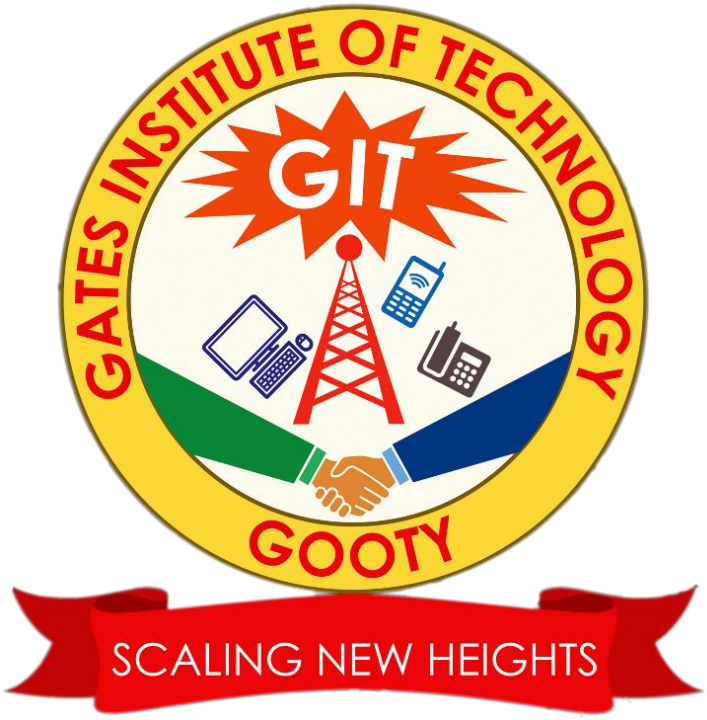


Gates Institute of Technology
(UGC Autonomous)
Gooty, Ananthapuramu Dist. – 515 002 (AP) India
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B. Tech (Regular-Full time)

(Effective for the students admitted into I B.Tech from the Academic B.Tech 2023-24 onwards)

CSE – DATA SCIENCE

COURSE STRUCTURE

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SYLLABUS

IV B.Tech I Semester

S.No.	Course Code	Title	L	T	P	Credits
1	23DST06	Big Data Analytics	3	0	0	3
2	23MBTU4a 23MBTU4a 23MBTU4a	**Management Course- II** 1. Business Ethics and Corporate Governance 2. E-Business 3. Management Science	2	0	0	2
3	23CST29a 23CST29b 23CST18c 23CST30d 23CST23e	**Professional Elective-IV** 1. Software Architecture & Design Pattern 2. Blockchain Technology 3. DevOps 4. NoSQL databases 5. Agentic AI Engineering	3	0	0	3
4	23CST30a 23DST07a 23DST07b 23CST31a 23CST30d	**Professional Elective-V** 1. Agile Methodologies 2. Expert Systems 3. Reinforcement Learning 4. High Performance Computing 5. AI Powered Application Development	3	0	0	3
5		**Open Elective-III**	3	0	0	3
6		**Open Elective-IV**	3	0	0	3
7	23CSP12	**Skill Enhancement Course** Full Stack Development -II	0	1	2	2
8	23CST39	**Audit Course** Gender Sensitization	2	0	0	-
9	23DSEII	Evaluation of Industry Internship	-	-	-	2
		Total	**19**	**1**	**02**	**21**

Open Elective – III

S.No	Course Code	Course Name	Offered by the Dept.
1	23CET24	Building Materials and Services	CIVIL
2	23CET25	Environmental Impact Assessment	
3	23EET22	Smart Grid Technologies	EEE
4	23MET23	3D Printing Technologies	ME
5	23ECT12	Microprocessors and Microcontrollers	ECE
6	23BST30	Wavelet transforms and its applications	Mathematics
7	23BST31	Smart Materials and Devices	Physics
8	23BST34	Introduction to Quantum Mechanics	
9	23BST32	Green Chemistry and Catalysis for Sustainable Environment	Chemistry
10	23BST33	Employability Skills	Humanities

Open Elective – IV

S.No	Course Code	Course Name	Offered by the Dept.
1	23CET26	Geo-Spatial Technologies	CIVIL
2	23CET27	Solid Waste Management	
3	23EET25	Electric Vehicles	EEE
4	23MET24	Total Quality Management	ME
5	23ECT29	Transducers and Sensors	ECE
6	23BST35	Introduction to Quantum Computing	CSE & Allied
7	23BST36	Financial Mathematics	Mathematics
8	23BST37	Sensors And Actuators for Engineering Applications	Physics
9	23BST38	Chemistry Of Nanomaterials and Applications	Chemistry
10	23CET26	Literary Vibes	Humanities
11	23BST40	Advanced Aptitude & Critical Thinking	Mathematics

IV B.Tech II Semester (CSE-Data Science)

S.No.	Course code	Title	Category	L	T	P	Credits
1	23DSIAP	Internship		-	-	-	4
2		Project		-	-	-	8
Total							**12**

IV B.Tech I Semester

23DST06	**BIG DATA ANALYTICS**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

Course Objectives:
This course is aimed at enabling the students to

- Provide an overview of an exciting growing field of big data analytics.
- Introduce the tools required to manage and analyze big data like Hadoop, NoSQL, Map Reduce, HIVE, Cassandra, Spark.
- Teach the fundamental techniques and principles in achieving big data analytics with scalability and streaming capability.
- Optimize business decisions and create competitive advantage with Big Data analytics

Course Outcomes: After the completion of the course, student will be able to

- Illustrate on big data and its use cases from selected business domains.
- Interpret and summarize on NoSQL,Cassandra
- Analyze the HADOOP and Map Reduce technologies associated with big data analytics and explore on Big Data applications Using Hive.
- Make use of Apache Spark, RDDs etc. to work with datasets.
- Assess real time processing with Spark Streaming.

UNIT-I: **Lecture 10Hrs**

What is big data, why big data, convergence of key trends, unstructured data, industry examples of big data, web analytics, big data and marketing, fraud and big data, risk and big data, credit risk management, big data and algorithmic trading, big data and healthcare, big data in medicine, advertising and big data, big data technologies, introduction to Hadoop, open source technologies, cloud and big data, mobile business intelligence, Crowd sourcing analytics, inter and trans firewall analytics.

UNIT-II: **Lecture 9Hrs**

Introduction to NoSQL, aggregate data models, aggregates, key-value and document data models, relationships, graph databases, schema less databases, materialized views, distribution models, sharding, master-slave replication, peer- peer replication, sharding and replication, consistency, relaxing consistency, version stamps, Working with Cassandra ,Table creation, loading and reading data.

UNIT-III: **Lecture 8Hrs**

Data formats, analyzing data with Hadoop, scaling out, Architecture of Hadoop distributed file system (HDFS), fault tolerance ,with data replication, High availability, Data locality , Map Reduce Architecture, Process flow, Java interface, data flow, Hadoop I/O, data integrity, compression, serialization. Introduction to Hive, data types and file formats, HiveQL data definition, HiveQL data manipulation, Logical joins, Window functions, Optimization, Table partitioning, Bucketing, Indexing, Join strategies.

UNIT-IV: **Lecture 9Hrs**

Apache spark- Advantages over Hadoop, lazy evaluation, In memory processing, DAG, Spark context, Spark Session, RDD, Transformations- Narrow and Wide, Actions, Data frames ,RDD to Data frames, Catalyst optimizer, Data Frame Transformations, Working with Dates and Timestamps, Working with Nulls in Data, Working with Complex Types, Working with JSON, Grouping, Window Functions, Joins, Data Sources, Broadcast Variables, Accumulators, Deploying Spark- On-Premises Cluster Deployments, Cluster Managers- Standalone Mode, Spark on YARN , Spark Logs, The Spark UI- Spark UI History Server, Debugging and Spark First Aid

IV B.Tech I Semester

UNIT V: **Lecture 10Hrs**

Spark-Performance Tuning, Stream Processing Fundamentals, Event-Time and State full Processing - Event Time, State full Processing, Windows on Event Time- Tumbling Windows, Handling Late Data with Watermarks, Dropping Duplicates in a Stream, Structured Streaming Basics - Core Concepts, Structured Streaming in Action, Transformations on Streams, Input and Output.

Text Books:

1. Big Data, Big Analytics: Emerging, Michael Minnelli, Michelle Chambers, and AmbigaDhiraj
2. SPARK: The Definitive Guide, Bill Chambers &MateiZaharia, O'Reilley, 2018Edition 3. Business Intelligence and Analytic Trends for Today's Businesses", Wiley,2013
3. P. J. Sadalage and M. Fowler, "NoSQL Distilled: A Brief Guide to the Emerging World Polyglot Persistence", Addison-Wesley Professional,2012
4. Tom White, "Hadoop: The Definitive Guide", Third Edition, O'Reilley,2012

Reference Books:

1. "Hadoop Operations", O'Reilley, Eric Sammer,2012
2. "Programming Hive", O'Reilley, E. Capriolo, D. Wampler, and J. Rutherglen,2012
3. "HBase: The Definitive Guide", O'Reilley, Lars George,2011
4. "Cassandra: The Definitive Guide", O'Reilley, Eben Hewitt,2010
5. "Programming Pig", O'Reilley, Alan Gates,2011

IV B.Tech I Semester

Course Code	**NESS ETHICS AND CORPORATE GOVERNANCE**	**L**	**T**	**P**	**C**
23MBTU4a		**2**	**0**	**0**	**2**
	Semester	**IV-I**			

Course Objectives:

1. To make the student understand the principles of business ethics
2. To enable them in knowing about the ethics in management
3. To facilitate the student role in corporate culture
4. To impart knowledge about the fair-trade practices
5. To encourage the student in knowing about the corporate governance

Course Outcomes (CO): Student will be able to

- Understand the Ethics and different types of Ethics.
- Understand business ethics and ethical practices in management
- Understand the role of ethics in management
- Apply the knowledge of professional ethics & technical ethics
- Analyze corporate law, ethics, codes & principles
- Evaluate corporate governance & corporate scams.

UNIT-I		Lecture Hrs: 7
Introduction – Meaning – Nature, Scope, significance, Loyalty, and ethical behavior.. Value systems - Business Ethics - Types, Characteristics, Factors, Contradictions and Ethical Practices in Management -Corporate Social Responsibility – Issues of Management – Crisis Management.		
UNIT-II		Lecture Hrs: 7
Introduction- Ethics in production, finance, Human resource management and Marketing Management - The Ethical Value System – Universalism, Utilitarianism, Distributive Justice, Social Contracts, Individual Freedom of Choice, Professional Codes; Culture and Ethics – Ethical Values in different Cultures - Culture and Individual Ethics – professional ethics and technical ethics.		
UNIT-III		Lecture Hrs: 7
Introduction - Meaning, definition, Nature, and significance – Key elements of corporate culture, shared values, beliefs and norms, rituals, symbols and language - Types of corporate culture, hierarchical culture, market driven culture – Organization leadership and corporate culture, leadership styles and their impact on culture, transformational leadership and culture change.		
UNIT-IV		Lecture Hrs: 7
Law and Ethics -Agencies enforcing Ethical Business Behavior - Legal Impact – Environmental Protection, Fair Trade Practices, legal Compliances, Safeguarding Health and wellbeing of Customers – Corporate law, Securities and financial regulations, corporate governance codes and principles.		
UNIT-V		Lecture Hrs: 7

IV B.Tech I Semester

Introduction - Meaning – Corporate governance code, transparency & disclosure -Role of auditors, board of directors and shareholders. Global issues, accounting and regulatory frame work - Corporate scams - Committees in India and abroad, corporate social responsibility. BoDs composition, Cadbury Committee - Various committees - Reports - Benefits and Limitations.
Textbooks:
1. Murthy CSV: Business Ethics and Corporate Governance, HPH July 2017 2. Bholananth Dutta, S.K. Podder – Corporation Governance, VBH. June 2010
Reference Books:
1. Dr. K. Nirmala, KarunakaraReaddy. Business Ethics and Corporate Governance, HPH 2. H.R.Machiraju: Corporate Governance, HPH, 2013 3. K. Venkataramana, Corporate Governance, SHBP. 4. N.M.Khandelwal. Indian Ethos and Values for Managers

IV B.Tech I Semester

Course Code	**E-BUSINESS**	**L**	**T**	**P**	**C**
23MBTU4b		**2**	**0**	**0**	**2**
	Semester	**IV-I**			

Course Objectives:		
1. To provide knowledge on emerging concept on E-Business related aspect. 2. To understand various electronic markets & business models. 3. To impart the information about electronic payment systems & banking. 4. To create awareness on security risks and challenges in E-commerce. 5. To the students aware on different e-marketing channels & strategies.		
Course Outcomes (CO): Student will be able to • Remember E-Business & its nature, scope and functions. • Understand E-market-Models which are practicing by the organizations • Apply the concepts of E-Commerce in the present globalized world. • Analyze the various E-payment systems & importance of net banking. • Evaluate market research strategies & E-advertisements. • Understand importance of E-security & control.		
UNIT-I		Lecture Hrs: 7
Introduction – Nature, meaning, significance, functions and advantages - Definition of Electronic Business - Functions of Electronic Commerce (EC)-Advantages & Disadvantages of E-Commerce –E-Commerce and E-Business, Internet Services, Online Shopping- E-Commerce Opportunities for Industries.		
UNIT-II		Lecture Hrs: 7
Introduction –E-Shops-E-Malls E-Groceries - Portals - Vertical Portals-Horizontal Portals - Advantages of Portals - Business Models- Business to Business (B2B)-Business to Customers(B2C) - Business to Government(B2G)-AuctionsB2B Portals in India		
UNIT-III		Lecture Hrs: 7
Introduction to electronic payment systems (EPS) -Types of electronic payments - Credit/debit cards, e-wallets, UPI, and crypto currencies -Smart cards and digital wallets: Features and usage -Electronic Fund Transfer (EFT): Role in business transactions -Infrastructure requirements and regulatory aspects of e-payments		
UNIT-IV		Lecture Hrs: 7
Security risks and challenges in electronic commerce - Cyber threats - Phishing, hacking, identity theft, and malware - Digital Signatures & Certificates - Security protocols over public networks (HTTP, SSL, TLS) -Firewalls in securing ebusiness platforms.		
UNIT-V		Lecture Hrs: 7

IV B.Tech I Semester

Introduction – Online Marketing – Advantages of Online Marketing – Internet Advertisement – Advertisement Methods – Conducting Online Market Research– – E-marketing planning: Online branding, social media marketing, and email marketing - E-business strategies: Digital advertising, content marketing, and analytics – E-Customer Relationship Management (eCRM) E-supply chain management (e-SCM)
Textbooks:
1. Arati Oturkar & Sunil Khilari. E-Business. Everest Publishing House, 2022 2. P.T.S Joseph. E-Commerce, Fourth Edition, Prentice Hall of India, 2011
Reference Books:
Reference Books: 1. Debjani, Kamalesh K Bajaj. E-Commerce, Second Edition Tata McGraw-Hill's, 2005 2. Dave Chaffey.E-Commerce E-Management, Second Edition, Pearson, 2012. 3. Henry Chan. E-Commerce Fundamentals and Application, RaymondLeathamWiley India 2007 4. S. Jaiswal. E-Commerce GalgotiaPublication Pvt Ltd., 2003.

IV B.Tech I Semester

Course Code	MANAGEMENT SCIENCE	L	T	P	C
23MBTU4c		**2**	**0**	**0**	**2**
	Semester	**IV-I**			

Course Objectives:

1. To provide fundamental knowledge on Management, Administration, Organization & its concepts.
2. To make the students understand the role of management in Production
3. To impart the concept of HRM in order to have an idea on Recruitment, Selection, Training & Development, job evaluation and Merit rating concepts
4. To create awareness on identify Strategic Management areas & the PERT/CPM for better Project Management
5. To make the students aware of the contemporary issues in modern management

Course Outcomes (CO): Student will be able to

- Remember the concepts & principles of management and designs of organization in a practical world
- Understand the knowledge of Work-study principles & Quality Control techniques in industry
- Apply the process of Recruitment & Selection in organization.
- Analyze the concepts of HRM & different training methods.
- Evaluate PERT/CPM Techniques for projects of an enterprise and estimate time & cost of project & to analyze the business through SWOT.
- Create awareness on contemporary issues in modern management & technology.

UNIT-I		Lecture Hrs: 7

Management - Concept and meaning - Nature-Functions - Management as a Science and Art and both. Schools of Management Thought - Taylor‘s Scientific Theory-Henry Fayol‘s principles - Elton Mayo‘s Human relations - Organizational Designs - Line organization - Line & Staff Organization - Functional Organization - Matrix Organization - Project Organization - Committee form of Organization - Social responsibilities of Management.

UNIT-II		Lecture Hrs: 7

Principles and Types of Plant Layout - Methods of Production (Job, batch and Mass Production), Work Study - Statistical Quality Control- Material Management - Objectives - Inventory-Functions - Types, Inventory Techniques - EOQ-ABC Analysis - Marketing Management - Concept - Meaning - Nature-Functions of Marketing - Marketing Mix - Channels of Distribution - Advertisement and Sales Promotion - Marketing Strategies based on Product Life Cycle.

UNIT-III		Lecture Hrs: 7

IV B.Tech I Semester

HRM - Definition and Meaning – Nature - Managerial and Operative functions - Job Analysis - Human Resource Planning(HRP) - Employee Recruitment-Sources of Recruitment - Employee Selection - Process - Employee Training and Development - methods - Performance Appraisal Concept - Methods of Performance Appraisal – Placement - Employee Induction - Wage and Salary Administration.		
UNIT-IV		Lecture Hrs: 7
Definition& Meaning - Setting of Vision - Mission - Goals - Corporate Planning Process - Environmental Scanning - Steps in Strategy Formulation and Implementation - SWOT Analysis - Project Management - Network Analysis - Programme Evaluation and Review Technique (PERT) - Critical Path Method (CPM) Identifying Critical Path - Probability of Completing the project within given time - Project Cost- Analysis - Project Crashing (Simple problems).		
UNIT-V		Lecture Hrs: 7
Customer Relations Management(CRM) - Total Quality Management (TQM) - Six Sigma Concept - Supply Chain Management(SCM) - Enterprise Resource Planning (ERP) - Performance Management – employee engagement and retention - Business Process Re-engineering and Bench Marking - Knowledge Management – change management – sustainability and corporate social responsibility.		
Textbooks:		
1. Frederick S. Hillier, Mark S. Hillier. Introduction to Management Science, October 26, 2023 2. A.R Aryasri, Management Science, TMH, 2019		
Reference Books:		
1. Stoner, Freeman, Gilbert.Management, Pearson Education, New Delhi, 2019. 2. 2. Koontz & Weihrich, Essentials of Management, 6/e, TMH, 2005. 3. Thomas N.Duening & John M.Ivancevich, Management Principles and Guidelines, Biztantra. 4. Kanishka Bedi, Production and Operations Management, Oxford University Press, 2004. 5. Samuel C.Certo, Modern Management, 9/e, PHI, 2005		

IV B.Tech I Semester

23CST29a	**SOFTWARE ARCHITECTURE AND DESIGN PATTERNS**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

Course Objectives:

After completing this course, the student should be able to:

- To understand the concept of patterns and the Catalog.
- To discuss the Presentation tier design patterns and their affect on: sessions, client access, validation and consistency.
- To understand the variety of implemented bad practices related to the Business and Integration tiers.

Course Outcomes:

- To highlight the evolution of patterns.
- To learn how to add functionality to designs while minimizing complexity
- To learn what design patterns really are, and are not
- To know about specific design patterns.
- To learn how to use design patterns to keep code quality high without over design.

UNIT I Lecture 9Hrs

Envisioning Architecture: The Architecture Business Cycle, What is Software Architecture, Architectural patterns, reference models, reference architectures, architectural structures and views. Creating an Architecture: Quality Attributes, Achieving qualities, Architectural styles and patterns, designing the Architecture, Documenting software architectures, Reconstructing Software Architecture.

UNIT II Lecture 8Hrs

Analyzing Architectures: Architecture Evaluation, Architecture design decision making, ATAM, CBAM. Moving from one system to many: Software Product Lines, Building systems from off the shelf components, Software architecture in future.

UNIT III Lecture 9Hrs

Patterns: Pattern Description, Organizing catalogs, role in solving design problems, Selection andusage.Creational and Structural patterns: Abstract factory, builder, factory method, prototype, singleton, adapter, bridge, composite, façade, flyweight.

UNIT IV Lecture 8Hrs

Behavioural patterns: Chain of responsibility, command, Interpreter, iterator, mediator, memento, observer, state, strategy. template method, visitor.

UNIT V Lecture 8Hrs

Case Studies: A-7E – A case study in utilizing architectural structures, The World Wide Web - a case study in interoperability, Air Traffic Control – a case study in designing for high availability, Celsius Tech – a case study in product line development

IV B.Tech I Semester

TEXT BOOKS:

1. Software Architecture in Practice, second edition, Len Bass, Paul Clements & Rick Kazman, Pearson Education, 2003.
2. Design Patterns, Erich Gamma, Pearson Education.

REFERENCES:

1. Beyond Software architecture, Luke Hohmann, Addison wesley, 2003.
2. Software architecture, David M. Dikel, David Kane and James R. Wilson, Prentice Hall PTR, 2001
3. Software Design, David Budgen, second edition, Pearson education, 2003
4. Head First Design patterns, Eric Freeman & Elisabeth Freeman, O'REILLY, 2007.
5. Design Patterns in Java, Steven John Metsker& William C. Wake, Pearson education, 2006 6. J2EE Patterns, Deepak Alur, John Crupi& Dan Malks, Pearson education, 2003.
7. Design Patterns in C#, Steven John metsker, Pearson education, 2004.
8. Pattern Oriented Software Architecture, F.Buschmann&others, John Wiley & Sons.

IV B.Tech I Semester

23CST29b	**BLOCK CHAIN TECHNOLOGY (Professional Elective –IV)**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

Course Objectives:

- Understand how block chain systems (mainly Bit coin and Ethereum) work and to securely interact with them.
- Design, build, and deploy smart contracts and distributed applications.
- Integrate ideas from block chain technology into their own projects.

Course Outcomes (CO):

After completion of the course, students will be able to

1. Demonstrate the foundation of the Block chain technology and understand the processes in payment and funding.
2. Identify the risks involved in building Block chain applications.
3. Review of legal implications using smart contracts.
4. Choose the present landscape of Blockchain implementations and Understand Crypto currency markets
5. Examine how to profit from trading crypto currencies.

UNIT - I Introduction Lecture 8Hrs

Introduction, Scenarios, Challenges Articulated, Block chain, Block chain Characteristics, Opportunities Using Block chain, History of Block chain. Evolution of Block chain: Evolution of Computer Applications, Centralized Applications, Decentralized Applications, Stages in Block chain Evolution, Consortia, Forks, Public Block chain Environments, Type of Players in Block chain Ecosystem, Players in Market.

UNIT - II Block chain Concepts Lecture 9Hrs

Block chain Concepts: Introduction, Changing of Blocks, Hashing, Merkle-Tree, Consensus, Mining and Finalizing Blocks, Currency aka tokens, security on block chain, data storage on block chain, wallets, coding on block chain: smart contracts, peer-to-peer network, types of block chain nodes, risk associated with bloc chain solutions, life cycle of block chain transaction.

UNIT - III Architecting Block chain solutions Lecture 9Hrs **Architecting**

Block chain solutions: Introduction, Obstacles for Use of Block chain, Block chain Relevance Evaluation Framework, Block chain Solutions Reference Architecture, Types of Block chain Applications. Cryptographic Tokens, Typical Solution Architecture for Enterprise Use Cases, Types of Block chain Solutions, Architecture Considerations, Architecture with Block chain Platforms, Approach for Designing Block chain Applications.

UNIT - IV Ethereum Block chain Implementation Lecture 8Hrs

Ethereum Block chain Implementation: Introduction, Tuna Fish Tracking Use Case, Ethereum Ecosystem, Ethereum Development, Ethereum Tool Stack, Ethereum Virtual Machine, Smart Contract Programming, Integrated Development Environment, Truffle Framework, Ganache, Unit Testing, Ethereum Accounts, My Ether Wallet, Ethereum Networks/Environments, Infura, Ether scan, Ethereum Clients, Decentralized Application, Metamask, Tuna Fish Use Case Implementation, Open Zeppel in Contracts .

UNIT - V Hyper ledger Block chain Implementation Lecture 8Hrs

Hyper ledger Implementation: Introduction, Use Case – Car Ownership Tracking, Hyper ledger Fabric, Hyper ledger Fabric Transaction Flow, FabCar Use Case Implementation, Invoking Chain code Functions Using Client

IV B.Tech I Semester

Application.

Advanced Concepts in Block chain: Introduction, Inter Planetary File System (IPFS), Zero Knowledge Proofs, Oracles, Self-Sovereign Identity, Block chain with IoT and AI/ML Quantum Computing and Block chain, Initial Coin Offering, Block chain Cloud Offerings, Block chain and its Future Potential.

Textbooks:

1. Ambadas, Arshad Sarfarz Ariff, Sham "Block chain for Enterprise Application Developers", Wiley, 2020
2. Andreas M. Antonopoulos, "Mastering Bitcoin: Programming the Open Blockchain", O'Reilly, 2017

Reference Books:

1. Blockchain: A Practical Guide to Developing Business, Law, and Technology Solutions, Joseph Bambara, Paul R. Allen, Mc Graw Hill.
2. Blockchain: Blueprint for a New Economy, Melanie Swan, O'Reilly

Online Learning Resources:

https://github.com/blockchainedindia/resources

IV B.Tech I Semester

23CST18c	**DevOps**	**L**	**T**	**P**	**C**
	Professional Elective-IV	**3**	**0**	**0**	**3**

Pre-requisite:

Fundamentals of software development and maintenance

Course Objectives:

- Understand collaboration and productivity by automating infrastructure and workflows
- Familiarize with continuous measuring applications performance

Course Outcomes: After completion of the course, students will be able to

• Enumerate the principles of continuous development and deployment, automation of configuration management, inter-team collaboration, and IT serviceability

• Describe Dev Ops &Dev Sec Ops methodologies and their key concepts

• Illustrate the types of version control systems, continuous integration tools, continuous monitoring tools, and cloud models

• Set up complete private infrastructure using version control systems and CI/CD tools

UNIT-I Lecture 8 Hrs

Dev Ops: An Overview, Dev Ops: Origins, Dev Ops: Roots, Dev Ops: Practices Dev Ops: Culture. **Adopting Dev Ops:** Developing the Playbook. Developing a Business Case for a Dev Ops: Developing the Business Case.

UNIT-II Lecture 9 Hrs

Completing the Business Model Canvas, Customer Segments, Value Segments, Value Propositions, Channels, Customer Relationships, Revenue Streams, Key Resources, Key Activities, Key Partnerships, Cost Structures. Dev Ops Plays for Optimizing the delivery Pipeline: Dev Ops as an optimization Exercise, Core Themes, The Dev Ops Plays, Specializing Core Plays.

UNIT-III Lecture 8 Hrs

Dev Ops Plays for Driving Innovation: Optimize to Innovate, The Uber Syndrome, Innovation and the Role of Technology, Core Themes, play: Build a Dev Ops Platform, play: Deliver Microservices Architectures, play: DevOps an API Economy, play: Organizing for Innovation.

UNIT-IV Lecture 10 Hrs

Scaling Dev Ops for the Enterprise: Core Themes, play: Dev Ops Center of Competency, play: Developing Culture of Innovation at Scale, play: Developing a Culture of continuous Improvement, play: Team Models for Dev Ops, play: Standardization of Tools and Process, play: Security Considerations for Dev Ops, Play: Dev Ops and Outsourcing.

UNIT-V Lecture 10 Hrs

Leading Dev Ops Adoption in the Enterprise: Play: Dev Ops as a transformation Exercise, play: Developing a Culture of Collaboration and Trust, play: Dev Ops Thinking for the Line of Business, play: starting with Pilot Projects, Play: Rearing Unicorns on an Aircrafts Carrier. Appendix Case Study: Example Dev Ops Adoption Roadmap Organization Background, Roadmap Structure, Adoption Roadmap.

Textbooks:

1. Sanjeev Sharma, The DevOps Adoption Playbook, Published by John Wiley & Sons, Inc.2017

Reference Books:

IV B.Tech I Semester

1. Sanjeev Sharma & Bernie Coyne, DevOps for Dummies, Published by John Wiley & Sons, Inc.
2. Michael Huttermann, DevOps for Developers, Apress publishers,2012.

Online Learning Resources:

Learning DevOps with Terraform Infrastructure Automation Course | Udemy

23CST30d	**NoSQL Databases**	**L**	**T**	**P**	**C**
	Professional Elective-IV	**3**	**0**	**0**	**3**

PRE-REQUISITES: Database Management Systems

COURSE OUTCOMES: At the end of the course student will be able to

- Discuss what type of NoSQL database to implement based on business requirements (key-value, document, full text, graph, etc.)
- Apply NoSQL data modeling from application specific queries
- Use Atomic Aggregates and denormalization as data modeling techniques to optimize query processing
- Distinguish various NOSQL database stores.
- Apply Indexing Techniques of NoSQL.

UNIT-I Introduction to NoSQL (10 Lectures)

Introduction to NoSQL: Definition And Introduction, Sorted Ordered Column-Oriented Stores, Key/Value Stores, Document Databases, Graph Databases, Examining Two Simple Examples, Location Preferences Store, Car Make And Model Database, Working With Language Bindings.

UNIT-II Interacting with NoSQL (10 Lectures)

If NoSql Then What, Language Bindings For NoSQL Data Stores, Performing Crud Operations, Creating Records, Accessing Data, Updating And Deleting Data

UNIT-III NoSQL Storage Architecture (10 Lectures) Working With Column-Oriented Databases, Hbase Distributed Storage Architecture, Document Store Internals, Understanding Key/Value Stores In Memcached And Redis, Eventually Consistent Non-Relational Databases.

UNIT-IV NoSQL Stores (12 Lectures)

Similarities Between SqlAndMongodb Query Features, Accessing Data From Column- Oriented Databases Like Hbase, Querying Redis Data Stores, Changing Document Databases, Schema Evolution In Column-Oriented Databases, Hbase Data Import And Export, Data Evolution In Key/Value Stores.

UNIT-V Indexing and Ordering Data Sets (8 Lectures) Indexing and Ordering Data Sets: Essential Concepts Behind A Database Index, Indexing And Ordering In Mongodb, Creating and Using Indexes In Mongodb, Indexing And Ordering In Couchdb, Indexing In Apache Cassandra.

TEXT BOOKS:

1. Shashank Tiwari, Professional NoSQL, Wrox Press, Wiley, 2011, ISBN: 978-0-470-94224-6
2. PramodSadalage and Martin Fowler, NoSQL Distilled, Addison-Wesley Professional, 2012.

REFERENCE BOOKS:

1. Dan McCreary and Ann Kelly, Making Sense of NoSQL, Manning Publications, 2013.
2. Gaurav Vaish, Getting Started with NoSQL, Packt Publishing, 2013.

IV B.Tech I Semester

23CST23e	Agentic AI Engineering	L	T	Pr	C
		3	-	-	3

Prerequisite: Knowledge of Python programming and Artificial Intelligence concepts. Course

Objectives:

- **To provide foundational knowledge of intelligent AI agents, their architectures, and operational principles.**
- **To equip students with the skills to design, develop, and orchestrate AI agents using modern frameworks and platforms.**
- **To enable students to build, deploy, and evaluate agentic AI solutions for real-world applications.**

Course Outcomes:

After successful completion of the course, students will be able to:

CO1 : Explain the principles, architectures, and types of intelligent AI agents.

CO2 : Develop AI agents using memory management, tool calling, and agent development platforms.

CO3: Build LLM-powered agents using planning, orchestration, RAG, and workflow automation techniques.

CO4: Analyze the coordination, collaboration, and workflow design of multi-agent systems.

CO5: Analyze agent deployment architectures and emerging trends in Agentic AI.

Unit I: Foundations of AI Agents **Lecture 9 Hrs**

Evolution of AI Agents and Agentic AI, Characteristics and Architecture of Intelligent Agents, Types of AI Agents, Agent Environment and Lifecycle, Reasoning and Decision-Making Concepts, Applications of AI Agents.

Unit II: Agent Design and Development **Lecture 8 Hrs**

Goal-Oriented and Task-Oriented Agents, Agent Memory and Context Management, Tool Calling and Function Calling, Coding Agents using Frameworks and Developing Agents using Low-Code/No-Code Platforms (n8n, Zapier, Make), Designing Domain-Specific Agents, Agent Testing and Evaluation.

Unit III: LLM-Powered Agents and Agent Workflows **Lecture 9 Hrs**

Large Language Models as Agent Brains, Agent Planning and Task Decomposition, Agent Orchestration and Workflow Management, Retrieval-Augmented Generation (RAG) for Agents, Workflow Automation using AI Agents, AI Coding and Knowledge Agents, Human-in-the-Loop

Systems.

Unit IV: Multi-Agent Systems and Collaboration **Lecture 8 Hrs**

Fundamentals of Multi-Agent Systems, Agent Coordination and Collaboration, Multi-Agent Workflow Design, Enterprise Workflow Automation, Enterprise AI Agent Applications, Case Studies of Multi-Agent Solutions.

Unit V: Agent Deployment and Emerging Trends **Lecture 8 Hrs**

Agent Deployment Architectures, Monitoring and Maintenance of Agent Systems, Emerging Trends in Agentic AI.

Design and Development of Multi-Agent Systems for Domain-Specific Applications such as Banking, Agriculture, Healthcare.

Text Books

1. Karthik Ramgopal, Designing Autonomous AI Agents, O'Reilly Media, 2024.
2. Paul Iusztin and Maxime Labonne, AI Engineering: Building Applications with Foundation Models, O'Reilly Media, 2025.

Reference Books

1. Valentino Zocca and Ram Sriharsha, Building LLM Powered Applications, Packt Publishing, 2024.
2. Jay Alammar and Maarten Grootendorst, Hands-On Large Language Models, O'Reilly Media, 2024.
3. Michael Wooldridge, An Introduction to MultiAgent Systems, 2nd Edition, Wiley, 2009.
4. Noah Gift and Alfredo Deza, Practical MLOps: Operationalizing Machine Learning Models, 2nd Edition, O'Reilly Media, 2024.

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23CST30a	**AGILE METHODOLOGIES (Professional Elective –V)**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

Course Objectives:

- To provide students with a theoretical as well as practical understanding of agile software development practices and how small teams can apply them to create high-quality software.
- To provide good understanding of software design and a set of software technologies and APIs.
- To carry out detailed examination and demonstration of Agile development and testing techniques.
- To discuss Agile software development

Course Outcomes:

After completion of the course, students will be able to

- Realize the importance of interacting with business stakeholders in determining the requirements for a software system
- Perform iterative software development processes: how to plan them, how to execute them.
- Point out the impact of social aspects on software development success.
- To analyse the Impact of Agile Processes in Requirements Engineering
- Show how agile approach for software quality assurance

UNIT I AGILE METHODOLOGY **Lecture 9 Hrs**

Theories for Agile Management – Agile Software Development – Traditional Model vs. Agile Model - Classification of Agile Methods – Agile Manifesto and Principles – Agile Project Management – Agile Team Interactions – Ethics in Agile Teams - Agility in Design, Testing – Agile Documentations – Agile Drivers, Capabilities and Values

UNIT II AGILE PROCESSES **Lecture 8Hrs**

Lean Production - SCRUM, Crystal, Feature Driven Development- Adaptive Software Development - Extreme Programming: Method Overview – Lifecycle – Work Products, Roles and Practices.

UNIT III AGILITY AND KNOWLEDGE MANAGEMENT **Lecture 8 Hrs**

Agile Information Systems – Agile Decision Making - Earl_S Schools of KM – Institutional Knowledge Evolution Cycle – Development, Acquisition, Refinement, Distribution, Deployment, Leveraging – KM in Software Engineering – Managing Software Knowledge – Challenges of Migrating to Agile Methodologies – Agile Knowledge Sharing – Role of Story-Cards – Story-Card Maturity Model (SMM).

UNIT IV AGILITY AND REQUIREMENTS ENGINEERING **Lecture 9 Hrs**

Impact of Agile Processes in RE–Current Agile Practices – Variance – Overview of RE Using Agile Managing Unstable Requirements – Requirements Elicitation – Agile Requirements Abstraction Model – Requirements Management in Agile Environment, Agile Requirements Prioritization – Agile Requirements Modeling and Generation – Concurrency in Agile Requirements Generation.

UNIT VAGILITY AND QUALITY ASSURANCE **Lecture 9 Hrs**

Agile Product Development – Agile Metrics – Feature Driven Development (FDD) – Financial and Production Metrics in FDD – Agile Approach to Quality Assurance - Test Driven Development – Agile Approach in Global Software Development.

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Textbooks:

1. David J. Anderson and Eli Schragenheim, —Agile Management for Software Engineering: Applying the Theory of Constraints for Business Results‖, Prentice Hall, 2003.
2. Hazza and Dubinsky, —Agile Software Engineering, Series: Undergraduate Topics in Computer Science‖, Springer, 2009.

Reference Books:

1. Craig Larman, —Agile and Iterative Development: A Manager_s Guide‖, Addison-Wesley, 2004.
2. Kevin C. Desouza, —Agile Information Systems: Conceptualization, Construction, and Management‖, Butterworth-Heinemann, 2007.

Online Learning Resources:

https://www.nptelvideos.com/video.php?id=904

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23DST07a	**EXPERT SYSTEMS** **Professional Elective-V**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

Course Outcomes:

- Acquire knowledge on fundamentals of knowledge representation
- Analyze Probabilistic Reasoning for knowledge
- Able to understand expert systems architecture

UNIT- I: **Lecture 10Hrs**

Overview of Artificial Intelligence: Definition & Importance of AI.

Knowledge: General Concepts: Introduction, Definition and Importance of Knowledge, Knowledge- Based Systems, And Representation of Knowledge, Knowledge Organization, Knowledge Manipulation, And Acquisition of Knowledge.

UNIT- II: **Lecture 8Hrs**

Knowledge Representation: Introduction, Syntax and Semantics for Propositional logic, Syntax and Semantics for FOPL, Properties of WFFs, Conversion to Clausal Form, Inference Rules, The Resolution Principle, No deductive Inference Methods, Representations Using Rules.

UNIT- III: **Lecture 9Hrs**

Dealing with Inconsistencies and Uncertainties: Introduction, Truth Maintenance Systems, Default Reasoning and the Closed World Assumption, Predicate Completion and Circumscription, Modal and Temporal Logics.

Probabilistic Reasoning: Introduction, Bayesian Probabilistic Inference, Possible World Representations, Dumpster-Shafer Theory, Ad-Hoc Methods.

UNIT- IV: **Lecture 9Hrs**

Structured Knowledge: Graphs, Frames and Related Structures: Introduction, Associative Networks, Frame Structures, Conceptual Dependencies and Scripts. **Object-Oriented Representations:** Introduction, Overview of Objects, Classes, Messages and Methods, Simulation Example using an OOS Program.

UNIT- V **Lecture 9Hrs**

Knowledge Organization and Management: Introduction, Indexing and Retrieval Techniques, Integrating Knowledge in Memory, Memory Organization Systems.

Expert Systems Architectures: Introduction, Rule Based System Architecture, Non-Production System Architecture, Dealing with uncertainty, Knowledge Acquisition and Validation, Knowledge System Building Tools.

Text Book:

1. Dan W. Patterson - Introduction to Artificial Intelligence and Expert Systems, PHI, New Delhi, 2006.

Reference Books:

1. E. Rich & K. Knight - Artificial Intelligence, 2/e, TMH, New Delhi, 2005.
2. P.H. Winston - Artificial Intelligence, 3/e, Pearson Edition, New Delhi, 2006.
3. D.W. Rolston,- Principles of AI & Expert System Development, TMH, New Delhi.

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23DST07b	**REINFORCEMENT LEARNING** **Professional Elective-V**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

Course Objectives:

- To learn RL task formulation (action space, state space, environment definition)
- To learn Tabular based solutions (dynamic programming, Monte Carlo, temporal-difference)
- To learn Function approximation solutions (Deep Q-networks)
- To learn Policy gradient from basic (REINFORCE) towards advanced topics (proximal policy optimization, deep deterministic policy gradient, etc.)
- To learn Model-based reinforcement learning

Course Outcomes: After completion of the course, students will be able to

- Formulate Reinforcement Learning problems
- Apply various Tabular Solution Methods to Markov Reward Process Problems
- Apply various Iterative Solution methods to Markov Decision Process Problems
- Comprehend Function approximation methods

UNIT I **Lecture 8Hrs**

Introduction: Course logistics and overview. Origin and history of Reinforcement Learning research. Its connections with other related fields and with different branches of machine learning.
Probability Primer: Brush up of Probability concepts - Axioms of probability, concepts of random variables, PMF, PDFs, CDFs, Expectation. Concepts of joint and multiple random variables, joint, conditional and marginal distributions. Correlation and independence.

UNIT II **Lecture 9Hrs**

Markov Decision Process: Introduction to RL terminology, Markov property, Markov chains, Markov reward process (MRP). Introduction to and proof of Bellman equations for MRPs along with proof of existence of solution to Bellman equations in MRP. Introduction to Markov decision process (MDP), state and action value functions, Bellman expectation equations, optimality of value functions and policies, Bellman optimality equations.
Prediction and Control by Dynamic Programming: Overview of dynamic programming for MDP, definition and formulation of planning in MDPs, principle of optimality, iterative policy evaluation, policy iteration, value iteration, Banach fixed point theorem, proof of contraction mapping property of Bellman expectation and optimality operators, proof of convergence of policy evaluation and value iteration algorithms, DP extensions.

UNIT III **Lecture 9Hrs**

Monte Carlo Methods for Model Free Prediction and Control: Overview of Monte Carlo methods for model free RL, First visit and every visit Monte Carlo, Monte Carlo control, On policy and off policy learning, Importance sampling.
TD Methods: Incremental Monte Carlo Methods for Model Free Prediction, Overview TD(0), TD(1) and TD(λ), k step estimators, unified view of DP, MC and TD evaluation methods, TD Control methods - SARSA, Q-Learning and their variants.

UNIT IV **Lecture 8Hrs**

Function Approximation Methods: Getting started with the function approximation methods, Revisiting risk minimization, gradient descent from Machine Learning, Gradient MC and Semi-gradient TD(0) algorithms, Eligibility trace for function approximation, After states, Control with function approximation, Least squares, Experience replay in deep Q-Networks.

UNIT - V **Lecture 8Hrs**

Policy Gradients: Getting started with policy gradient methods, Log-derivative trick, Naive REINFORCE algorithm, bias and variance in Reinforcement Learning, Reducing variance in policy gradient estimates, baselines, advantage function, actor-critic methods.

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Textbooks:

1. Sutton, Richard S., and Andrew G. Barto. Reinforcement learning: An introduction. MIT press, 2018.
2. Leon-Garcia, Alberto. Probability and random processes for electrical engineering. Pearson Education India, 1994

Reference Books:

1. Murphy, Kevin P. Machine learning: a probabilistic perspective. MIT press, 2012.

Online Learning Resources:

1. A brief introduction to reinforcement learning (freecodecamp.org)
2. Reinforcement learning – GeeksforGeeks

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23CST30d	**AI Powered Application Development**	**L**	**T**	**P**	**C**
		3	**-**	**-**	**3**

Course Objectives:

- **To provide knowledge of AI-powered application development using modern software engineering and Python programming concepts.**
- **To enable students to design and develop full-stack applications integrated with AI models, APIs, and databases.**
- **To equip students with skills to build, deploy, and evaluate AI-powered applications for real-world scenarios.**

Prerequisite: Knowledge of Python programming, databases, and Artificial Intelligence concepts.

Course Outcomes:

After successful completion of the course, students will be able to: CO1: Explain the fundamentals of AI-powered application development.

CO2: Develop full-stack AI applications using frontend, backend, and database technologies.

CO3: Integrate LLMs and SLMs into applications using AI services, APIs, and SDKs.

CO4: Analyze the design and implementation of AI-powered application features.

CO5: Analyze deployment, scaling, and monitoring strategies for AI-powered applications.

Unit I: Application Development (9 Hrs)

Introduction to AI-Powered Applications, Software Development Life Cycle (SDLC), Agile Methodology and Scrum Basics, AI Application Development Lifecycle, Lambda Functions, map() and filter(), Iterators and Generators, Object-Oriented Programming Concepts, Exception Handling, Modules and Packages, Working with JSON Data.

Unit-II: Full-Stack AI Application Development (9 Hrs)

Web Application Architecture, MVC and MVT Design Patterns, Frontend Development using React.js, RESTful API Development, Database Integration using Python and ORM, CRUD Operations, Integration of Frontend and Backend Applications.

Unit III: AI Model Integration for Applications (9 Hrs)

Introduction to Large Language Models (LLMs) and Small Language Models (SLMs), AI Service Integration using APIs, Working with AI SDKs and Frameworks, Integrating LLMs and SLMs into Python Applications, Prompt Engineering Fundamentals, AI Response Processing and Validation.

Unit IV: Building AI-Powered Applications (9 Hrs)

Design of AI-Powered Application Features, Conversational AI and Chatbots, Document Analysis and Knowledge Applications, AI Content Generation Applications AI Agents and Productivity Applications, Case Studies of AI-Powered Applications.

Unit V: Deployment and Scaling (8 Hrs)

Application Deployment Fundamentals, Containerization Concepts, Cloud Deployment Basics, Scaling AI Applications, Logging and Monitoring, Capstone Project Design and Implementation.

Text Books

1. Eric Matthes, Python Crash Course, 3rd Edition, No Starch Press, 2023.
2. William S. Vincent, Django for APIs, 5th Edition, WelcomeToCode, 2024.
3. Paul Iusztin and Maxime Labonne, AI Engineering: Building Applications with Foundation Models, O'Reilly Media, 2025.

Reference Books

1. Valentino Zocca and Ram Sriharsha, Building LLM Powered Applications, Packt Publishing, 2024.
2. Jay Alammar and Maarten Grootendorst, Hands-On Large Language Models, O'Reilly Media, 2024.
3. Simon Holmes, Clive Harber, Tomomi Imura, Noel Hurst, Christian Kaindl, The React Workshop, 2nd Edition, Packt Publishing, 2024.
4. Noah Gift and Alfredo Deza, Practical MLOps: Operationalizing Machine Learning Models, 2nd Edition, O'Reilly Media, 2024.

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23CSP12	**FULL STACK DEVELOPMENT -2** **Skill Enhancement Course**	**L**	**T**	**P**	**C**
		0	**1**	**2**	**2**

Course Objectives: The main objectives of the course are to

- Make use of Modern-day JavaScript with ES6 standards for designing Dynamic web pages
- Building robust & responsive User Interfaces using popular JavaScript library **_React.js**‘. Building robust backend APIs using **_Express.js**‘
- Establishing the connection between frontend (React) User interfaces and backend APIs (Express) with Data Bases(MySQL)

Course Outcomes:

- Building fast and interactive UIs
- Applying Declarative approach for developing web apps
- Understanding ES6 features to embrace modern JavaScript
- Building reliable APIs with Express.js
- Understanding and using Routes
- Developing search engine optimised websites

Experiments covering the Topics:

- Introduction to DOM (Document Object Model), EcmaScript (ES6) standards and features like Arrow functions, Spread operator, Rest operator, Type coercion, Type hoisting, String literals, Array and Object Destructuring.
- Basics of React.js like React Components, JSX, Conditional rendering Differences between Real DOM and Virtual DOM.
- Important React.js concepts like React hooks, Props, React forms, Fetch API, Iterative rendering using JavaScript map() function.
- JavaScript runtime environment node.js and its uses, Express.js and Routing, Micro-Services architecture and MVC architecture, database connectivity using (MySQL)
- Introduction to MySQL, setting up MySQL and configuring, Databases, MySQL queries, sub queries, creating MySQL driver for database connectivity to Express.js server.

Sample Experiments:

1. **Introduction to Modern JavaScript and DOM**
    - **a.** Write a JavaScript program to link JavaScript file with the HTML page
    - **b.** Write a JavaScript program to select the elements in HTML page using selectors
    - **c.** Write a JavaScript program to implement the event listeners
    - **d.** Write a JavaScript program to handle the click events for the HTML button elements
    - **e.** Write a JavaScript program to With three types of functions
        - **i.** Function declaration
        - **ii.** Function definition
        - **iii.** Arrow functions

2. ***Basics of React.js***
    - **a.** Write a React program to implement a counter button using react class components
    - **b.** Write a React program to implement a counter button using react functional components
    - **c.** Write a React program to handle the button click events in functional component
    - **d.** Write a React program to conditionally render a component in the browser
    - **e.** Write a React program to display text using String literals
3. ***Important concepts of React.js***
    - **a.** Write a React program to implement a counter button using React use State hook

b. Write a React program to fetch the data from an API using React use Effect hook

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a. Write a React program with two react components sharing data using Props.
b. Write a React program to implement the forms in react
c. Write a React program to implement the iterative rendering using map() function.

2. ***Introduction to Node.js and Express.js***
   a. Write a program to implement the _hello world' message in the route through the browser using Express
   b. Write a program to develop a small website with multiple routes using Express.js
   c. Write a program to print the _hello world' in the browser console using Express.js
   d. Write a program to implement the CRUD operations using Express.js
   e. Write a program to establish the connection between API and Database using Express – MySQL driver
3. ***Introduction to MySQL***
   a. Write a program to create a Database and table inside that database using MySQL Command line client
   b. Write a MySQL queries to create table, and insert the data, update the data in the table
   c. Write a MySQL queries to implement the subqueries in the MySQL command line client
   d. Write a MySQL program to create the script files in the MySQL workbench
   a. Write a MySQL program to create a database directory in Project and initialize a database. sql file to integrate the database into API