Quantum Fourier Transform on different input states.
- Shore's Core:** Implementing the period-finding component of Shore's algorithm.
- Quantum Walks:** Simulating a discrete-time quantum walk on a 1D line.

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BTCS712	SEC	Cloud Competency Lab	0	0	0	30	20	0	0	2	1

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COURSE OBJECTIVES:

The student will have ability to:

1. Understand cloud development concepts and AWS architecture.
2. Develop applications using AWS services like S3, Lambda, and DynamoDB.
3. Implement secure, scalable, and event-driven cloud applications.
4. Analyze deployment strategies and CI/CD pipelines in cloud environments.

COURSE OUTCOMES:

Upon completion of the subject, students will be able to:

1. Develop and deploy applications using AWS cloud services.
2. Implement REST APIs and serverless architectures.
3. Analyze cloud security, scalability, and performance issues.
4. Design distributed applications using messaging and workflow services.

SYLLABUS

UNIT I

6 HOURS

Introduction to Cloud Developing on AWS: Overview of AWS Cloud and infrastructure, Roles in cloud computing, Introduction to development lifecycle in cloud, AWS SDKs and development tools (Cloud9, CloudShell), Basics of distributed systems and cloud architecture.

UNIT II

6 HOURS

Storage and Security in AWS: Amazon S3: Buckets, objects, and storage management, Data protection and access control, AWS Identity and Access Management (IAM), Authentication and authorization mechanisms, Cross-account access and security best practices.

UNIT III

6 HOURS

Database and API Development: AWS database services overview, Amazon DynamoDB concepts (RCU, WCU, indexing), Developing NoSQL solutions, REST API development using Amazon API Gateway, API deployment, monitoring, and optimization

UNIT IV

6 HOURS

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Serverless and Container-Based Development: Serverless computing concepts, AWS Lambda: Function creation and deployment, Event-driven architectures, Containerization using Docker, AWS container services and Elastic Beanstalk.

UNIT V

6 HOURS

Advanced Cloud Development & Deployment: Caching with Amazon ElastiCache and CloudFront, Messaging services: Amazon SQS, SNS, Kinesis, Workflow orchestration using AWS Step Functions, Security in cloud applications (Cognito, STS), CI/CD pipelines using AWS Code services and CloudFormation.

TEXTBOOKS:

1. Amazon Web Services, *AWS Training and Certification Material (AWS Academy Cloud Developing)*. [Online]. Available: <https://aws.amazon.com/training/academy/>
2. M. Wittig and A. Wittig, *Amazon Web Services in Action*. Shelter Island, NY, USA: Manning Publications, 2015.

REFERENCE:

1. J. P. Mueller, *AWS for Developers*. Hoboken, NJ, USA: Wiley, 2017.
2. B. Golden, *Amazon Web Services for Dummies*. Hoboken, NJ, USA: Wiley, 2013.
3. Amazon Web Services, *AWS Official Documentation*.

LIST OF PRACTICALS

1. Working with AWS Cloud9 and CloudShell
2. Creating and managing S3 buckets
3. Implementing IAM roles and policies
4. Developing applications using DynamoDB
5. Building REST APIs using API Gateway
6. Creating serverless applications using AWS Lambda
7. Containerizing applications using Docker
8. Implementing caching with CloudFront/ElastiCache
9. Developing messaging systems using SQS and SNS
10. Automating deployment using CI/CD pipelines

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BTIBM721	DCC	Introduction to Blockchain	60	20	20	30	20	3	0	2	4

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COURSE OBJECTIVES:

The student will have ability to:

1. To introduce the core concepts, foundational global infrastructure, and standard service delivery models of Google Cloud Platform (GCP).
2. To identify the structural configuration, networking, deployment, and scalability mechanics of cloud-based compute and storage engines.
3. To design secure, automated microservice deployment architectures and serverless data workflows leveraging modern IT monitoring suites.

COURSE OUTCOMES:

Upon completion of the subject, students will be able to:

1. Explain the core architecture of Google Cloud, including its physical regions, project resource hierarchy model, and IAM security controls.
2. Deploy and run virtual machine instances, scalable managed container workloads, and cloud storage systems securely within an isolated virtual network environment.
3. Examine microservice resource metrics using cloud operations tooling and apply policy frameworks to optimize operational availability and enterprise security compliance.

SYLLABUS

UNIT I 6 HOURS

CLOUD INFRASTRUCTURE FUNDAMENTALS & ACCESS CONTROL:

Introduction to Cloud Computing: Shift from On-Premises IT to Elastic Cloud Architectures. Google Cloud Global Footprint: Regions, Zones, and Points of Presence (PoPs). GCP Project Resource Hierarchy: Organizations, Folders, Projects, and Resources. Interaction Interfaces: Cloud Console GUI, Google Cloud SDK (gcloud CLI), Cloud Shell interactive terminal. Identity and Access Management (IAM): Mapping Principals (Users, Groups, Service Accounts) to Roles (Primitive, Predefined, Custom) through secure validation policies.

UNIT II 6 HOURS

CLOUD COMPUTE PROCESSING ENGINES & CONTAINERIZATION:

Google Compute Engine (GCE): Virtual Machine (VM) instantiation, machine type families, custom images, persistent boot disks, and volume snapshots. Horizontal Scaling: Compute Engine Autoscaling and Managed Instance Groups (MIGs). Introduction to Containers vs. Hypervisor Virtualization. Google Kubernetes Engine (GKE): Cluster architecture, control planes, pods, declarative deployments, services, and multi-zone node pool configurations.

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UNIT III		6 HOURS
VIRTUAL NETWORKING & SCALABLE STORAGE ARCHITECTURE: Google Virtual Private Cloud (VPC): Subnet isolation, global routing paths, and ingress/egress Firewall rulesets. Networking Topologies: Internal/External IP address schemes and cloud DNS. Traffic Distribution: Global and Regional HTTP(S) Cloud Load Balancing. Storage Topologies: Unstructured data management with Google Cloud Storage (GCS), bucket ACLs, and object lifecycle rules. Managed Relational Storage: Cloud SQL, globally distributed Cloud Spanner. NoSQL Databases: Firestore and Cloud Bigtable.		
UNIT IV		7 HOURS
SERVERLESS COMPUTE & ASYNCHRONOUS MICROSERVICE INTEGRATION: Monolithic vs. Microservice Application Patterns. Serverless Processing Runtimes: Google Cloud Run (stateless containerized execution) and Google Cloud Functions (event-driven micro-execution blocks). Decoupled Enterprise Workflows: Asynchronous message passing using Cloud Pub/Sub architecture (Topics, Pull/Push Subscriptions, and message ordering semantics). Continuous Automation: Building container deployment pipelines using Cloud Build blocks.		
UNIT V		6 HOURS
OPERATIONS MANAGEMENT, SECURITY COMPLIANCE, & BIG DATA ANALYTICS: Google Cloud Operations Workspace: Dynamic resource performance dashboards, threshold-based Alerting strategies, and log collection paths via unified Cloud Logging sinks. Cloud Security Baselines: Enforcing the Principle of Least Privilege and cryptographic envelope encryption using Cloud Key Management Service (KMS). Introduction to the Data Analytics Ecosystem: Serverless multi-terabyte analytical queries inside Google BigQuery, and pipeline orchestration using Cloud Dataflow.		
TEXTBOOKS:		
1.	D. Sullivan, <i>Official Google Cloud Certified Associate Cloud Engineer Study Guide</i> , 1st ed. Indianapolis, IN, USA: Sybex, 2019.	
2.	J. Lipson and A. Singh, <i>Google Cloud Platform in Action</i> , 1st ed. West Point, NY, USA: Manning Publications, 2020.	
REFERENCE:		
1.	S. P. T. Krishnan and L. Gonzalez, <i>Building Cloud Apps with Google Cloud Platform: Programming, Google App Engine, and Cloud Data Store</i> , 1st ed. Berkeley, CA, USA: Apress, 2015.	
2	J. Muñiz and R. C. Das, <i>Google Cloud Platform Cookbook: Over 40 recipes to help you build, scale, and manage computing and storage solutions</i> , 1st ed. Birmingham, UK: Packt Publishing, 2018.	

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BTIBM721	DCC	Introduction to Blockchain	60	20	20	30	20	3	0	2	4

Legends: L - Lecture; T - Tutorial/Teacher Guided Student Activity; P – Practical; C - Credit; *Teacher Assessment shall be based following components: Quiz/Assignment/ Project/Participation in Class, given that no component shall exceed more than 10 marks.

LIST OF PRACTICALS

1.	Workspace Configuration: Interacting with the Google Cloud Console GUI, authenticating environment states via gcloud CLI commands, and initializing project environments using Google Cloud Shell
2.	Custom Networking Topology: Creating a multi-tier Virtual Private Cloud (VPC) network with public/private isolated subnets and constructing granular ingress/egress Firewall barriers.
3.	Server Infrastructure Management: Spanning, configuring, and executing remote SSH bindings to a Linux Compute Engine instance, extending its root block persistent volume, and mapping static external network IPs.
4.	Object Storage Implementation: Orchestrating structural spaces inside Cloud Storage, modifying objects across the multi-tier lifestyle engine (Standard, Nearline, Coldline, Archive), and assigning explicit IAM service policies.
5.	Managed Relational Databases: Initializing a highly-available Cloud SQL database instance, setting up data transactional tables, and establishing secure proxy tunnels from a client VM.
6.	Containerized Cluster Deployment: Constructing Docker container images, publishing builds to the Artifact Registry, and standing up application services inside a managed Google Kubernetes Engine (GKE) cluster.
7.	Event-Driven System Logic: Scripting and deploying an event-triggered Cloud Function that executes microservice processing automatically when new data documents arrive in a targeted Cloud Storage bucket.
8.	Auto-Scaling Microservices: Deploying a web service container onto Google Cloud Run and integrating it with an external HTTP(S) Load Balancer to mitigate simulated user traffic surges.
9.	Auditing and Observability Monitoring: Standing up custom metric monitoring alerts, assembling active environment dashboards, and routing operational data using Google Cloud Operations Workspace.
10.	Large-Scale Data Warehousing: Importing multi-gigabyte open-source datasets into a Google BigQuery environment and writing highly optimized serverless analytical SQL queries.

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SEMESTER-VII (2023-2027)

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			THEORY			PRACTICAL					
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BTDSE720	DSE	Reinforcement Learning	60	20	20	30	20	3	0	2	4

Legends: L - Lecture; T - Tutorial/Teacher Guided Student Activity; P – Practical; C - Credit; *Teacher Assessment shall be based following components: Quiz/Assignment/ Project/Participation in Class, given that no component shall exceed more than 10 marks.

COURSE OBJECTIVES:

The student will have ability:

1. To introduce the foundational concepts of the agent-environment interaction and reward-based learning.
2. To provide a deep understanding of Multi-armed Bandits and exploration-exploitation trade-offs.
3. To enable students to model real-world problems as Markov Decision Processes (MDPs).
4. To master tabular and function approximation methods for solving large-scale RL problems.
5. To explore advanced topics like Deep Q-Networks (DQN), Hierarchical RL, and partially observable environments.

COURSE OUTCOMES:

Upon completion of the subject, students will be able to:

1. Formulate sequential decision-making problems using the framework of Markov Decision Processes.
2. Analyze and implement Bandit algorithms to solve exploration-exploitation dilemmas in industrial scenarios.
3. Solve MDPs using Dynamic Programming, Monte Carlo, and Temporal Difference (TD) methods.
4. Apply Deep Learning function approximators (DQN) to solve RL problems with high-dimensional state spaces.
5. Design hierarchical and policy-based solutions for complex, multi-step engineering tasks.

SYLLABUS

UNIT I

9 HOURS

Introduction and Bandit Problems: - Introduction to RL: The Agent-Environment Interface, Rewards, and Goals. The Exploration-Exploitation Trade-off; Multi-armed Bandits: ϵ -greedy, Upper Confidence Bound (UCB), PAC-learning, Median Elimination, and basic Policy Gradient for Bandits.

UNIT II

9 HOURS

Markov Decision Processes (MDPs):- Finite MDPs: States, Actions, and Transitions. Return and Episodes; Bellman Equations: State-Value and Action-Value functions; Bellman Optimality Equations. Modeling industrial processes (e.g., chemical reactor control) as MDPs.

UNIT III

9 HOURS

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Fundamental Solution Methods: - Dynamic Programming: Policy Evaluation, Policy Iteration, and Value Iteration. Monte Carlo Methods for prediction and control. Temporal Difference (TD) Learning: TD (0), SARSA, and Q-Learning. Eligibility Traces: TD (λ) and n-step Bootstrapping.

UNIT IV

9 HOURS

Function Approximation and Deep RL: - Scaling RL: Value function approximation, Linear methods, and Least Squares RL. Deep Q-Networks (DQN): Experience Replay and Target Networks. Policy Gradient Methods for full RL: REINFORCE algorithm and Actor-Critic architecture.

UNIT V

9 HOURS

Advanced RL Architectures: - Hierarchical Reinforcement Learning (HRL): Options framework and goal-conditioned RL. Partially Observable MDPs (POMDPs): Belief states and applications. Case studies in robotics and automated system optimization.

TEXTBOOKS:

1. R. S. Sutton and A. G. Barto, *Reinforcement Learning: An Introduction*, 2nd ed. Cambridge, MA, USA: MIT Press, 2018.
2. C. Szepesvari, *Algorithms for Reinforcement Learning*. San Rafael, CA, USA: Morgan & Claypool, 2010.

REFERENCE:

1. D. P. Bertsekas, *Reinforcement Learning and Optimal Control*. Belmont, MA, USA: Athena Scientific, 2019.
2. M. Laskin, *Deep Reinforcement Learning in Action*. Shelter Island, NY, USA: Manning Publications, 2020.
3. K. Arulkumaran, M. P. Deisenroth, M. Brundage, and A. A. Bharath, "Deep Reinforcement Learning: A Brief Survey," *IEEE Signal Processing Magazine*, vol. 34, no. 6, pp. 26-38, Nov. 2017.
4. https://onlinecourses.nptel.ac.in/noc26_cs81/preview

LIST OF PRACTICALS

1. **Bandit Lab:** Implementation of ϵ -greedy and UCB algorithms for a 10-armed bandit problem.
2. **Frozen Lake (DP):** Solving the Frozen Lake environment using Policy Iteration and Value Iteration.
3. **Blackjack (MC):** Implementation of First-visit Monte Carlo for predicting win rates in Blackjack.
4. **Cliff Walking (TD):** Comparative study of SARSA (on-policy) and Q-Learning (off-policy) in a grid world.

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- Mountain Car (Linear FA):** Solving the Mountain Car problem using linear function approximation with tiling.
- Cart Pole (DQN):** Implementation of a Deep Q-Network with Experience Replay to balance a pole.
- Lunar Lander (DQN):** Tuning hyper-parameters (learning rate, γ) for a stable landing using DQN.
- REINFORCE Implementation:** Solving the Acrobot environment using basic Policy Gradient.
- Actor-Critic:** Implementing the Advantage Actor-Critic (A2C) algorithm on a continuous control task.
- Custom Environment:** Building a custom MDP environment for a simple chemical process (e.g., tank level control) and solving it via Q-Learning.

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BTDSE722	DSE	Prompt Engineering and Fine Tuning	60	20	20	30	20	3	0	2	4

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COURSE OBJECTIVES:

The student will have ability:

1. To understand the architectural foundations of LLMs and the mechanics of tokenization and temperature.
2. To master advanced prompting techniques like Chain-of-Thought, ReAct, and Few-Shot learning.
3. To explore multi-modal prompting for image, voice, and video generation.
4. To learn the end-to-end process of Fine-Tuning, including dataset preparation and PEFT (Parameter-Efficient Fine-Tuning)
5. To evaluate the ethical, safety, and cost implications of deploying AI-driven solutions.

COURSE OUTCOMES:

Upon completion of the subject, students will be able to:

1. Apply foundational knowledge of LLMs to design effective "Prompt Cards" and structured inputs for text mastery.
2. Design and implement complex "Vibe Coding" workflows and low-code Chabot's for industrial automation.
3. Conduct investigations into model performance by comparing zero-shot prompting vs. supervised fine-tuning.
4. Execute Parameter-Efficient Fine-Tuning (LoRA/QLoRA) on open-source models for specialized domain tasks.
5. Assess the security, ethical, and economic constraints of shipping AI products to production.

SYLLABUS

UNIT I

9 HOURS

Foundational Prompting & Text Mastery: - LLM Foundations: Tokenization, Context Windows, and Temperature. The "Prompt Card" Framework. Techniques for Text Mastery: Summarization, Information Extraction, and Domain-specific Translation. Structured output generation (JSON/Markdown).

UNIT II

9 HOURS

Advanced Reasoning & Multi-modal Prompting: - Reasoning Frameworks: Chain-of-Thought (Cot), Tree-of-Thoughts, and React prompting. Visual Prompting: Image generation, branding consistency, and DALL-E/ Midjourney integration. Introduction to Voice and Video prompting workflows.

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Legends: L - Lecture; T - Tutorial/Teacher Guided Student Activity; P – Practical; C - Credit; *Teacher Assessment shall be based following components: Quiz/Assignment/ Project/Participation in Class, given that no component shall exceed more than 10 marks.

UNIT III

9 HOURS

AI-Assisted Development & Low-Code Solutions: - "Vibe Coding" and Copilots: Using AI to write, debug, and optimize code. Building Chatbots using no-code/low-code platforms (e.g., Flowise, Lang Flow). Prompt Chaining and Autonomous Agents basics.

UNIT IV

9 HOURS

Dataset Engineering & Fine-Tuning Foundations: - When to Prompt vs. When to Fine-Tune. Dataset Preparation: Cleaning, formatting (JSONL), and synthetic data generation. Supervised Fine-Tuning (SFT). Parameter-Efficient Fine-Tuning (PEFT): Introduction to LoRA and QLoRA.

UNIT V

9 HOURS

Deployment, Ethics, and Governance: - Quality Assurance in Prompting: A/B testing prompts and LLM-as-a-judge. Ethical AI: Bias mitigation, Red-Teaming, and Jailbreak prevention. Cost Management: Token optimization and caching. Shipping and Showcasing AI products.

TEXTBOOKS:

1. N. Schwalbe, *Prompt Engineering for LLMs: Art and Science*. Sebastopol, CA, USA: O'Reilly Media, 2024.
2. S. Raschka, *Build a Large Language Model (from Scratch)*. Shelter Island, NY, USA: Manning Publications, 2024.

REFERENCE:

1. B. Ahmadi, *Hands-On Graph Neural Networks with Python*. Birmingham, UK: Packt Publishing, 2023.
2. T. Brown et al., "Language Models are Few-Shot Learners," *arXiv preprint arXiv:2005.14165*, 2020.
3. E. Hu et al., "LoRA: Low-Rank Adaptation of Large Language Models," *In Proc. of ICLR*, 2022.
4. https://onlinecourses.swayam2.ac.in/e-learning/preview/imb26_mg131

LIST OF PRACTICALS

1. **Prompt Card Design:** Create a standardized prompt template for extracting safety data from chemical industry reports.
2. **Text Mastery Lab:** Perform multi-step summarization and translation of technical research papers.
3. **Reasoning Lab:** Implement "Chain-of-Thought" prompting to solve complex chemical stoichiometry

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BTDSE722	DSE	Prompt Engineering and Fine Tuning	60	20	20	30	20	3	0	2	4

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problems.

- Multi-modal Branding:** Use DALL-E/Stable Diffusion to create a consistent brand identity for a hypothetical AI startup.
- No-Code Chatbot:** Build a customer support chatbot using Lang Flow that interfaces with a local PDF knowledge base.
- Synthetic Data Gen:** Use a large model (GPT-4) to generate 100 high-quality training pairs for a smaller model (Llama-3).
- Model Evaluation:** Conduct a "blind taste test" comparing the outputs of three different LLMs on the same prompt set.
- Fine-Tuning (PEFT):** Implement LoRA fine-tuning on a 7B parameter model using a specialized dataset (e.g., Medical or Legal).
- Security Audit:** Perform "Red-Teaming" on an LLM to identify vulnerabilities to prompt injection.
- Cost Optimization:** Calculate and compare the cost-per-inference for different token-saving prompting strategies.

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SEMESTER-VIII (2023-2027)

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			THEORY			PRACTICAL					
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BTCS705N	SEC	Industrial Training	0	0	0	0	50	0	0	4	2

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COURSE OBJECTIVES:

The student will have ability to:

1. To expose students to authentic engineering environments, corporate operations, and professional workflows, bridging the gap between classroom theory and industry practice.
2. To train students in systematic problem identification, data collection, and analytical troubleshooting by tackling real-world engineering issues or software deployment constraints.
3. To cultivate essential workplace competencies, including professional ethics, time management, collaborative teamwork, and structured technical reporting.

COURSE OUTCOMES:

Upon completion of the subject, students will be able to:

1. Analyze the operational architecture, infrastructure, and technical tools utilized by a modern engineering enterprise or research institution.
2. Formulate, evaluate, and propose optimal engineering or software-driven solutions for a minimum of three distinct real-world technical problems observed during the training period.
3. Compile an industry-grade technical training report and professionally defend their observations, technical skills, and project outcomes before an expert evaluation committee.

Guidelines for Students Undergoing Industrial Training

1. Overview & Institutional Scope

Students need to complete a mandatory **minimum 2-week industrial training** program during the summer vacation of after third year.

- **Prerequisite:** Before starting your training, students must obtain clear instructions and official approval from the designated Faculty In-Charge and then by Head of Department (HOD).
- **Alternative Attachments:** In place of a traditional corporate internship, students are permitted to complete an academic attachment of equal duration at a recognized national institution (such as an IIT, NIT, or IIIT) or an accredited university abroad.

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- **Professional Value:** This training serves as initial transition into corporate engineering. It is designed to cultivate practical engineering skills, build industry networks, enhance employability, and establish a foundational awareness of workplace behavior, interpersonal dynamics, and professional ethics.

2. Operational Phasing & Responsibilities

Students are completely responsible for ensuring their conduct throughout the placement cycle is ethical, conscientious, and professional.

1. Application & Approval: Pre-Training.

Apply for a suitable training slot through the Training and Placement (T&P) Officer at least one semester in advance. Once an offer is secured, submit a copy of the official offer letter to your HOD or Faculty Coordinator. You are strictly prohibited from changing your company choice once it has been officially approved.

2. Verify Company Eligibility: Conflict of Interest Check.

To prevent a conflict of interest, students are strictly prohibited from completing training at a family-owned business or an enterprise where close relatives hold direct management authority.

3. Immediate Joining Notification: Day 1 of Training.

Upon arriving at training site, students must immediately contact to Faculty Coordinator. Provide your exact start date, company name, your active contact details, and the contact information of your designated industry supervisor.

4. Problem Formulation & Study: During Training.

Actively engage with the industry's technical tasks. Students must identify and document 3 to 4 practical problems currently faced by the facility or software engineering team

5. Professional Conduct & Confidentiality: Daily Operations.

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Maintain 100% attendance and strictly follow all rules, safety protocols, and regulations enforced by the host organization. Protect the company's intellectual property; students are legally and ethically bound to maintain absolute confidentiality and must not share proprietary company data with third parties.

3. Industrial Training Report Guidelines

Students must compile a comprehensive technical report of **at least 25 to 30 pages** documenting their work. If multiple students are trained at the same organization, each student must author and submit an entirely independent, unique report.

Core Content Requirements

The technical manuscript must thoroughly document the following areas:

- **Enterprise Profile:** Essential history, market domain, infrastructure, and corporate introduction of the company.
- **Operational Workflows:** The sequence of manufacturing operations, production systems, or software development lifecycles (SDLC) deployed at the site.
- **Physical or Logical Layout:** A clear description of the facility floors, laboratories, workshops, or administrative networks.
- **Technical Configurations:** The major industrial equipment used, or the complete computer/server architecture and development environments required for running specialized enterprise software.
- **Logistics (Where Applicable):** The physical movement of raw, semi-finished, and finished materials (exempt for pure software engineering tracks).
- **Technical Case Studies:** Detailed formulation of your 3 to 4 technical problems, including the underlying data gathered, analysis steps, precise software commands or engineering math used, and your final data-driven recommendations.

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- **Industrial Validation:** A formal certificate of completion issued, signed, and stamped by your industry supervisor covering the exact duration of your training.

Document Structure Checklist

The final report must be organized in the following order:

1. Preface & Acknowledgements
2. Official Training Certificate (featuring the signature and seal of the authorized industry representative)
3. Table of Contents
4. Introduction to the Organization
5. Training Schedule & Timeline
6. Daily Work Logs & Technical Observations
7. Specific Assignment / Handled Project Details
8. Post-Training Learning Outcomes & Personal Reflections
9. Executive Summary & Bibliography (properly referencing all text citations, books, technical papers, or engineering standards used)

4. Assessment Framework & Evaluation

Evaluation is continuous and designed to measure the quality of your insights relative to graduate-level engineering attributes. A copy of your finalized report must be distributed to your industry employer, your internal department advisor, and your personal archive.

Evaluation Mechanism

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Choice Based Credit System (CBCS) in the light of NEP-2020

B.Tech./ B.Tech + M.Tech / B.Tech + MBA (CSE/ IT/CSBS) - All Programs

SEMESTER-VIII (2023-2027)

COURSE CODE	CATEGORY	COURSE NAME	TEACHING & EVALUATION SCHEME					L	T	P	CREDITS
			THEORY			PRACTICAL					
			END SEM University Exam	Two Term Exam	Teachers Assessment*	END SEM University Exam	Teachers Assessment*				
BTCS705N	SEC	Industrial Training	0	0	0	0	50	0	0	4	2

Legends: L - Lecture; T - Tutorial/Teacher Guided Student Activity; P – Practical; C - Credit; ***Teacher Assessment** shall be based following components: Quiz/Assignment/ Project/Participation in Class, given that no component shall exceed more than 10 marks.

The overall grade will be determined by the Faculty Coordinator and an appointed departmental expert committee via a formal **Seminar Presentation and Viva-Voce**.

Assessment Component	Evaluation Focus Criteria	Expected Graduate Attributes Tested
Technical Report	- Analytical depth of the case studies - Technical accuracy of data and logs - Structure and formatting compliance	- Engineering Knowledge - Problem Analysis - Investigation of Complex Problems
Seminar Presentation	- Clarity and quality of visual slides - Professional delivery and communication flow - Depth of technical knowledge during Q&A	- Modern Tool Usage - Design/Development of Solutions - Executive Presence

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			THEORY			PRACTICAL					
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BTCS706N	SEC	Project	0	0	0	120	80	0	0	8	4

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COURSE OBJECTIVES:

The student will have ability to:

1. Enable students to identify real-world, complex engineering problems and apply systematic research methodologies to formulate viable technical solutions.
2. Train students in designing, engineering, testing, and validating a complete product, system module, or computing architecture using modern engineering tools and industry-standard practices.
3. Foster collaborative engineering management skills, technical report writing, and the professional defense of engineered solutions before an evaluation panel.

COURSE OUTCOMES:

Upon completion of the subject, students will be able to:

1. Formulate a well-defined problem statement by critically reviewing contemporary research literature, identifying technical gaps, and establishing clear engineering requirements.
2. Design and develop an architectural framework, hardware prototype, or software system by incorporating sustainable design methodologies, algorithm design, and resource optimization.
3. Implement and deploy the proposed system using modern development environments, programming paradigms, cloud infrastructure, or advanced technical tools.
4. Evaluate the performance, scalability, and security parameters of the developed system against standard benchmark metrics, interpreting the results through rigorous testing.
5. Compile comprehensive, industry-grade technical project reports and documentation compliant with standard engineering formats, defending the work effectively through oral presentations.

Project Timeline

Phases

Phase 1: Planning & Requirement Analysis (Weeks 1–2)

Focus: Defining the scope, setting up infrastructure, and identifying functional requirements.

- **Week 1: Project Initiation**

- Form teams and define the problem statement.
- **Tooling:** Set up **Jira** boards (Scrum or Kanban), create Backlog, and initialize **Git** repositories.
- **Deliverable:** Project Vision document and initial Product Backlog.

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- Week 2: Functional Modeling**

- Identify Actors and Use Cases.
- UML Deliverables: * Use Case Diagram:** To define system boundaries.
 - Use Case Descriptions:** Detailed text for each primary flow.
- Tooling:** Map Use Cases to Jira User Stories.

Phase 2: Object-Oriented Analysis (Weeks 3–4)

Focus: Understanding the "What" of the system without focusing on implementation.

- Week 3: Static Analysis**

- Identify domain entities and their relationships.
- UML Deliverables:**
 - Object Diagram:** To model specific instances and data snapshots.
 - Initial Class Diagram (Domain Model):** Focus on attributes and relationships (1:1, 1:N, M:N) without methods.

- Week 4: Dynamic Analysis**

- Model how the system reacts to events.
- UML Deliverable: Activity Diagram:** To model complex business logic and parallel workflows.

Phase 3: Object-Oriented Design (Weeks 5–7)

Focus: Defining the "How" – architecture, patterns, and component interactions.

- Week 5: Interaction Modeling**

- UML Deliverable: * Sequence Diagram:** Detailed logic showing how objects communicate over time to fulfill a use case.

- Week 6: Detailed Class Design & Packaging**

- Apply SOLID principles and Design Patterns.
- UML Deliverables:**
 - Detailed Class Diagram:** Including methods, visibility, and interfaces.
 - Package Diagram:** Organizing classes into logical modules/subsystems.

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- **Week 7: System Architecture**

- **UML Deliverables:**

- **Component Diagram:** Visualizing physical modules (API, Database, UI).
 - **Deployment Diagram:** Mapping software components to hardware/nodes (Cloud, Servers).

Phase 4: Implementation & CI/CD Integration (Weeks 8–10)

Focus: Coding, version control, and automated pipelines.

- **Week 8: Sprint 1 - Core Features**

- Develop core logic based on the Class and Sequence diagrams.
 - **Git Strategy:** Use branching (Feature branches → Develop → Main).

- **Week 9: CI/CD Pipeline Setup**

- Configure **GitHub Actions** or **GitLab CI**.
 - Automate build triggers on every git push.

- **Week 10: Sprint 2 - Integration**

- Develop UI and connect to the database.
 - **Jira:** Move stories to "In Progress" and "Testing."

Phase 5: Testing & Deployment (Weeks 11–12)

Focus: Quality assurance and final delivery.

- **Week 11: Testing Phase**

- **Unit Testing:** (JUnit, PyTest) ensuring methods work as intended.
 - **Integration Testing:** Testing the flow between components.
 - **Tooling:** Integrate test reports into the CI/CD pipeline.

- **Week 12: Deployment & Final Review**

- Finalize the **Deployment Diagram** to match the production environment.
 - Deploy to a staging/production environment (Heroku, AWS, or Azure).
 - Project Demo and handover.

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Jira Backlog and a Git Branching Strategy

1. Jira Backlog & Sprint Structure

The project is divided into **six 2-week Sprints**. **Sample Jira Epic & Story Structure:**

Epic	Sample User Stories (Tasks)	Status
Requirements & Design	Create Use Case Diagrams; Draft System Architecture; Set up Jira Board.	Done/Sprint 1
Infrastructure	Initialize Git Repo; Configure CI/CD Pipeline; Setup Database.	Sprint 2
User Management	Design User Class; Implement Login/Auth; Sequence Diagram for Auth.	Sprint 3
Core Features	[Project Specific Logic]; Unit Tests for Core Logic.	Sprint 4-5
Deployment	Final Deployment Diagram; Production Hosting; Documentation.	Sprint 6

2. Git Branching Strategy

Students should avoid pushing directly to the main branch. A **Feature Branch Workflow** is best for academic teams to prevent code conflicts.

- **main branch:** Contains stable, production-ready code.
- **develop branch:** The integration branch where all features are merged before going to main.
- **feature/feature-name branches:** Created for every individual Jira task (e.g., feature/user-login).

3. Testing & CI/CD Pipeline

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To meet your requirement for testing software and CI/CD, the students should implement a pipeline that triggers on every **Pull Request** to the develop branch.

The Pipeline Flow:

1. **Build:** Compile the code to ensure there are no syntax errors.
2. **Unit Test:** Automatically run tests (e.g., JUnit, PyTest, or Jest). If tests fail, the merge is blocked.
3. **Static Analysis:** Use tools like SonarQube or ESLint to check for code "smells."
4. **Deploy:** Automatically deploy to a staging environment (like Vercel, Netlify, or AWS).

4. UML to Code Mapping (Object-Oriented Focus)

Students must ensure that their diagrams are not just "drawings" but blueprints:

- **Class Diagram** → Directly maps to the Classes and Attributes in their code.
- **Sequence Diagram** → Maps to the logic inside their methods (which object calls which method).
- **Package Diagram** → Maps to the Folder Structure of their project.

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Project Grading Rubric (Total 100%)

1. Analysis & Design (30%)

- **UML Consistency:** Do the diagrams match the actual code implementation?
 - *Check:* Does the **Class Diagram** reflect the actual inheritance and associations in the source code?
- **Behavioral Accuracy:** Do **Sequence Diagrams** correctly identify method calls between objects?
- **Architectural Soundness:** Does the **Deployment Diagram** accurately map to the cloud/server infrastructure used?

2. Object-Oriented Implementation (25%)

- **Encapsulation:** Are attributes private? Are getters/setters used appropriately?
- **Inheritance/Polymorphism:** Are these used to reduce code redundancy?
- **Solid Principles:** Is the code modular? (e.g., Single Responsibility Principle).
- **Design Patterns:** Did the team implement at least one recognizable pattern (e.g., Singleton, Factory, or Observer)?

3. DevOps & Tooling (20%)

- **Jira Management:** Is the backlog updated? Are stories assigned to specific members?
 - *Check:* Do commit messages reference Jira ticket IDs?
- **Git Workflow:** Is there evidence of Pull Requests and Code Reviews?
 - *Check:* Avoid "Mega-commits" (one giant commit at the end of the week).
- **CI/CD Pipeline:** Does the pipeline automatically trigger on pushes? Is the build status visible (Green/Red)?

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4. Testing & Quality (15%)

- **Unit Testing:** Is there a significant percentage of code coverage?
- **Integration Testing:** Are API endpoints or database connections tested?
- **Documentation:** Is the README.md clear, including setup instructions and a system overview?

5. Final Deployment (10%)

- **Accessibility:** Is the project hosted on a live URL?
- **Stability:** Does the system handle basic "unhappy path" errors without crashing?

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Definition of Done (DoD) Checklist

A Jira ticket is only considered **Done** when it meets the following criteria:

1. Design & Modeling

- **UML Alignment:** Any changes to the code structure are reflected in the **Class Diagram**.
- **Logic Validation:** For complex logic, a **Sequence Diagram** has been updated or created.
- **Documentation:** Public methods and classes are documented using standard docstrings (e.g., Javadoc, Docstring).

2. Code Quality & Standards

- **OO Principles:** Code follows Encapsulation and avoids "God Classes" (Single Responsibility Principle).
- **No Hardcoding:** Configuration values (like API keys or DB URLs) are in environment variables.
- **Peer Review:** At least one other team member has reviewed the **Pull Request (PR)** on Git.

3. Testing & CI/CD

- **Unit Tests:** New logic has corresponding unit tests.
- **CI Pipeline:** The CI/CD build is **Green** (passing) on the feature branch.
- **Zero Regressions:** Existing functionality still works as expected.

4. Integration

- **Git Merge:** The feature branch has been merged into the develop branch.
- **Jira Update:** The ticket is moved to the "Done" column and the "Actual Time Spent" is logged.

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Evaluation Schedule

Phase	Milestone	Expected Artifacts
Month 1	Foundation	Use Case, Activity, and Object Diagrams. Jira Backlog setup.
Month 2	Design	Sequence, Class, and Package Diagrams. Git Feature branches active.
Month 3	Execution	Component and Deployment Diagrams. Working CI/CD pipeline and Unit Tests.

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Weekly Progress Report Template

Project Title: [Project Name]

Team ID: [ID]

Date: [Date Range]

1. Executive Summary

- **Current Sprint:** [Sprint # of 6]
- **Sprint Goal:** (e.g., Finalize Sequence Diagrams and setup Database connection)
- **Status:** On Track | At Risk | Delayed

2. UML & OOAD Progress

- **Diagrams Completed this week:** (e.g., Package Diagram, Component Diagram)
- **Diagrams Revised:** (List any changes made based on implementation feedback)
- **OO Concept Applied:** (e.g., "Implemented Interface Inheritance for the Payment module")

3. Technical Execution (DevOps & Git)

- **Jira Tasks Completed:** [Link to Jira tickets]
- **Git Activity:**
 - Active Branches: [List branch names]
 - Merged Pull Requests: [List PR IDs]
- **CI/CD Status:** [e.g., Build Passing / 85% Code Coverage]

4. Testing Summary

- **Total Unit Tests:** [Number]

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- **Pass Rate:** [Percentage]%
- **Key Bug Identified:** [Brief description of one technical challenge overcome]

5. Goals for Next Week

- [Goal A]
- [Goal B]

Project Guide Signature

Project In-charge Signature

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B. Tech – CSE (FSDB)

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BTCS707N	SEC	Technical Skill Presentation	0	0	0	0	50	0	0	2	1

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COURSE OBJECTIVES:

The student will have ability to:

1. Develop the ability to critically analyze, structure, and distill complex, emerging technical concepts into clear, professional presentations.
2. Cultivate professional communication, body language, and executive presence required for industry technical briefings.
3. Implement secure, scalable, and event-driven cloud applications.
4. Train students to defend their technical choices, methodologies, and architectures during rigorous peer and evaluator Q&A sessions.

COURSE OUTCOMES:

Upon completion of the subject, students will be able to:

1. Independently research and systematically organize advanced technical topics into logical, scannable, and cohesive presentation structures.
2. Deliver technical presentations with clarity, precise professional terminology, and strong audience engagement.
3. Respond confidently and accurately to technical questions, demonstrating a deep, foundational grasp of the presented subject matter.

Guidelines

Assessment Parameter	Focus Area	Max Marks
Technical Depth & Accuracy	Mastery of the topic, correct terminology, clarity of architecture/logic.	15
Slide Design & Visuals	Use of diagrams/flowcharts, scannability, avoidance of text walls.	10
Delivery & Body Language	Confidence, voice modulation, eye contact, and pacing.	10
Q&A & Defense	Ability to handle counter-questions and demonstrate conceptual clarity.	10
Time Management	Adherence to the allotted slot and smooth handling of transitions.	5
Total		50

Chairperson

Board of Studies, Shri Vaishnav
Vidyapeeth Vishwavidyalaya, Indore

Chairperson

Faculty of Studies, Shri Vaishnav
Vidyapeeth Vishwavidyalaya, Indore

Controller of Examination

Shri Vaishnav Vidyapeeth
Vishwavidyalaya, Indore

Registrar

Shri Vaishnav Vidyapeeth
Vishwavidyalaya, Indore