DEVI AHILYA VISHWAVIDYALAYA, INDORE

FACULTY OF ENGINEERING

FRAMEWORK OF SCHEME

III Year B. Tech. Programme (As Per AICTE Guideline)

(Computer Science and Business Systems)

INSTITUTE OF ENGINEERING & TECHNOLOGY

(www.ietdavv.edu.in)

DEVI AHILYA VISHWAVIDYALAYA, INDORE

INSTITUTE OF ENGINEERING & TECHNOLOGY

SCHEME OF EXAMINATION FOR III B. Tech. PROGRAMME

(As per AICTE guideline and NEP 2020)

Semester-VI

S. No.	Course Code	Course Name	Type	CI(L+T)-LI-TW+SL) (Hours/Semester)	Credits* (Total Hrs/30)
1.	6RBPC1	Compiler Design	PC	20+10-20-70	4
2.	6RBPC2	Big Data Computing	PC	20+10-20-70	4
3.	6RBPC3	Marketing Research & Marketing Management	PC	20+10-00-60	3
4.	6RBPC4	Blockchain Technologies	PC	20+10-00-60	3
5.	6RBPE1	Program Elective – II	PE	20+10-20-70	4
6.	6RBOE1	Open Elective-II	OE	20+10-00-60	3
7.	6RBPC5	Internet of Things	PC	00+00-10-20	1
TOTAL CREDITS					**22**

S. No.	Course Code	List of Program Elective - II
1.	6RBPE1	Cloud Computing
2.	6RBPE2	Deep Learning for Computer Vision
3.	6RBPE3	Data Mining & Pattern Warehousing

S. No.	Course Code	List of Open Elective - II
1.	6RBOE1	Digital Marketing
2.	6RBOE2	Customer Relationship Management

**This is as per the new National Credit Framework, which accounts for 30 hrs. of learning as equivalent to 1 credit.*

Legend:

a) BS-Basic Science, ES-Engineering Science, HS-Humanities and Social Science including Management, PC-Programme Core, IK- Indian Knowledge System.
b) CI: Classroom Instruction (Includes different instructional/implementation strategies, Lecture (L), Tutorial (T), Case method, Demonstrations, Video demonstration, Problem based learning. to deliver theoretical concepts).
c) LI: Laboratory Instruction (Includes experiments/practical performances /problem based experiences in laboratory, workshop, field or other locations using different instructional/Implementation strategies).
d) TW: Term work (Includes assignments, seminars, micro projects, industrial visits, any other student activities).
e) SL: Self Learning, MOOCs, spoken tutorials, online educational resources. (If provided in curriculum structure).

<table>
<tr><td colspan="3">Devi Ahilya Vishwavidyalaya, Indore, India
Institute of Engineering and Technology</td><td colspan="4">III Year B.Tech. (Computer Science & Business Systems) VI Sem</td></tr>
<tr><td>Course Code & Name</td><td colspan="6">Instructions Hours per Semester and Credits</td></tr>
<tr><td rowspan="3">6RBPC1:
Compiler Design</td><td colspan="2">Classroom Instruction (CI)</td><td>Lab Instruction (LI)</td><td>Term Work (TW) and Self Learning (SL)</td><td>Total no. of Hours Per Semester</td><td>Total Credits (Total Hours/30)</td></tr>
<tr><td>L</td><td>T</td><td>P</td><td>TW+SL</td><td rowspan="2">120</td><td rowspan="2">4</td></tr>
<tr><td>20</td><td>10</td><td>20</td><td>70</td></tr>
</table>

Course Learning Objectives:

- To provide a framework for understanding the fundamentals of Compiler.
- To familiarize students with new Compilation Problems.
- To develop skills to understand how to Design a Compiler.
- To develop ability to understand how to enhance performance of a Compiler for newly evolved Programming Languages.

Prerequisites: Knowledge of Computer Programming, Data Structures, and Discrete Mathematics. Knowledge of several different Programming Languages will be useful.

COURSE CONTENTS

Unit I

Introduction to Compiling: Compilers: The Analysis-Synthesis Model of Compilation; Analysis of the Source Program: Lexical Analysis, Syntax Analysis, Semantic Analysis; The Phases of a Compiler: Symbol Table Management, The Analysis Phases, Intermediate Code Generation, Code Optimization; Cousins of the Compiler: System Software, Interpreters, Preprocessors, Assemblers, Linkers and Loaders, Macros; The Grouping of Phases: Front and Back Ends, Passes; Compiler Construction Tools.

CO Mapped: CO1

Unit II

Lexical Analysis: The Role of the Lexical Analyzer: Lexical Analysis Versus Parsing, Tokens, Patterns and Lexemes, Attributes for Tokens, Lexical Errors; Specification of Tokens: Strings and Languages, Regular Expressions; Recognition of Tokens: Transition Diagrams; Finite Automata: Nondeterministic Finite Automata, Deterministic Finite Automata; From Regular Expression to Automata: Conversion of an NFA to DFA, Construction of an NFA from a Regular Expression.

CO Mapped: CO2

Unit III

Syntax Analysis: Introduction: The Role of the Parser, Classification of Grammars; Context Free Grammars: Parse Tree and Derivations, Ambiguity, CFG versus Regular Expressions; Writing a Grammar: Lexical Versus Syntactic Analysis, Eliminating Ambiguity; Top- Down Parsing: Recursive Descent Parsing, LL(1) Grammars, Nonrecursive Predictive Parsing; Bottom-Up Parsing: Reductions, Shift Reduce Parsing; LR Parsing: Simple LR, Constructing SLR-Parsing Tables, Constructing LALR Parsing Tables.

CO Mapped: CO3

Unit IV

Intermediate-Code Generation and Run-Time Environment: Variants of Syntax Trees: Directed Acyclic Graphs for Expressions; Three Address Code: Addresses and Instructions, Quadruples, Triples; Type Checking: Rules for Type Checking, Type Conversions; Storage Organization: Static Versus Dynamic Storage Allocation; Stack Allocation of Space: Activation Trees; Introduction to Garbage Collection.

CO Mapped: CO4

Unit V

Code Optimization and Planning a Compiler: Basic Blocks and Flow Graphs: Basic Blocks, Flow Graphs; Optimization of Basic Blocks: The DAG Representation of Basic Blocks, Local Common Subexpressions Elimination, Semantic Preserving Transformations; Loop Optimization; Virtual Machines and their Interpreters; The LLVM Modular and Reusable Compiler Technologies, Overview of The HiPE Compiler; Case Studies of Compilers and Future Trends: The Sun Compilers for SPARC, The IBM XL Compilers for the POWER and POWERPC Architecture.

CO Mapped: CO5

Course Outcomes (CO):

CO. No.	**CO**
CO1	Understanding of compiler.
CO2	Understanding of lexical analyzer.
CO3	Understanding of syntax analysis.
CO4	Creating a run time environment for compiler.
CO5	Apply code optimization and plan a tiny compiler.

Books Recommended:

[1] Compilers: Principles, Techniques, and Tools; Alfred V. Aho, Ravi Sethi, Jeffrey D. Ullman; Pearson Education.
[2] Compilers: Principles, Techniques, and Tools; Alfred V. Aho, Monica S. Lam, Ravi Sethi, Jeffrey D. Ullman; Pearson Education.
[3] System Programming: D M Dhamdhere; McGraw Hill Education.
[4] System Programming and Operating Systems: D M Dhamdhere; McGraw Hill Education.

CO-PO-PSO Relationship:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	1	1	1	-	-	-	-	-	-	3	2	1
CO2	3	3	2	2	1	-	-	-	-	-	-	2	3	1
CO3	3	3	2	2	2	-	-	-	-	-	-	3	2	1
CO4	3	3	2	2	2	1	-	-	-	-	-	2	3	1
CO5	3	3	2	2	2	3	1	-	-	-	-	3	2	1

- *CO (Rows) mention Nil / Very Small / Insignificant Contribution to the PO (Column)
- 1: Relevant and Small Significant 2: Medium or Moderate and 3: Strong.

<table>
<tr><td colspan="3">Devi Ahilya Vishwavidyalaya, Indore, India
Institute of Engineering and Technology</td><td colspan="4">III Year B.Tech. (Computer Science & Business Systems) VI Sem</td></tr>
<tr><td>Course Code & Name</td><td colspan="6">Instructions Hours per Semester and Credits</td></tr>
<tr><td rowspan="3">6RBPC2:
Big Data Computing</td><td colspan="2">Classroom Instruction (CI)</td><td>Lab Instruction (LI)</td><td>Term Work (TW) and Self Learning (SL)</td><td>Total no. of Hours Per Semester</td><td>Total Credits (Total Hours/30)</td></tr>
<tr><td>L</td><td>T</td><td>P</td><td>TW+SL</td><td rowspan="2">120</td><td rowspan="2">4</td></tr>
<tr><td>20</td><td>10</td><td>20</td><td>70</td></tr>
</table>

Course Learning Objectives:

- To provide a deep understanding of Big Data frameworks and architectural foundations including the Hadoop ecosystem and MapReduce model.
- To master distributed in-memory computation, data abstractions, and complex analytics execution configurations using Apache Spark.
- To equip students with practical skills to design, build, and optimize scalable real-time processing pipelines and NoSQL distributed schemas.

Prerequisites:

A solid foundation in Java or Python Programming, Data Structures and Algorithms, Database Management Systems (SQL), and elementary knowledge of Distributed Systems.

COURSE CONTENTS

Unit I

Introduction to Big Data Ecosystems: Core attributes of Big Data (Volume, Velocity, Variety, Veracity and Value), scale challenges, and standard enterprise applications. Distributed File Storage: Detailed architecture of Hadoop Distributed File System (HDFS), NameNode, DataNode, secondary NameNode mechanics, block replication strategies, and failure handling. Distributed Compute Framework: The MapReduce execution paradigm, Map phase, Shuffling & Sorting, Reduce phase, and optimization strategies. Resource Orchestration: Overview of YARN architecture, NodeManagers, ResourceManager, and application lifecycles.

CO Mapped: CO1

Unit II

Introduction to Apache Spark: Limitations of traditional MapReduce frameworks and the shift to in-memory parallel computation paradigms. Spark Core Architectural Pipeline: Spark Driver, Worker nodes, Executors, Cluster Managers (Standalone, Mesos, YARN), and execution graphs. Structured Resilient Data Abstractions: Resilient Distributed Datasets (RDDs), immutable transformations, evaluations through actions, lineage graphs, and lazy

evaluation semantics. Advanced Spark Execution Engine: Directed Acyclic Graphs (DAG) construction, logical/physical planning, stage boundaries, shuffling operations, and Spark DataFrame/Dataset SQL APIs.

CO Mapped: CO2

Unit III

Distributed NoSQL Data Stores: Architectural constraints of relational databases under horizontal scales and deep exploration of the CAP Theorem (Consistency, Availability, and Partition Tolerance). Document-Oriented Systems: Structural layout of semi-structured schemas, index construction, query design, and optimization execution using MongoDB aggregation frameworks. Column-Family Architecture: Distributed storage design, partition keys, clustering keys, write paths, SSTables, MemTables, and eventual consistency tunings inside Apache Cassandra and HBase systems.

CO Mapped: CO3

Unit IV

Real-Time Stream Processing Systems: Foundational concepts of message queues, event logs, bounded vs. unbounded data, and micro-batch vs. native continuous stream execution. Distributed Event Streaming Engine: High-density layout of Apache Kafka, brokers, topics, cluster log partitions, offsets, producer routing configurations, and highly scalable consumer group rebalancing metrics. Advanced Processing Frameworks: Designing fault-tolerant event pipelines, exactly-once delivery semantics, stateful computations, sliding/tumbling windows, and watermarking patterns.

CO Mapped: CO4

Unit V

Modern Enterprise Data Architecture: Traditional Data Warehousing structural constraints, emergence of Data Lakes, and evolution towards modern unified Lakehouse design patterns. Storage Engine Frameworks: Structural layout, transactional atomicity, concurrency controls (ACID), and metadata handling using Delta Lake or Apache Iceberg on distributed filesystems. End-to-End Solutions & Governance: Lambda and Kappa structural designs, metadata lineage tracking, data governance landscapes, and managed cloud deployments (Amazon EMR/Databricks cloud analytics workflows). Comprehensive Case Study: Designing an end-to-end telemetry system or clickstream analytical platform using Kafka, Spark, and NoSQL storage tiers.

CO Mapped: CO5

Course Outcomes (CO):

CO. No.	CO
CO1	Analyze the fundamental architectures of distributed file systems (HDFS) and compute execution paradigms (MapReduce/YARN) to handle massive datasets.
CO2	Formulate parallel compute routines and implement distributed data pipelines using Apache Spark Core, RDD transformations, and DataFrame optimization structures.
CO3	Design and optimize scalable distributed data models across diverse NoSQL systems (Document, Column-Family) based on operational CAP constraints.
CO4	Construct stateful and fault-tolerant continuous stream processing applications utilizing distributed message brokers and advanced windowing techniques.
CO5	Architect unified enterprise Data Lakehouse storage fabrics and design scalable data pipelines utilizing industry standard cloud and orchestration frameworks.

List of Practicals:

Recommended Environments / Tools: Linux/Ubuntu environment, Hadoop Ecosystem, Apache Spark Shell/PySpark, Kafka Cluster, MongoDB Cluster, Docker Engine, and Jupyter Notebook pipelines.

1. Hadoop Ecosystem Cluster Setup & Operations: Configure a pseudo-distributed single-node Hadoop cluster; execute core terminal HDFS directory interactions, multi-block file transfers, and node sanity tracking validation tasks.

2. Distributed Word Count via MapReduce Paradigm: Design and implement a standard Java/Python execution script parsing raw logs; run custom map partitions, sort shuffles, and compile counts within the MapReduce execution pipeline.

3. In-Memory Spark RDD Programming: Initialize localized SparkSession runtimes; program data extraction pipelines over unstructured logs using low-level transformations (map, filter, flatMap) and pipeline final results through aggregate actions.

4. Advanced Spark SQL Dataframes Transformation Pipeline: Extract multi-source structured CSV/JSON datasets; write complex optimization schemas leveraging expression conditions, column grouping lookups, and window analytical aggregations using Spark DataFrames.

5. Distributed Document Modeling using NoSQL MongoDB Frameworks: Design schema definitions modeling multi-relational structures inside document layouts; execute complex multi-stage aggregation query filters matching nested document structures.

6. High-Throughput Column-Family Schema Deployments in Cassandra/HBase: Construct column-family tables with specific primary partitioning and clustering keys; perform range queries and evaluate structural layout performance under wide keyspace reads.

7. Real-Time Message Distribution Pipelines with Apache Kafka: Setup multi-broker Kafka configurations; implement standalone Producer and Consumer code scripts establishing continuous data transfers across active network topic boundaries.

8. Fault-Tolerant Continuous Windowed Analytics using Spark Streaming: Construct an integrated execution environment consuming real-time Kafka streams; write stateful streaming transformations deploying sliding time windows with strict watermarking constraints.

9. Unified Lakehouse Architecture Execution Engine: Build a localized transaction tracking layer using Delta Lake/Apache Iceberg formats over standard filesystems; execute ACID validations, schema enforcement, and time-travel rollbacks.

10. End-to-End Enterprise Big Data Telemetry Pipe (Capstone Execution Project): Design and build an individual micro-project syncing real-time tracking data generators to Kafka partitions, transforming metrics incrementally via Spark Streaming, and persisting analytical views onto a NoSQL tier.

Books Recommended:

[1] "Hadoop: The Definitive Guide" by Tom White (O'Reilly Media).
[2] "Spark: The Definitive Guide" by Bill Chambers and Matei Zaharia (O'Reilly Media).
[3] "Designing Data-Intensive Applications" by Martin Kleppmann (O'Reilly Media).
[4] "NoSQL Distilled: A Brief Guide to the Emerging World of Polyglot Persistence" by Pramod J. Sadalage and Martin Fowler (Addison-Wesley).

CO-PO-PSO Relationship:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	2	1	1	-	-	-	1	-	-	3	2	1
CO2	3	3	3	2	2	-	-	-	2	-	-	3	3	2
CO3	3	3	2	2	2	-	-	-	1	-	-	3	2	2
CO4	3	3	3	2	2	1	-	-	2	-	-	3	3	3
CO5	3	3	3	3	3	2	1	-	2	1	1	3	3	3

- *CO (Rows) mention Nil / Very Small / Insignificant Contribution to the PO (Column)
- 1: Relevant and Small Significant 2: Medium or Moderate and 3: Strong.

Devi Ahilya Vishwavidyalaya, Indore, India **Institute of Engineering and Technology**				**III Year B.Tech. (Computer Science & Business Systems) VI Sem**		
Course Code & Name	**Instructions Hours per Semester and Credits**					
6RBPC3: Marketing Research & Marketing Management	**Classroom Instruction (CI)**		**Lab Instruction (LI)**	**Term Work (TW) and Self Learning (SL)**	**Total no. of Hours Per Semester**	**Total Credits (Total Hours/30)**
	L	**T**	**P**	**TW+SL**	**90**	**3**
	20	**10**	**00**	**60**		

Course Learning Objectives:

- To provide students with a foundational and comprehensive grasp of both marketing management principles and systemic marketing research designs.
- To enable analytical evaluation of the consumer journey, product lifecycle positioning, market segmentations, and multi-channel deployment models.
- To equip students with structured methodological frameworks to conceptualize research problems, run structural data collections, and deploy qualitative and quantitative analysis methodologies.
- To bridge standard computational methods (Predictive data models, CRM analytics, sentiment models) with enterprise business strategies and tactical operations.

Prerequisites: Knowledge of fundamentals of management. Basics of statistics, probability modeling, and introductory business analytics paradigms.

COURSE CONTENTS

Unit I

Foundations of Marketing Management & The Research Ecosystem: Core concepts of marketing value, market space structures, and the holistic marketing mix orientation (4Ps and 7Ps models). Defining Marketing Research (MR) boundaries: role in executive decision cycles, insights infrastructure, and research ethics. The structural Research Design Process: formulating problem hypotheses, defining exploratory Vs descriptive Vs causal layouts, tracking systematic research errors, and managing information management networks.

CO Mapped: CO1

Unit II

Consumer Behavior Analytics, Segmentation, and Target Positioning: Deconstructing macro and micro environment variables affecting customer logic. Behavior dynamics modeling: psychographic profiling, motivation streams, perception frameworks, and structured customer journey blueprints. Strategic frameworks: Market Segmentation structures (Demographic, geographic, behavioral matrices), target selection modeling,

positioning vectors, and tracking brand perceptual maps via multidimensional positioning layouts.

CO Mapped: CO2

Unit III

Measurement, Scaling Instrument Designs, and Data Collection Frameworks: Operationalizing variables: nominal, ordinal, interval, and ratio metrics scales. Primary scaling methodologies: Likert scales, Semantic Differentials, and Stapel scaling metrics. Primary survey engineering: item writing pipelines, ordering rules, pre-testing steps, and avoiding scaling response biases. Secondary internal/external data pathways, observation methods, focus group designs, and probability vs. non-probability sample design structures.

CO Mapped: CO3

Unit IV

Tactical Marketing Matrix Decisions & Analytics Platforms: Product portfolio mechanics: product line expansions, architectural bundling, and New Product Development (NPD) research models. Pricing configurations: value-driven, competitive structures, and running price-elasticity optimization analytics. Distribution ecosystem design: omnichannel flows, logistics value chains, and retail footprint analysis. Promotion mix automation: campaign optimization frameworks, digital ad tracking metrics, attribution setups, and Customer Relationship Management (CRM) workflows.

CO Mapped: CO4

Unit V

Advanced Marketing Analytics, Multivariate Processing, and Strategic Insights: Quantitative processing frameworks: descriptive data treatments, bivariate cross-tabulation setups, and parameter testing (t-tests, ANOVA models). Advanced multivariate modeling implementations: Multiple Regression modeling, Factor Analysis structures for cluster reduction, Discriminant models, and Cluster segmentation. Specialized applied workflows: Sentiment analysis tracking, digital clickstream pathways analytics, customer churn predictive runs, and structuring executive reporting pipelines.

CO Mapped: CO5

Course Outcomes (CO):

CO. No.	CO
CO1	Deconstruct foundational marketing dimensions and map integrated engineering steps to organize structured marketing research project designs.
CO2	Model systemic consumer choice pathways and deploy rigorous market segmentation, targeting paradigms, and positioning mapping schemas.
CO3	Formulate optimized research metrics instruments, operationalize scaling attributes, and validate robust target data collection models.
CO4	Evaluate operational tactical dynamics covering product lifecycles, value-pricing matrices, channel operations, and CRM system analytics workflows.
CO5	Apply advanced multivariate quantitative algorithms, predictive churn models, and sentiment analytics routines to optimize strategic market positioning solutions.

Books Recommended:

[1] "Marketing Research: An Applied Orientation" by Naresh K. Malhotra and Satyabhushan Dash, Pearson Education.

[2] "Marketing Management" by Philip Kotler, Kevin Lane Keller, Alexander Chernev, Jagdish N. Sheth, and G. Shainesh, Pearson Education.

[3] "Marketing Analytics: Data-Driven Techniques with Microsoft Excel" by Wayne L. Winston, John Wiley & Sons.

[4] "Research Design: Qualitative, Quantitative, and Mixed Methods Approaches" by John W. Creswell and J. David Creswell, SAGE Publications.

CO-PO-PSO Relationship:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	1	1	2	1	-	-	2	3	1	3	2	1
CO2	3	3	2	2	2	2	1	-	2	2	-	2	3	2
CO3	3	3	3	2	3	-	-	-	2	2	-	3	2	2
CO4	3	2	2	3	3	2	1	1	3	2	2	2	3	3
CO5	2	3	3	3	3	1	-	-	2	2	1	3	2	3

- *CO (Rows) mention Nil / Very Small / Insignificant Contribution to the PO (Column)
- 1: Relevant and Small Significant 2: Medium or Moderate and 3: Strong.

Devi Ahilya Vishwavidyalaya, Indore, India **Institute of Engineering and Technology**				**III Year B.Tech. (Computer Science & Business Systems) VI Sem**		
Course Code & Name	**Instructions Hours per Semester and Credits**					
6RBPC4: Blockchain Technologies	**Classroom Instruction (CI)**		**Lab Instruction (LI)**	**Term Work (TW) and Self Learning (SL)**	**Total no. of Hours Per Semester**	**Total Credits (Total Hours/30)**
	L	**T**	**P**	**TW+SL**	**90**	**3**
	20	**10**	**00**	**60**		

Course Learning Objectives:

- To provide a deep conceptual framework of cryptographic principles, decentralized protocols, and consensus mechanisms powering distributed ledgers.
- To master smart contract design, algorithmic execution paradigms, and state machine transitions using Solidity on EVM-compatible ecosystems.
- To architect and deploy production-grade decentralized applications (dApps), enterprise ledger boundaries, and secure web3 interface layers.

Prerequisites: Solid proficiency in Data Structures and Algorithms (Specifically trees and hashing matrices). Knowledge of Computer Networks, Cryptography, and general Web Application Architecture templates.

COURSE CONTENTS

Unit I

Introduction to Blockchain and Cryptographic Primitives: Evolution of distributed ledger technology, centralized vs decentralized records, structural mechanics of a block. Cryptographic hashing: SHA-256 properties, cryptographic nonce, and collision resistance. Asymmetric Key Cryptography: Elliptic Curve Cryptography (ECC), public/private key matrices, digital signatures, and identity confirmation. Merkle Tree: Transaction aggregation, proof of inclusion, and state verification. Fundamental network topologies: Peer-to-Peer (P2P) file transfers, node synchronization routines, and transaction propagation matrices.

CO Mapped: CO1

Unit II

Distributed Consensus Mechanisms and Cryptoeconomics: Byzantine Generals Problem: Theoretical breakdown, crash faults, and malicious actor boundaries. Proof of Work (PoW): Algorithmic difficulty adjustments, target spaces, miners, energy expenditure dynamics, and

vulnerability thresholds. Proof of Stake (PoS): Validator selections, slashing rules, gas consumption economics, staking matrices, and security models. Alternative Paradigms: Delegated Proof of Stake (DPoS), Proof of Authority (PoA), and Practical Byzantine Fault Tolerance (PBFT) networks.

CO Mapped: CO2

Unit III

Smart Contract Architecture and Solidity Programming: Introduction to the Ethereum Virtual Machine (EVM): Turing completeness, account storage spaces (Externally Owned Accounts vs Contract Accounts), and global execution contexts. Solidity Language Fundamentals: Data types, storage/memory/calldata state variables, visibility modifiers (public, private, internal, external), mappings, and structs. Flow Control and Algorithmic Layouts: Functions, view/pure states, modifiers, custom error handlers (require, assert, revert), and event emission matrices. Financial Engineering: Native token transfers, fallback/receive mechanics, and contract-to-contract interactions.

CO Mapped: CO3

Unit IV

Decentralized Application (dApp) Engineering and Web3 Integration: Smart Contract Life Cycles: Compilation, bytecodes, Application Binary Interfaces (ABI), gas cost modeling, and transaction deployments. Web3 Connection Interfaces: Integrating client applications via Web3.js / Ethers.js frameworks. Managing State Connections: JSON-RPC nodes, local development testnets (Hardhat / Foundry ecosystems), wallet integrations (MetaMask API providers). Decentralized Storage Interfacing: Peer-to-Peer metadata storage models via InterPlanetary File System (IPFS) and content addressing.

CO Mapped: CO4

Unit V

Enterprise Ecosystems, Security Vectors, and Future Horizons: Enterprise Ledger Architectures: Permissioned networks vs public frameworks. Hyperledger Fabric: Modular channels, ordering services, endorsing policies, and chaincode environments. Security Vectors and Vulnerabilities: Reentrancy exploits, integer overflows/underflows, flash loan vector logic, front-running strategies, and contract audit patterns. Advanced Scaling Solutions: Layer 2 structures (Optimistic and Zero-Knowledge Rollups), State Channels, Cross-Chain Bridges, and Oracle systems (Chainlink data feeds).

CO Mapped: CO5

Course Outcomes (CO):

CO. No.	CO
CO1	Analyze the cryptographic foundations, network primitives, and structural parameters of distributed block data layouts.
CO2	Evaluate distributed consensus mechanisms and algorithmic game theory dynamics across diverse peer-to-peer networks.
CO3	Formulate, write, and optimize secure smart contract logic utilizing Solidity on EVM processing execution environments.
CO4	Design, build, and deploy end-to-end decentralized application pipelines integrating web3 interface libraries and IPFS networks.
CO5	Assess enterprise permissioned ledger boundaries, mitigate structural contract vulnerabilities, and integrate oracle data systems.

Books Recommended:

[1] "Mastering Bitcoin: Programming the Open Blockchain" by Andreas M. Antonopoulos, O'Reilly Media.
[2] "Mastering Ethereum: Building Smart Contracts and dApps" by Andreas M. Antonopoulos and Dr. Gavin Wood, O'Reilly Media.
[3] "Blockchain Blueprints: Principles, Platforms, and Use Cases" by Imran Bashir, Packt Publishing.
[4] "Token Economy: How the Web3 Reinvents the Internet" by Shermin Voshmgir, Token Economy Blockchain Hub.

CO-PO-PSO Relationship:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	1	1	1	-	-	-	-	-	-	3	2	1
CO2	3	3	2	2	1	-	-	-	-	-	-	2	3	1
CO3	3	3	2	2	2	-	-	-	-	-	-	3	2	1
CO4	3	3	2	2	2	1	-	-	-	-	-	2	3	1
CO5	3	3	2	2	2	3	1	-	-	-	-	3	2	1

- *CO (Rows) mention Nil / Very Small / Insignificant Contribution to the PO (Column)
- 1: Relevant and Small Significant 2: Medium or Moderate and 3: Strong.

<table>
<tr><td colspan="3">Devi Ahilya Vishwavidyalaya, Indore, India
Institute of Engineering and Technology</td><td colspan="4">III Year B.Tech. (Computer Science & Business Systems) VI Sem</td></tr>
<tr><td>Course Code & Name</td><td colspan="6">Instructions Hours per Semester and Credits</td></tr>
<tr><td rowspan="2">6RBPE1: Cloud Computing</td><td colspan="2">Classroom Instruction (CI)</td><td>Lab Instruction (LI)</td><td>Term Work (TW) and Self Learning (SL)</td><td>Total no. of Hours Per Semester</td><td>Total Credits (Total Hours/30)</td></tr>
<tr><td>L</td><td>T</td><td>P</td><td>TW+SL</td><td rowspan="2">120</td><td rowspan="2">4</td></tr>
<tr><td>20</td><td>10</td><td>20</td><td>70</td></tr>
</table>

Course Learning Objectives:

- To provide students with a clear understanding of the evolution, core principles, characteristics, and socio-economic value models of Cloud Computing.
- To demystify physical/virtual resource management layer mechanics spanning Type-1/Type-2 Hypervisors and container structures.
- To cultivate technical capabilities in provisioning, building, orchestrating, and administering production workloads inside enterprise cloud platforms.
- To systematically address the modern enterprise architecture domain focusing on identity control patterns, risk frameworks, and business continuity loops.

Prerequisites: A solid baseline in Computer Networks, Operating System architecture abstractions, Distributed Systems terminology, and basic shell scripting utilities.

COURSE CONTENTS

Unit I

Introduction to Cloud Frameworks & Models: Foundational concepts, timeline historical evolution from mainframe timesharing to grid architectures. Core operational characteristics: On-demand self-service, broad network access, resource pooling, rapid elasticity, and measured utility billing. Service delivery frameworks: Infrastructure as a Service (IaaS), Platform as a Service (PaaS), Software as a Service (SaaS). Deployment variations: Public, Private, Community, and Hybrid infrastructure configurations. Financial metrics and mechanics: Transition shifts from Capital Expenditure (CapEx) models to flexible Operational Expenditure (OpEx) strategies, pricing structures, and initial business valuation strategies.

CO Mapped: CO1

Unit II

Virtualization & Containerization Topologies: Principles of virtualization, logical partitioning abstraction mechanisms, and hypervisor taxonomy (Bare-Metal Type-1 vs Hosted Type-2 hypervisors). Execution engine variations: Full Virtualization, Para-

Virtualization, and Hardware-Assisted structures. Compute instances lifecycle handling, memory management matrices, and logical storage allocation. Containerization primitives: Namespace isolation levels, Control Groups (cgroups) kernel mechanics, and layered file configurations. Orchestration fundamentals: Managed runtime deployments, ingress load balancing patterns, horizontal auto-scaling rules, and container ecosystem designs.

CO Mapped: CO2

Unit III

Distributed Infrastructure & Core Architecture: Cloud datacenter design, software-defined storage architectures, Block, File, and Object storage hierarchies. Software-Defined Networking (SDN): Virtual Private Clouds (VPCs), subnets, routing configuration parameters, internet gateway bindings, and security boundary zones. Distributed computing architectures: Service-Oriented Architecture (SOA) origins to modular microservices patterns. Serverless paradigm: Function-as-a-Service (FaaS) event routing pipelines, transient execution state handling, and cold-start scheduling delays.

CO Mapped: CO3

Unit IV

Cloud Security, Governance & Risk Frameworks: The Shared Responsibility Model boundaries between hyperscalers and tenant administrators. Security architectural concepts: Data-at-rest encryption layers and data-in-transit (TLS/SSL) mechanisms. Identity and Access Management (IAM): Role-Based Access Control (RBAC), Policy enforcement languages, single-sign-on (SSO) federations, and Multi-Factor Authentication (MFA). Auditing standards: Logging telemetry, compliance frameworks (SOC 2, ISO/IEC 27017, HIPAA), SLA parameters, service level objectives (SLO), and financial breach penalty tracking.

CO Mapped: CO4

Unit V

Enterprise Clouds, Scale & Business Continuity: Hyperscale environment overviews (Amazon Web Services, Microsoft Azure, Google Cloud Platform). Infrastructure as Code (IaC): Declarative provisioning engine patterns and immutable state architectures. Disaster Recovery (DR) models: Recovery Point Objective (RPO) and Recovery Time Objective (RTO) metrics. Multi-region high availability designs: Backup & Restore, Pilot Light models, Warm Standby architectures, and Multi-Site active-active pipelines. Cost optimization practices, anomaly detection alerts, and an outlook on Edge/Fog distributed computing systems.

CO Mapped: CO5

Course Outcomes (CO):

CO. No.	CO
CO1	Explain core cloud computing operational frameworks, economic utility matrices, service structures, and deployment variations.
CO2	Apply and evaluate infrastructure abstraction layers using bare-metal/hosted hypervisors and modern application container setups.
CO3	Design multi-tier distributed storage architectures, software-defined network parameters, and serverless compute processing networks.
CO4	Formulate corporate compliance structures, access boundaries, data validation encryptions, and comprehensive telemetry audits.
CO5	Architect multi-region high-availability configurations, declarative resource automation scripts, and cross-datacenter disaster plans.

List of Practicals:

Recommended Infrastructure Components & Tools: AWS Core Console, Microsoft Azure Sandbox, Oracle VirtualBox / KVM Hypervisors, Linux CLI, Docker Engine, Kubernetes API (Minikube), Terraform HCL Engine.

1. Hypervisor Deployment & Resource Provisioning: Install a Type-2 hypervisor sandbox, configure multi-node guest instances, allocate compute/memory pools, and document logical resource overcommit constraints.

2. Advanced Linux Networking & Bridging: Configure local virtual network interface loops, establish bridge routing devices, create host-only, NAT, and internal isolated overlay topologies via terminal controls.

3. Container Image Packaging & Isolation: Build custom base container images using declarative multi-stage optimization files, implement localized volume storage bindings, and map execution ports to network layouts.

4. Multi-Container Architecture Routing: Orchestrate decoupled web application stacks using unified multi-container definitions, configuring inter-service environment structures and runtime dependency controls.

5. Kubernetes Pod Scheduling & Services: Deploy basic application containers into localized cluster nodes, configuration boundaries, and establish internal ClusterIP alongside external NodePort proxy entry channels.

6. Hyperscale Networking Infrastructure (VPC): Formulate a custom Virtual Private Cloud architecture within an enterprise portal, organizing isolated public/private subnets, custom routing paths, and internet gateways.

7. Cloud Compute Auto-Scaling & Load Balancing: Provision elastic compute instance groups behind public application load balancers, defining threshold scale triggers based on target runtime tracking telemetry.

8. Identity Access Controls & Multi-Tenant Boundaries: Engineer granular identity profiles using custom role policies, configuring strict cross-account trust boundaries and resource level restriction tokens.

9. Infrastructure as Code (IaC) Automation: Write modular declarative automation templates to construct complete infrastructure states, demonstrating target modifications through execution graph plans.

10. Object Storage Pipelines & Lifecycle Rules: Instantiate global object storage entities, configuring programmatic API access tokens, granular object version targets, and cost-effective cold tier transition scripts.

Books Recommended:

[1] "Cloud Computing: Concepts, Technology & Architecture" by Thomas Erl, Ricardo Puttini, and Zaigham Mahmood, Pearson Education.

[2] "Distributed and Cloud Computing: From Parallel Processing to the Internet of Things" by Kai Hwang, Jack Dongarra, and Geoffrey C. Fox, Morgan Kaufmann.

[3] "Cloud Computing Architecture" by Christie Fowler, O'Reilly Media.

[4] "AWS Certified Solutions Architect Official Study Guide" by Joe Baron et al., John Wiley & Sons.

CO-PO-PSO Relationship:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	1	1	1	-	-	-	-	-	-	3	2	1
CO2	3	3	2	2	2	-	-	-	-	-	-	3	3	2
CO3	3	3	3	2	3	-	-	-	-	-	-	3	2	3
CO4	3	2	2	3	2	1	1	2	-	-	-	2	3	2
CO5	3	3	3	3	3	2	2	-	-	-	-	3	3	3

- *CO (Rows) mention Nil / Very Small / Insignificant Contribution to the PO (Column)
- 1: Relevant and Small Significant 2: Medium or Moderate and 3: Strong.

<table>
<tr><td colspan="4">Devi Ahilya Vishwavidyalaya, Indore, India
Institute of Engineering and Technology</td><td colspan="3">III Year B.Tech. (Computer Science & Business Systems) VI Sem</td></tr>
<tr><td>Course Code & Name</td><td colspan="6">Instructions Hours per Semester and Credits</td></tr>
<tr><td rowspan="3">6RBPE2:
Deep Learning for Computer Vision</td><td colspan="2">Classroom Instruction (CI)</td><td>Lab Instruction (LI)</td><td>Term Work (TW) and Self Learning (SL)</td><td>Total no. of Hours Per Semester</td><td>Total Credits (Total Hours/30)</td></tr>
<tr><td>L</td><td>T</td><td>P</td><td>TW+SL</td><td rowspan="2">120</td><td rowspan="2">4</td></tr>
<tr><td>20</td><td>10</td><td>20</td><td>70</td></tr>
</table>

Course Learning Objectives:

- To understand the foundational concepts of Artificial Neural Networks and Deep Learning.
- To familiarize students with the architectures of Convolutional Neural Networks (CNNs) for visual tasks.
- To explore advanced computer vision concepts like Object Detection, Segmentation, and Generative Modeling.
- To develop hands-on skills in implementing deep learning models for real-world visual applications.

Prerequisites: Python Programming, Basic Machine Learning concepts, Linear Algebra, and Probability.

COURSE CONTENTS

Unit I

Foundations of Deep Learning & Image Processing: Introduction to Computer Vision; Image Formation and Representation; Traditional vs. Deep Learning approach; Biological Neuron vs. Artificial Neuron; Perceptron and Multilayer Perceptron (MLP); Forward Propagation and Backpropagation Algorithm; Activation Functions (Sigmoid, Tanh, ReLU); Loss Functions for Classification and Regression.

CO Mapped: CO1

Unit II

Convolutional Neural Networks (CNNs): Introduction to Convolution operation; Padding, Stride, and Pooling operations (Max pooling, Average pooling); Anatomy of a CNN Architecture; Deep Learning Optimization Algorithms: SGD, Adagrad, RMSProp, Adam; Overfitting challenges and Regularization Techniques: Dropout, Batch Normalization, Data Augmentation.

CO Mapped: CO2

Unit III

Advanced CNN Architectures & Transfer Learning: Classic CNN Architectures: LeNet-5, AlexNet, VGGNet; Advanced Networks: ResNet (Residual Learning), Inception Networks; Concept of Transfer Learning; Feature Extraction vs. Fine-Tuning a pre-trained network; Visualizing CNN Layers and Filters.

CO Mapped: CO3

Unit IV

Object Detection and Image Segmentation: Region-based CNNs (R-CNN, Fast R-CNN, Faster R-CNN); Single-shot detectors: YOLO (You Only Look Once), SSD; Intersection over Union (IoU) and Non-Maximum Suppression (NMS); Image Segmentation: Semantic Segmentation vs. Instance Segmentation; Fully Convolutional Networks (FCN), U-Net Architecture.

CO Mapped: CO4

Unit V

Generative Models, Future Trends & Lab Exercises: Autoencoders: Undercomplete, Regularized, and Denoising; Introduction to Generative Adversarial Networks (GANs); Vision Transformers (ViTs) overview; Case Studies: Face Recognition, Autonomous Driving.

CO Mapped: CO5

Course Outcomes (CO):

CO. No.	CO
CO1	Understand the fundamentals of neural networks and foundational concepts of computer vision.
CO2	Analyze and implement standard Convolutional Neural Network (CNN) components and optimization strategies.
CO3	Apply pre-trained state-of-the-art CNN models using transfer learning techniques for visual data.
CO4	Design and deploy deep learning models for complex visual tasks like object detection and segmentation.
CO5	Evaluate advanced generative models and execute hands-on practical implementations for visual systems.

List of Practicals:

1. Introduction to Tensors: Basic tensor operations and matrix manipulations using PyTorch/TensorFlow.
2. Multilayer Perceptron (MLP): Build basic neural network from scratch to classify non-linear data.
3. Image Classification with CNN: Custom CNN to classify MNIST or CIFAR-10 dataset.
4. Regularization and Optimization: Analyze dropout, batch normalization, and Adam vs SGD.
5. Transfer Learning Application: Use pre-trained network (VGG16/ResNet50) for custom classification.
6. Object Detection Pipeline: Implement object detection using pre-trained YOLO/SSD framework.
7. Semantic Segmentation: Design and train a basic U-Net model for medical/satellite image segmentation.
8. Generative Models: Implement a simple GAN to synthesize handwritten digits.

Books Recommended:

[1] Deep Learning for Computer Vision; Rajalingappaa Shanmugamani; Packt Publishing.

[2] Deep Learning; Ian Goodfellow, Yoshua Bengio, Aaron Courville; MIT Press.

[3] Computer Vision: Algorithms and Applications; Richard Szeliski; Springer.

[4] Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow; Aurélien Géron; O'Reilly Media.

CO-PO-PSO Relationship:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	1	1	1	-	-	-	-	-	-	3	2	1
CO2	3	3	2	2	1	-	-	-	-	-	-	2	3	1
CO3	3	3	2	2	2	-	-	-	-	-	-	3	2	1
CO4	3	3	2	2	2	1	-	-	-	-	-	2	3	1
CO5	3	3	2	2	2	3	1	-	-	-	-	3	2	1

- *CO (Rows) mention Nil / Very Small / Insignificant Contribution to the PO (Column)
- 1: Relevant and Small Significant 2: Medium or Moderate and 3: Strong.

<table>
<tr><td colspan="3">Devi Ahilya Vishwavidyalaya, Indore, India
Institute of Engineering and Technology</td><td colspan="4">III Year B.Tech. (Computer Science & Business Systems) VI Sem</td></tr>
<tr><td>Course Code & Name</td><td colspan="6">Instructions Hours per Semester and Credits</td></tr>
<tr><td rowspan="2">6RBPE3: Data Mining & Pattern Warehousing</td><td colspan="2">Classroom Instruction (CI)</td><td>Lab Instruction (LI)</td><td>Term Work (TW) and Self Learning (SL)</td><td>Total no. of Hours Per Semester</td><td>Total Credits (Total Hours/30)</td></tr>
<tr><td>L</td><td>T</td><td>P</td><td>TW+SL</td><td rowspan="2">120</td><td rowspan="2">4</td></tr>
<tr><td>20</td><td>10</td><td>20</td><td>70</td></tr>
</table>

Course Learning Objectives:

- To understand the core concepts of Data Warehousing, Architecture, and Online Analytical Processing (OLAP).
- To familiarize students with the process of Data Mining, Data Preprocessing, and clean-up tasks.
- To develop skills in discovering patterns using Association Rules, Classification, and Clustering algorithms.
- To evaluate advanced patterns and explore modern warehousing configurations.

Prerequisites: Knowledge of Database Management Systems (DBMS), Basic Statistics, and Fundamentals of Algorithms.

COURSE CONTENTS

Unit I

Data Warehousing and OLAP Technology: Introduction to Data Warehouse; Operational Database Systems vs. Data Warehouses; Multidimensional Data Model: Data Cubes, Stars, Snowflakes, and Fact Constellations Schemas; OLAP Operations: Roll-up, Drill-down, Slice, Dice, and Pivot; Three-tier Data Warehouse Architecture; Data Warehouse Implementation and Metadata Repository.

CO Mapped: CO1

Unit II

Introduction to Data Mining & Data Preprocessing: Data Mining Functionalities and Task Primitives; Integration of a Data Mining System with a Database or Data Warehouse System; Major Issues in Data Mining; Data Preprocessing: Data Cleaning (Missing values, Noisy data), Data Integration, Data Reduction, Data Transformation, and Data Discretization.

CO Mapped: CO2

Unit III

Association Rule Mining & Sequential Patterns: Mining Frequent Patterns, Associations, and Correlations; Frequent Itemset Mining Methods: Apriori Algorithm, FP-Growth Algorithm; Mining Various Kinds of Association Rules: Multilevel and Multidimensional Association Rules; Pattern Evaluation Methods; Introduction to Sequential Pattern Mining.

CO Mapped: CO3

Unit IV

Classification and Prediction: Issues Regarding Classification and Prediction; Classification by Decision Tree Induction (ID3, C4.5); Bayesian Classification: Naïve Bayes Classifier; Classification by Backpropagation (Neural Networks); Support Vector Machines (SVM) overview; Prediction: Linear and Multiple Regression; Classifier Accuracy Measures and Evaluation.

CO Mapped: CO4

Unit V

Clustering and Advanced Pattern Warehousing: Cluster Analysis: Types of Data in Cluster Analysis, Categorization of Major Clustering Methods; Partitioning Methods: K-Means and K-Medoids; Hierarchical Methods: BIRCH, AGNES; Density-Based Methods: DBSCAN; Pattern Warehousing: Concepts, Pattern Representation, Pattern Aggregation, and Pattern Matching; Spatial, Multimedia, and Web Mining Applications.

CO Mapped: CO5

Course Outcomes (CO):

CO. No.	**CO**
CO1	Understand the principles of data warehousing architecture and multi-dimensional OLAP modeling.
CO2	Apply various data preprocessing techniques to improve data quality for mining operations.
CO3	Discover frequent itemsets and mine association rules using foundational algorithms.
CO4	Design and evaluate predictive classification models for structured business datasets.
CO5	Implement diverse clustering methods and comprehend pattern warehouse structures for advanced analytical applications.

Books Recommended:

[1] Data Mining: Concepts and Techniques; Jiawei Han, Micheline Kamber, Jian Pei; Morgan Kaufmann.
[2] Data Warehousing Fundamentals for IT Professionals; Paulraj Ponniah; Wiley.
[3] Introduction to Data Mining; Pang-Ning Tan, Michael Steinbach, Vipin Kumar; Pearson Education.
[4] Data Mining Techniques; Arun K. Pujari; Universities Press.

CO-PO-PSO Relationship:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	1	1	1	-	-	-	-	-	-	3	2	1
CO2	3	3	2	2	1	-	-	-	-	-	-	2	3	1
CO3	3	3	2	2	2	-	-	-	-	-	-	3	2	1
CO4	3	3	2	2	2	1	-	-	-	-	-	2	3	1
CO5	3	3	2	2	2	3	1	-	-	-	-	3	2	1

- *CO (Rows) mention Nil / Very Small / Insignificant Contribution to the PO (Column)
- 1: Relevant and Small Significant 2: Medium or Moderate and 3: Strong.

<table>
<tr><td colspan="3">Devi Ahilya Vishwavidyalaya, Indore, India
Institute of Engineering and Technology</td><td colspan="4">III Year B.Tech. (Computer Science & Business Systems) VI Sem</td></tr>
<tr><td>Course Code & Name</td><td colspan="6">Instructions Hours per Semester and Credits</td></tr>
<tr><td rowspan="2">6RBOE1: Digital Marketing</td><td colspan="2">Classroom Instruction (CI)</td><td>Lab Instruction (LI)</td><td>Term Work (TW) and Self Learning (SL)</td><td>Total no. of Hours Per Semester</td><td>Total Credits (Total Hours/30)</td></tr>
<tr><td>L</td><td>T</td><td>P</td><td>TW+SL</td><td rowspan="2">90</td><td rowspan="2">3</td></tr>
<tr><td>20</td><td>10</td><td>00</td><td>60</td></tr>
</table>

Course Learning Objectives:

- To understand the basic concepts and principles of digital marketing.
- To develop knowledge of digital marketing tools, techniques, and platforms.
- To understand customer behavior and digital marketing strategies.
- To develop skills for planning, implementing, and managing digital marketing campaigns.
- To analyse digital marketing performance and make data-driven decisions.

Prerequisites: Basic knowledge of Internet and Computer Applications.

COURSE CONTENTS

Unit I

Digital Marketing-An Overview: Introduction, Objectives, Definition of Digital Marketing, Scope, Benefits and characteristics, Digital Marketing vs Traditional Marketing, Examples of best practices in Digital Marketing, B2B and B2C digital marketing.

CO Mapped: CO1

Unit II

Search Engine Optimization and Search Engine Marketing: Introduction to search engines, Search Engine Optimization (SEO), search engine crawling, indexing and ranking, keyword research and analysis, on-page SEO, off-page SEO, technical SEO, local SEO, Search Engine Marketing (SEM), Google Ads and paid search advertising, Pay-Per-Click (PPC), ad ranking and bidding strategies, and conversion rate optimization.

CO Mapped: CO2

Unit III

Social Media and Content Marketing: Introduction to social media marketing, social media platforms and their characteristics, Facebook and Instagram marketing, LinkedIn marketing, YouTube marketing, social media campaign planning, social media content strategy, content marketing concepts, blogging and copywriting, video and visual content marketing, influencer marketing, social media engagement and community management, and social media analytics and performance measurement.

CO Mapped: CO3

Unit IV

Web Analytics, E-Commerce and Marketing Automation: Introduction to web analytics, Google Analytics and GA4 concepts, website traffic analysis, Key Performance Indicators (KPIs), conversion and goal tracking, customer acquisition and retention metrics, e-commerce marketing, online marketplaces and product promotion, email marketing, mobile marketing, marketing automation, Customer Relationship Management (CRM), online reputation management, A/B testing, and conversion optimization.

CO Mapped: CO4

Unit V

AI, Emerging Technologies and Digital Marketing Strategy: Artificial Intelligence in digital marketing, Generative AI and content creation, AI-based customer segmentation, chatbots and conversational marketing, predictive analytics, recommendation systems, personalization in digital marketing, Big Data and customer analytics, Machine Learning applications in marketing, voice search and visual search, digital marketing ethics and privacy, data protection and cybersecurity in digital marketing, ROI and ROAS, campaign performance evaluation, and development of an integrated digital marketing strategy.

CO Mapped: CO5

Course Outcomes (CO):

CO. No.	**CO**
CO1	Explain fundamental concepts, channels, and strategies of digital marketing.
CO2	Apply SEO and SEM techniques for improving online visibility and customer acquisition.
CO3	Develop social media and content marketing strategies using appropriate digital platforms.
CO4	Analyse digital marketing data using web analytics, KPIs, and conversion metrics.
CO5	Evaluate AI, emerging technologies, ethical issues, and integrated digital marketing strategies.

Books Recommended:

[1] Strauss, Judy &Frost Raymond (2009). E-Marketing. New Jersey: Prentice Hall.
[2] Agarwala, K.N. &Agarwala, D(2006). Business on the Net: What's and How's of Ecommerce. New Delhi: McMillan.
[3] Ravi, Kalakota&Andrew ,Whinston(1997). Frontiers of E-Commerce. Delhi: Addision Wesley. O,Brien J. (2011). Management Information System. New Delhi: TMH.
[4] Oberoi, Sundeep(2001). E-Security and You. Delhi: TMH 5. Levine, Young Margret (2002) . The complete reference to Internet. Delhi: TMH

CO-PO-PSO Relationship:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	2	2	2	1	2	1	1	1	1	2	1	2	2	2
CO2	3	2	3	2	3	1	1	1	1	2	1	3	3	3
CO3	2	2	3	2	3	1	1	1	3	3	2	3	2	2
CO4	3	3	2	3	3	1	1	1	2	2	2	3	3	3
CO5	3	3	3	3	3	2	2	2	2	2	2	3	2	3

- *CO (Rows) mention Nil / Very Small / Insignificant Contribution to the PO (Column)
- 1: Relevant and Small Significant 2: Medium or Moderate and 3: Strong.

<table>
<tr><td colspan="3">Devi Ahilya Vishwavidyalaya, Indore, India
Institute of Engineering and Technology</td><td colspan="4">III Year B.Tech. (Computer Science & Business Systems) VI Sem</td></tr>
<tr><td>Course Code & Name</td><td colspan="6">Instructions Hours per Semester and Credits</td></tr>
<tr><td rowspan="3">6RBOE2: Customer Relationship Management</td><td colspan="2">Classroom Instruction (CI)</td><td>Lab Instruction (LI)</td><td>Term Work (TW) and Self Learning (SL)</td><td>Total no. of Hours Per Semester</td><td>Total Credits (Total Hours/30)</td></tr>
<tr><td>L</td><td>T</td><td>P</td><td>TW+SL</td><td rowspan="2">90</td><td rowspan="2">3</td></tr>
<tr><td>20</td><td>10</td><td>00</td><td>60</td></tr>
</table>

Course Learning Objectives:

- To understand the core pillars, strategic evolution, and economic frameworks of relationship marketing.
- To introduce automation structures in Operational CRM across enterprise sales, marketing, and support funnels.
- To explore analytics models, database architectures, and segmentation strategies using customer data metrics.
- To build execution workflows for cross-functional deployment, integration, and risk mitigation in enterprise CRM ecosystems.

Prerequisites: Fundamentals of Management, Business Communication, and Database awareness.

COURSE CONTENTS

Unit I

Conceptual Framework of CRM: Evolution of Relationship Marketing; Transactional vs. Relationship Marketing Core Tenets; Definitive Architecture of CRM; The Customer Value Lifecycle; Strategic Frameworks: The Ladder of Loyalty, Customer Acquisition, Retention, and Defection Dynamics; Financial Economics of Customer Relationships.

CO Mapped: CO1

Unit II

Operational CRM & Automation Pipelines: Anatomy of Operational CRM; Sales Force Automation (SFA): Activity, Lead, and Pipeline Management Structures; Marketing Automation Platforms: Campaign Execution, List Management, and Optimization Parameters; Customer Service and Support Infrastructure: Inbound/Outbound Contact Center Technologies, Web-Based Self-Service Configurations.

CO Mapped: CO2

Unit III

Analytical & Collaborative CRM Systems: Analytical CRM Architecture: Data Integration Frameworks, Customer Data Platforms (CDP), and Warehouse Structuring; RFM Analysis (Recency, Frequency, Monetary Value); Customer Lifetime Value (CLV) Calculation Models; Data Privacy Laws and Profiling; Collaborative CRM: Omni-channel Strategy, Touchpoint Sync, and Ecosystem Orchestration.

CO Mapped: CO3

Unit IV

Strategic Matrix & Enterprise Implementation: Strategic Customer Monetization: Up-selling, Cross-selling, and Personalized Product Bundling; The Enterprise CRM Lifecycle: Business Case Architecture, Vendor Requirements Analysis, Software Selection Frameworks; Data Migration Governance, Solution Customization Risk Matrix, Training Methodologies, and Post-Go-Live Support Structure.

CO Mapped: CO4

Unit V

Contemporary Trends, Platforms, & Governance: Modern Visual Interfaces and UX in Enterprise CRM; Social CRM Infrastructure and Real-Time Sentiment Mining; Mobile CRM Deployments; Cloud Architectures (SaaS vs. On-Premise Evaluation); Conversational AI Integration and Autonomous Resolution Chatbots; Ethics and Data Protection Mandates (GDPR & DPDP Act compliance); Enterprise Case Studies: Salesforce, HubSpot, and Microsoft Dynamics Ecosystems.

CO Mapped: CO5

Course Outcomes (CO):

CO. No.	CO
CO1	Understand the foundational strategies, financial economics, and retention mechanics of relationship marketing.
CO2	Analyze and manage operational automation architecture across enterprise sales, marketing, and service funnels.
CO3	Apply mathematical analytics frameworks and customer data profiling to determine lifetime value metrics.
CO4	Design structural migration blueprints and implementation roadmaps for multi-vendor cloud deployments.
CO5	Appraise emerging paradigms like conversational AI chatbots, social sentiment monitoring, and modern compliance legislations.

Books Recommended:

[1] Customer Relationship Management: Concepts and Technologies; Francis Buttle and Stan Maklan; Routledge.

[2] Customer Relationship Management: Getting it Right!; Judith W. Kincaid; Prentice Hall.

[3] Customer Relationship Management: A Strategic Approach; Jagdish N. Sheth and G. Shainesh; McGraw Hill.

[4] Managing Customer Relationships: A Strategic Framework; Don Peppers and Martha Rogers; Wiley.

CO-PO-PSO Relationship:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	1	1	1	-	-	-	-	-	-	3	2	1
CO2	3	3	2	2	1	-	-	-	-	-	-	2	3	1
CO3	3	3	2	2	2	-	-	-	-	-	-	3	2	1
CO4	3	3	2	2	2	1	-	-	-	-	-	2	3	1
CO5	3	3	2	2	2	3	1	-	-	-	-	3	2	1

- *CO (Rows) mention Nil / Very Small / Insignificant Contribution to the PO (Column)
- 1: Relevant and Small Significant 2: Medium or Moderate and 3: Strong.

Devi Ahilya Vishwavidyalaya, Indore, India **Institute of Engineering and Technology**				**III Year B.Tech. (Computer Science & Business Systems) VI Sem**		
Course Code & Name	**Instructions Hours per Semester and Credits**					
6RBPC5: Internet of Things	**Classroom Instruction (CI)**		**Lab Instruction (LI)**	**Term Work (TW) and Self Learning (SL)**	**Total no. of Hours Per Semester**	**Total Credits (Total Hours/30)**
	L	**T**	**P**	**TW+SL**	**30**	**1**
	00	**00**	**10**	**20**		

Course Learning Objectives:

- To learn the fundamentals of IoT and how to build hardware and software for IoT-based systems.
- To impart necessary and practical knowledge of components of the Internet of Things
- To develop skills required to build real-life IoT-based projects.

Prerequisites: Students should have basic knowledge of computer networks, computer programming, basic electronics and digital systems. Basic knowledge of cloud computing is desirable.

COURSE CONTENTS

Unit I

Introduction to IoT: Architectural Overview, Design principles and needed capabilities, IoT Applications, Sensing, Actuation, Basics of Networking, M2M and IoT Technology Fundamentals- Devices and gateways, Data management, Business processes in IoT, Everything as a Service (XaaS), Role of Cloud in IoT, Security aspects in IoT.

CO Mapped: CO1

Unit II

Elements of IoT: Hardware Components- Computing (Arduino, Raspberry Pi), Communication, Sensing, Actuation, I/O interfaces. Software Components- Programming API's (using Python/Node.js/Arduino) for Communication. Protocols-MQTT, ZigBee, Bluetooth, CoAP, UDP, TCP.

CO Mapped: CO2

Unit III

IoT Application Development: Solution framework for IoT applications- Implementation of Device integration, Data acquisition and integration.

CO Mapped: CO3

Unit IV

Device data storage: Unstructured data storage on cloud/local server, Authentication, authorization of devices.

CO Mapped: CO4

Unit V

IoT Case Studies: IoT case studies and mini projects based on Industrial automation, Transportation, Agriculture, Healthcare, Home Automation.

CO Mapped: CO5

Course Outcomes (CO):

CO. No.	CO
CO1	Understand internet of Things and its hardware and software components
CO2	Interface I/O devices, sensors & communication modules
CO3	Remotely monitor data and control devices
CO4	Develop real life IoT based projects

List of Practicals:

1. Implementation of LED blinking using Arduino.
2. Interfacing a push button with Arduino for digital input operation.
3. Interfacing temperature sensor (LM35/DHT11) with Arduino.
4. Development of an LDR-based automatic street light system.
5. Implementation of buzzer alarm system using sensor input.
6. Controlling LED using Bluetooth module (HC-05) and mobile application.
7. Wi-Fi-based device control using ESP8266/NodeMCU module.
8. Uploading sensor data to a cloud platform using ThingSpeak.
9. Demonstration of MQTT protocol using publish/subscribe communication.
10. Development of a simple home automation mini project (light/fan control).

Books Recommended:

[1] Vijay Madisetti, Arshdeep Bahga, Internet of Things: A Hands-on Approach, University Press.
[2] Raj Kamal, Internet of Things: Architecture and Design Principles, McGraw-Hill Education.
[3] Dr. S. R. N. Reddy, Rachit Thukral and Manasi Mishra, Introduction to Internet of Things: A Practical Approach, ETI Labs.
[4] Adrian McEwen and Hakim Cassimally, Designing the Internet of Things, Wiley.

CO-PO-PSO Relationship:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	1	1	1	-	-	-	-	-	-	3	2	1
CO2	3	3	2	2	1	-	-	-	-	-	-	3	3	2
CO3	3	3	2	2	2	-	-	-	1	-	-	3	3	2
CO4	3	3	2	2	2	1	-	-	1	1	1	3	3	2