Semester

V

Name of the Programme: B. Tech. in Information Technology	**Year**: III	**Semester**: V
Course Name: Design and Analysis of Algorithms	**Course Code**: ITUL501/CSUL501/CAUL501/ CDUL501/ CIUL601	**Credit**: 3
Max Marks: 100	**CIE:** 40	**SEE:** 60
End Term Exam Time: 3 Hrs.	**Teaching Scheme:** CI (45) + TW & SL (45) = 90 hrs. per semester	

Module No.	Contents	Classroom Instruction (CI) Hours
1	**Introduction:** Objective, Scope, Outcome of the Course and Prerequisite.	1
2	**Algorithm Basic:** Review of Algorithm, Complexity, Complexity Measures and Notations, Solving Recurrences: Substitution method, Recursion tree, Master method. **Divide and Conquer:** Binary Search, Merge sort, Quick sort and Strassen's matrix multiplication algorithm.	9
3	**Greedy Method:** Knapsack Problem, Job Sequencing, Optimal Merge Patterns, Huffman code and Minimal Spanning Trees. **Dynamic Programming:** Matrix Chain Multiplication, Longest Common Subsequence and 0/1 Knapsack Problem.	9
4	**Branch And Bound:** Traveling Salesman Problem, Backtracking Algorithms and N-queens problem. **Pattern Matching Algorithms:** Naïve and Rabin Karp string matching algorithms, KMP Matcher and Boyer Moore Algorithms.	8
5	**Assignment Problems:** Formulation, Implementation with lower bound theory and Hungarian Algorithm, Quadratic. **Randomized Algorithms-** Las Vegas algorithms, Monte Carlo algorithms, randomized algorithm for Min-Cut. **Maximum Flow:** Problem definition of Multicommodity flow, Flow shop scheduling and Network capacity assignment problems, Ford-Fulkerson Method for Network Capacity.	10
6	**Problem class NP, NP-Hard and NP-Complete:** Basic concepts, non-deterministic algorithms, NP-hard and NP-complete classes, Cook's theorem, Clique Problem, Hamiltonian-Cycle Problem, Traveling-Salesman Problem, N-SAT Problem, Graph Coloring problem, Vertex Cover and Set Cover Problem, Approximation Algorithm.	8
	Total	**45**

Text Books:

1. T. H. Cormen, C. E. Leiserson, R. L. Rivest, and C. Stein, Introduction to Algorithms, 4th ed. Cambridge, MA, USA: MIT Press, 2022.
2. M. T. Goodrich and R. Tamassia, Design and Analysis of Algorithms, Indian Adaptation ed. New Delhi, India: Wiley India, 2021.

Reference Books:

1. A. V. Aho, J. E. Hopcroft, and J. D. Ullman, The Design and Analysis of Computer Algorithms. Reading, MA, USA: Addison-Wesley, 1985, reprint.
2. S. S. Skiena, The Algorithm Design Manual, 3rd ed. Cham, Switzerland: Springer, 2020.

Prerequisite:

1. Good understanding of basic mathematics, including logarithms, summations, and discrete mathematics.
2. Prior knowledge of fundamental data structures such as arrays, linked lists, stacks, queues, trees, and graphs.
3. Ability to program efficiently in languages like C or C++.
4. Basic understanding of algorithmic concepts such as searching, sorting, and hashing.

Swami Keshvanand Institute of Technology, Management & Gramothan, Jaipur

Name of the Programme: B. Tech. in Information Technology	**Year**: III	**Semester**: V
Course Name: Machine Learning	**Course Code**: ITUL502/ CSUL502/ CAUL502/ CDUL502/ CIUL502	**Credit**: 3
Max Marks: 100	**CIE:** 40	**SEE:** 60
End Term Exam Time: 3 Hrs.	**Teaching Scheme:** CI (45) + TW & SL (45) = 90 hrs. per semester	

Module No.	Contents	Classroom Instruction (CI) Hours
1.	**Introduction:** Objective, Scope, Outcome of the Course and Prerequisite.	1
2.	**Introduction to Machine Learning:** Overview, Comparison with Traditional Programming, Types of Machine Learning, Machine Learning Process Flow, Applications and Challenges, Bias and Variance Tradeoff. **Data Preprocessing:** Data Quality Issues, Data Cleaning (Missing Values, Outlier Detection), Feature Scaling (Normalization, Standardization), Encoding Categorical Variables (One-Hot Encoding, Label Encoding).	8
3.	**Supervised Learning – I (Regression & Fundamentals) Regression Techniques:** Linear Regression, Multiple Regression, Polynomial Regression. **Performance Measures (Regression):** Mean Absolute Error (MAE), Mean Squared Error (MSE), Root Mean Squared Error (RMSE).	5
4.	**Supervised Learning – II (Classification Algorithms) Probability-Based Learning:** Naïve Bayes Classifier, **Boundary-Based Learning:** k-Nearest Neighbors (k- NN), Support Vector Machine (SVM), Perceptron Model, Logistic Regression, Introduction to Neural Networks (Biological Inspiration), Activation Functions (Sigmoid, Tanh, ReLU); **Rule-Based Learning:** Decision Trees, **Ensemble Learning:** Random Forest, Bagging, Boosting, **Performance Measures (Classification):** Confusion Matrix, Accuracy, Precision, Recall, F1-Score.	11
5.	**Unsupervised Learning— Clustering Techniques:** Partitioning (K-Means, K- Medoids), Hierarchical Clustering, DBSCAN, Gaussian Mixture Model (GMM), **Association Rule Mining:** Apriori Algorithm, Frequent Pattern Growth (FP-Growth), **Performance Measures:** Elbow Method, Silhouette Score.	10
6	**Feature Engineering and Dimensionality Reduction:** Filter methods, wrapper methods, and embedded methods; need for dimensionality reduction, curse of dimensionality, Principal Component Analysis (PCA), Singular Value Decomposition (SVD). **Recommendation Systems:** Overview, Importance and Applications, Collaborative Filtering (User-based, Item-based), Content-Based Filtering (Concept and Working Principles).	10
	Total	**45**

Text Books:

1. T. M. Mitchell, *Machine Learning*, 1st ed. New York, NY, USA: McGraw-Hill Education, 2025, ISBN: 978-8176711401
2. S. Dutt, S. Chandramouli and A. K. Das, *Machine Learning*, 2nd ed. New Delhi, India: Pearson Education, 2024, ISBN: 978-8119896738

Reference Books:

1. A. Géron, Hands-On Machine Learning with Scikit-Learn, Keras, and Tensor Flow: Concepts, Tools, and Techniques to Build Intelligent Systems, 3rd ed. Sebastopol, CA, USA: O'Reilly Media, 2022, ISBN: 978-1098125974.
2. A. C. Müller and S. Guido, Introduction to Machine Learning with Python: A Guide for Data Scientists. Sebastopol, CA, USA: O'Reilly Media, 2016, ISBN: 978-1449369415.
3. P. Harrington, Machine Learning in Action. Manning Publications, Shelter Island, NY, USA, 2012, ISBN: 978-1617290183

Prerequisite:

1. Fundamentals of linear algebra (vectors, matrices, operations).
2. Basic statistics (mean, variance, probability distributions) .
3. Proficiency in Python programming.

Swami Keshvanand Institute of Technology, Management & Gramothan, Jaipur

Name of the Programme: B. Tech. in Information Technology	**Year**: III	**Semester**: V
Course Name: MERN Stack	**Course Code**: ITUL503	**Credit**: 3
Max Marks: 100	**CIE:** 40	**SEE:** 60
End Term Exam Time: 3 Hrs.	**Teaching Scheme:** CI (45) + TW & SL (45) = 90 hrs. per semester	

Module No.	Contents	Classroom Instruction (CI) Hours
1.	**Introduction:** Objective, Scope, Outcome of the Course and Prerequisite.	1
2.	**Introduction to Web Architecture:** Web architecture (Client–Server Architecture, HTTP and HTTPS Protocols). **Java Script:** Java Script: Introduction to JavaScript, How to link java script files, Running JavaScript in the Browser and Console, Execution context and call stack, Hoisting var, let, const, function declarations, Scope chain and lexical scope, Event loop basics, arrow functions, parameters and arguments in JS Function, Understanding Scoping in JS.	10
3.	**Advanced JS:** Introduction to DOM in JavaScript, Understanding DOM Structure and Tree, Fetching Elements in DOM, DOM Tree Traversal, Manipulating DOM Element in JavaScript, Create and Removing DOM Elements**,** Event Handling in JavaScript. **Asynchronous** Programming in JavaScript.	9
4.	**Introduction to React:** Understanding React Functional components, defining a Component, Component Rendering, Understanding JSX, React Router and Single Page Applications, React Forms. **TypeScript:** Types, interfaces, type safety in fronted.	9
5.	**Advanced Backend Development:** Node.js Architecture, Express.js framework: Routing, Controllers, RESTful API design principles, Authentication & Authorization: JWT (JSON Web Tokens), Role-Based Access Control (RBAC), Input validation and error handling, Testing APIs using tools (e.g., Postman).	8
6	**Database Management & Optimization:** Introduction to NoSQL Databases and MongoDB, CRUD operations in MongoDB, Schema Design using Mongoose (ODM), Indexing and Query Optimization, Aggregation pipeline, Transactions and Data Validation.	8
	Total	**45**

Textbooks:

1. E. Brown, Web Development with Node and Express: Leveraging the JavaScript Stack, 2nd ed., O'Reilly Media, 2019.
2. A. Banks and E. Porcello, Learning React: Modern Patterns for Developing React Apps, 2nd ed., O'Reilly Media, 2020.

Reference Books:

1. D. Flanagan, JavaScript: The Definitive Guide – Master the World's Most-Used Programming Language, 7th ed., O'Reilly Media, 2020.
2. S. Subramanian, Pro MERN Stack: Full Stack Web App Development with MongoDB, Express, React, and Node, 2nd ed., Apress, 2019.
3. M. McDonald, Web Security for Developers: Real Threats, Practical Defense. San Francisco, CA, USA: No Starch Press, 2020.

Prerequisite:

1. Fundamentals of HTML, CSS and JavaScript.
2. Understanding of basic programming concepts.

Swami Keshvanand Institute of Technology, Management & Gramothan, Jaipur

Name of the Programme: B. Tech. in Information Technology	**Year**: III	**Semester**: V
Course Name: Cloud Computing	**Course Code**: ITUL504/ CSUL601/ CAUL504/ CDUL601	**Credit**: 2
Max Marks: 100	**CIE:** 40	**SEE:** 60
End Term Exam Time: 3 Hrs.	**Teaching Scheme:** CI (30) + TW & SL (30) = 60 hrs. per semester	

Module No.	Contents	Classroom Instruction (CI) Hours
1	**Introduction:** Objective, Scope, Outcome of the Course and Prerequisite.	1
2	**Introduction to Cloud Computing:** Enabling Technology, Features, Characteristics and Components of Cloud Computing. Challenges, Risks and Approaches of Migration into Cloud. Ethical Issue in Cloud Computing, Cloud Reference Model, Future of the cloud and Edge.	6
3	**Cloud Service and Deployment Models:** Cloud Service Models: Infrastructure as a Service (IaaS), Platform as a Service (PaaS), Software as a Service (SaaS). Cloud Deployment Models- Public Cloud, Private Cloud, Hybrid Cloud, Community Cloud, Cloud Economics and Cost Models, Service Level Agreements (SLA).	5
4	**Virtualization:** Definition, Understanding and Benefits of Virtualization. Implementation Level of Virtualization, Virtualization Concepts and Types: Server Virtualization, Storage Virtualization, Network Virtualization, Types of Hypervisors, Virtual Machine Management.	7
5	**Cloud Security and Services:** Cloud Security Services, Design Principles, Policy Implementation, Cloud Security Challenges, Cloud Computing Security Architecture, Legal Issues in Cloud Computing, Data Security in Cloud: Business Continuity and Disaster Recovery, Risk Mitigation, Threats in Cloud, Trust Management.	6
6	**Cloud Platform Providers:** Amazon Web Services, Google AppEngine, Microsoft Azure Design, Cloud Applications- Data Analysis, Satellite Image Processing, Customer Relationship Management (CRM).	5
	Total	**30**

Text Books:

1. R. Buyya, C. Vecchiola, T. Selvi, S. Poojara, and S. N. Srirama, Mastering Cloud Computing, 2nd ed. New Delhi, India: McGraw-Hill, 2024, ISBN: 978-9355329509.
2. T. Erl and E. B. Monroy, Cloud Computing: Concepts, Technology & Architecture. Noida, India: Pearson Education, 2024, ISBN: 978-8196943219.

Reference Books:

1. K. Brown, B. Woolf, and J. Yoder, Cloud Application Architecture Patterns: Designing, Building, and Modernizing for the Cloud. Sebastopol, CA, USA: O'Reilly Media, 2025, ISBN: 978-1098116903.
2. E. Bauer and R. Adams, Reliability and Availability of Cloud Computing. Hoboken, NJ, USA: Wiley, 2012, ISBN: 978-1118177013.

Prerequisites for Cloud Computing:

1. Fundamentals of computer systems, operating systems, and networks .
2. Understanding of programming and application deployment.

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Name of the Programme: B. Tech. in Information Technology	**Year**: III	**Semester**: V
Course Name: Cryptography and Network Security	**Course Code**: ITUL511/ CSUL503/ CAUL512/ CDUL512/ CIUL512	**Credit**: 3
Max Marks: 100	**CIE:** 40	**SEE:** 60
End Term Exam Time: 3 Hrs.	**Teaching Scheme:** CI (45) + TW & SL (45) = 90 hrs. per semester	

Module No.	Contents	Classroom Instruction (CI) Hours
1	**Introduction:** Objective, Scope, Outcome of the Course and Prerequisite.	1
2	**Security Concepts:** The need for Security, Goals, Security Services, Security Mechanisms, **Types of Security Attacks**, Network Security Model and Malware viruses. **Cryptography Concepts and Techniques**: Introduction, Encryption and Decryption, Substitution Techniques, Transposition Techniques, Symmetric and Asymmetric key Cryptography.	9
3	**Symmetric key Ciphers**: Algorithm Modes, Block Cipher Principles, Feistel Structure, DES, AES. **Asymmetric key Ciphers:** Principles of Public Key Cryptosystems, RSA Algorithm, Elgamal Cryptography, Elliptive Curve Cryptography.	9
4	**Cryptographic Hash Functions:** Hash functions, Message Authentication Code, MD5, Secure Hash Algorithm (SHA-512), Message Authentication Codes: Authentication Requirements, HMAC, CMAC, Digital signatures, Elgamal Digital Signature Scheme. **Key Management and Distribution:** Symmetric Key Distribution using Symmetric & Asymmetric Encryption, Distribution of Public Keys, Diffie-Hellman Key Exchange, Kerberos, X.509 Authentication Service, Public-Key Infrastructure.	9
5	**Transport-level Security:** Web Security Considerations, Secure Socket Layer and Transport Layer Security, HTTPS, Secure Shell (SSH), **SET**. **Wireless Network Security: fundamentals of** Wireless Security, Mobile Device Security, IEEE 802.11, (wi-fi) standards and security (WPA3) .	9
6	**E-Mail Security:** Pretty Good Privacy, S/MIME. **IP Security**: IP Security Overview, Virtual Private Networks (VPNs) IP Security Architecture, Authentication Header, Encapsulating Security Payload, Internet Key Exchange, Intruders, Intrusion Detection and Prevention, Unified Threat Management.	8
	Total	**45**

Text Books:

1. W. Stallings, Cryptography and Network Security: Principles and Practice, 8th ed. Hoboken, NJ, USA: Pearson Education, 2023.
2. A. Kahate, Cryptography and Network Security, 4th ed. New Delhi, India: McGraw Hill Education, 2019.

Reference Books:

1. J. Katz and Y. Lindell, Introduction to Modern Cryptography, 3rd rev. ed. Boca Raton, FL, USA: CRC Press, 2020.
2. M. Stamp, Information Security: Principles and Practice, 3rd ed. Hoboken, NJ, USA: Wiley India / Wiley, 2022.

Prerequisite:

1. Mathematical Foundations – Discrete mathematics, number theory (modular arithmetic, primes), and basic probability.
2. Computer Networks – TCP/IP and OSI models, network protocols.

Swami Keshvanand Institute of Technology, Management & Gramothan, Jaipur

Name of the Programme: B. Tech. in Information Technology	**Year**: III	**Semester**: V
Course Name: Parallel and Distributed Computing	**Course Code**: ITUL512/ CSUL612/ CAUL612/ CDUL612/ CIUL612	**Credit**: 3
Max Marks: 100	**CIE:** 40	**SEE:** 60
End Term Exam Time: 3 Hrs.	**Teaching Scheme:** CI (45) + TW & SL (45) = 90 hrs. per semester	

Module No.	Contents	Classroom Instruction (CI) Hours
1	**Introduction:** Objective, Scope, Outcome of the Course and Prerequisite.	1
2	**Introduction to Parallel Processing:** Generations of Computer Systems, Trends towards Parallel Processing, Parallelism in Uni-processor Systems, Parallel Computer Structures, Serial versus Parallel Processing. **Cache Memory and Management:** Memory Structure, Characteristics of Cache Memory, Cache Memory Organizations, Cache Coherence.	9
3	**Principles of Pipelining:** Pipelining, Principles of Linear Pipelining, Pipeline Hazards, Bottlenecks, Instruction and Arithmetic Pipelines, Principles of Designing Pipelined Processors.	9
4	**Distributed Systems:** Concepts, Types of Operating systems, Goals, Features, Nodes, Services, Architecture Models, Communication Network Protocols, Design issues, Distributed Computing Environment (DCE). **Processes:** Processes and Threads, Graph Models for Process Representation, Client/Server Model, Notions of time and state, Recording the state of distributed systems, Clocks and event precedence, Time Services, Clock Synchronization.	9
5	**Inter-process Communication and Coordination**: Message Passing, Request/Reply, RPC, System Performance Model, Static Process Scheduling, Dynamic Load Sharing and Balancing, **Distributed File System and Shared Memory:** Characteristics, Design and implementation, Memory Access Architectures, Memory Consistency Models, Distributed Shared Memory.	9
6	**Distributed Computation and Agreement:** Preliminaries, Causality, Distributed Snapshots, Modeling a Distributed Computation. Concept of Faults and Failures, Adversaries, Byzantine Agreement, Replicated Data Management: concepts and issues, Database Techniques. **Case Study:** CORBA Architecture.	8
	Total	**45**

Text Books:

1. K. Hwang and F. A. Briggs, Computer Architecture and Parallel Processing. New York, NY, USA: McGraw-Hill, 1984, ISBN: 0-07-031556-6.
2. R. Chow and T. Johnson, Distributed Operating Systems and Algorithm Analysis, 1st ed. USA: Addison-Wesley, 1997, ISBN: 978-0201498387.

Reference Books:

1. A. Kulkarni, N. P. Giri, N. Joshi and B. Jadhav, Parallel and Distributed Systems, 2nd ed. New Delhi, India: Wiley, 2017, ISBN: 978-8126565825.
2. A. S. Tanenbaum and M. van Steen, Distributed Systems: Principles and Paradigms, 2nd ed. Upper Saddle River, NJ, USA: Pearson Education, 2007.

Prerequisite:

1. Basic understanding of Operating System.
2. Basic understanding of Computer Networking.
3. Basic understanding of Computer Architecture and Organization.

Swami Keshvanand Institute of Technology, Management & Gramothan, Jaipur

Name of the Programme: B. Tech. in Information Technology	**Year**: III	**Semester**: V
Course Name: Design and Analysis of Algorithms Lab	**Course Code**: ITUP520	**Credit**: 1
Max Marks: 100	**CIE:** 60	**SEE:** 40
End Term Exam Time: 3 Hrs.	**Teaching Scheme:** LI (30) = 30 hrs. per semester	

S. No.	Experiments
1	Implement a program that processes an unsorted integer array and multiple search queries. First, sort the given array using the Quick Sort algorithm, and then answer each query by determining whether a given element exists in the array using Binary Search.
2	Implement the Divide and Conquer by Strassen's matrix multiplication algorithm.
3	Implement Knapsack problem using Dynamic Programming and Greedy Method.
4	Find Minimum Cost Spanning Tree of a given undirected graph using Prim's and Kruskal's algorithm.
5	You are given an integer array arr of length n, where the i-th matrix has dimensions arr[i-1] x arr[i]. Implement a function using Dynamic Programming to compute the minimum number of scalar multiplications required to multiply the entire chain of matrices.
6	Implement the Longest Common Subsequence (LCS) problem using Dynamic Programming.
7	Implement N Queen's problem using Back Tracking.
8	Develop a program to perform string pattern matching using KMP Algorithm.
9	Implement assignment problems by Branch and Bound method.
10	Implement All-Pairs Shortest Paths Problem using Floyd's algorithm.

Swami Keshvanand Institute of Technology, Management & Gramothan, Jaipur

Name of the Programme: B. Tech. in Information Technology	**Year**: III	**Semester**: V
Course Name: Machine Learning Lab	**Course Code**: ITUP521	**Credit**: 1
Max Marks: 100	**CIE:** 60	**SEE:** 40
End Term Exam Time: 3 Hrs.	**Teaching Scheme:** LI (30) = 30 hrs. per semester	

S. No.	Experiments
1	Use of Python libraries such as NumPy, SciPy, Pandas, Matplotlib, and scikit-learn for data creation, loading, preprocessing, exporting, and visualization.
2	Write a Python program to demonstrate various Data-processing techniques for data cleaning (Reshaping, Filtering, merging data, and handling missing values) and transformations (scaling & encoding).
3	Write a Python program to implement Regression for continuous and discrete data and plot the graph.
4	Write a program to implement the k-Nearest Neighbor and Naïve-bayes classifier algorithm to classify the breast cancer data set in scikit-learn. Print both correct and wrong predictions.
5	Implement Support Vector Machine for a dataset and compare the accuracy by applying the following kernel functions: **a.** Linear **b.** Polynomial **c.** RBF
6	Write a program to demonstrate the working of the Decision Tree–based ID3 algorithm using an appropriate dataset.
7	Apply the Random Forest algorithm on a given dataset to predict the output class. Analyze the model performance by varying the number of trees and comparing the results.
8	Implement the K-Means clustering algorithm and analyze its performance by varying the number of clusters (k) and comparing the results.
9	Write a program to implement Principal Component Analysis (PCA) for transforming high-dimensional data into a lower-dimensional feature space.
10	Train a simple neural network and compare the performance using Sigmoid, Tanh, and ReLU activation functions.
11	Mini Project on Industry-Based Case Studies.

Swami Keshvanand Institute of Technology, Management & Gramothan, Jaipur

Name of the Programme: B. Tech. in Information Technology	**Year**: III	**Semester**: V
Course Name: MERN Stack Lab	**Course Code**: ITUP522	**Credit**: 1
Max Marks: 100	**CIE:** 60	**SEE:** 40
End Term Exam Time: 3 Hrs.	**Teaching Scheme:** LI (30) = 30 hrs. per semester	

Module No.	List of Experiments
1	Construct a complex webpage layout (like a dashboard sidebar and gallery) using HTML5 semantic tags and CSS3 Grid.
2	Build an interactive "Interest Rate Calculator" using ES6+ syntax (arrow functions, destructuring).
3	Develop a modular script using ES6 classes and prototypes to handle different execution contexts of this keyword.
4	Define and render functional components using JSX to build a dynamic UI that updates based on props.
5	Implement react-router for multi-page navigation and create a validated user input form using React state.
6	Set up a Redux store, actions, and reducers to manage data flow across multiple disconnected components.
7	Build a backend server with Express, implementing custom middleware and routing for standard HTTP methods.
8	Connect to MongoDB, design a schema with Mongoose, and perform basic Create, Read, Update, and Delete Operations.
9	Implement user login with bcrypt password salting.
10	Create A full-stack MERN mini application where students can securely register, log in, and manage personal data with real-time database updates.

Swami Keshvanand Institute of Technology, Management & Gramothan, Jaipur

Name of the Programme: B. Tech. in Information Technology	**Year**: III	**Semester**: V
Course Name: Advance Java Lab	**Course Code**: ITUP523	**Credit**: 1
Max Marks: 100	**CIE:** 60	**SEE:** 40
End Term Exam Time: 3 Hrs.	**Teaching Scheme:** LI (30) = 30 hrs. per semester	

S. No.	Experiments
1	Implement Java Applet to show life cycle (init, start, paint, stop, destroy) and apply debugging to understand the program flow.
2	Create a menu-driven desktop application (e.g. calculator) using Java Swing and its components.
3	Design a Registration and Sign-In page for desktop application and connect it with JDBC.
4	Create a user registration and login module with CRUD operations using JDBC to implement Sign-Up and Authentication functionality.
5	Create a basic client-server application using Java Socket programming along with the concept of JSON conversion of Java objects.
6	Implement Java RMI to understand how distributed systems can be designed.
7	Develop a web application module using JSP and Servlets following MVC architecture.
8	Implement session management, cookies, and server-side form validation using JSP and Servlets.
9	Implement serialization and deserialization of Java objects for persistent data storage and transfer.
10	Develop a RESTful Web Service architecture and demonstrate how web clients communicate with server APIs.

Semester

VI

Swami Keshvanand Institute of Technology, Management & Gramothan, Jaipur

Name of the Programme: B. Tech. in Information Technology	**Year**: III	**Semester**: VI
Course Name: DevOps Engineering	**Course Code**: ITUL601	**Credit**: 2
Max Marks: 100	**CIE:** 40	**SEE:** 60
End Term Exam Time: 3 Hrs.	**Teaching Scheme:** CI (30) + TW & SL (30) = 60 hrs. per semester	

Module No.	Contents	Classroom Instruction (CI) Hours
1	**Introduction:** Objective, Scope, and Outcome of the Course.	1
2	**Introduction to DevOps and Lifecycle:** DevOps Introduction, Goals and Benefits of DevOps, DevOps Lifecycle, Roles and Responsibilities of DevOps Engineer, DevOps Principles (Collaboration, Automation, Continuous Improvement, Monitoring), Agile vs DevOps, Infrastructure as Code (IaC) Concepts.	5
3	**Version Control Systems:** Introduction to Version Control Systems, Types of Version Control Systems, Git Fundamentals, Git Repository Concepts, Git Commands (init, clone, add, commit, push, pull, branch, merge), Branching and Merging Concepts, Repository Management.	4
4	**Continuous Integration:** Introduction to Continuous Integration (CI), CI Workflow, CI Tools Overview. **Jenkins and Build Automation:** Introduction to Jenkins, Jenkins Architecture (Master-Agent/Controller-Node), Jenkins Dashboard Overview, Jenkins Job/Pipeline Concepts (Freestyle vs Pipeline), Jenkins file Basics, Build Automation Concepts, Automated Testing in CI Pipeline, Continuous Feedback in CI Process.	6
5	**Continuous Deployment and Containerization:** Continuous Delivery and Continuous Deployment Concepts, CI/CD Pipeline Overview, Deployment Strategies, Configuration Management Concepts, Virtualization vs Containerization, Docker Basics, Docker Architecture, Docker Commands.	6
6	**Kubernetes Fundamentals:** Introduction to Kubernetes, Kubernetes Architecture, Pods and Containers, Container Orchestration Basics. **Monitoring and Observability Tools**: Introduction to Prometheus & Grafana, Time Series Data Concepts, Metrics Collection and Types (Counter, Gauge, Histogram), Prometheus Architecture (Server, Exporters, Alertmanager), Grafana Dashboard Creation, Logging and Alerting Concepts, Performance Monitoring Basics.	8
	Total	**30**

Text Books:

1. J. Davis and K. Daniels, ***Effective DevOps****: Building a Culture of Collaboration, Affinity, and Tooling at Scale*, 1st ed., Sebastopol, CA, USA: O'Reilly Media, 2016.
2. N. Turnbull, ***The DevOps Adoption Handbook***, 1st ed., Birmingham, U.K.: Packt Publishing, 2018.

Reference Books:

1. G. Kim, J. Humble, P. Debois, and J. Willis, ***The DevOps Handbook****: How to Create World-Class Agility, Reliability, and Security in Technology Organizations*, 1st ed., Portland, OR, USA: IT Revolution Press, 2016.
2. N. Poulton, ***Docker Deep Dive***, 1st ed., Boston, MA, USA: Leanpub, 2020.
3. K. Hightower, B. Burns, and J. Beda, ***Kubernetes: Up and Running*** *– Dive into the Future of Infrastructure*, 2nd ed., Sebastopol, CA, USA: O'Reilly Media, 2019.

Prerequisite:

1. Basic knowledge of Programming Concepts, Familiarity with Operating Systems (Linux/Windows),
2. Understanding of Software Development Life Cycle (SDLC).

Swami Keshvanand Institute of Technology, Management & Gramothan, Jaipur

Name of the Programme: B. Tech. in Information Technology	**Year**: III	**Semester**: VI
Course Name: Compiler Design	**Course Code**: ITUL602/CSUL602	**Credit**: 3
Max Marks: 100	**CIE:** 40	**SEE:** 60
End Term Exam Time: 3 Hrs.	**Teaching Scheme:** CI (45) + TW & SL (45) = 90 hrs. per semester	

Module No.	Contents	Classroom Instruction (CI) Hours
1	**Introduction:** Objective, Scope, and Outcome of the Course.	1
2	**Introduction to Compiler:** Definition of Translator, Compiler, Interpreter, Phases of compiler, Bootstrapping, lexical analyzer, Input Buffering, Recognition of tokens, Error handling.	8
3	**Syntax Analysis:** Introduction to parsing. Top-down parsing, LL grammars and error handling of LL parser, Recursive descent parsing, predictive parsers, bottom-up parsing, Shift reduce parsing, LR parsers, Construction of SLR, CLR & LALR parsing tables, parsing with ambiguous grammar, Operator precedence parsing.	10
4	**Syntax Directed Translation:** Syntax directed definitions, Construction of syntax trees, S-Attributed Definition, L-attributed definitions, Top-down translation. Intermediate code forms using postfix notation, DAG, three address code, TAC for various control structures, Representing TAC using triples and quadruples, Boolean expression and control structures.	10
5	**Storage organization:** Storage allocation, Strategies, Activation records, accessing local and non-local names in a block structured language, Parameters passing, Symbol table organization, Data structures used in symbol tables.	8
6	**Code Optimization and Code Generation:** Definition of basic block control flow graphs, DAG representation of basic block, Advantages of DAG Sources of optimization, Loop optimization, Idea about global data flow analysis, Loop invariant computation, Peephole optimization, Code generation from DAG.	8
	Total	**45**

Text Books:

1. A. V. Aho, M. S. Lam, R. Sethi, and J. D. Ullman, *Compilers: Principles, Techniques, and Tools*, 2nd ed. Boston, MA, USA: Pearson/Addison-Wesley, 2007.

Reference Books:

1. S. S. Muchnick, *Advanced Compiler Design and Implementation*. San Francisco, CA, USA: Morgan Kaufmann, 1997.
2. D. Grune, K. van Reeuwijk, H. E. Bal, C. J. H. Jacobs, and K. Langendoen, *Modern Compiler Design*, 2nd ed. Amsterdam, Netherlands: Springer, 2012.

Prerequisite:

1. Theory of Computation: Mastery of Regular Expressions, Finite Automata, and Context-Free Grammars for scanning and parsing.
2. Data Structures: Trees, Directed Acyclic Graphs (DAGs), and Hash Tables for code representation.

Swami Keshvanand Institute of Technology, Management & Gramothan, Jaipur

Name of the Programme: B. Tech. in Information Technology	**Year**: III	**Semester**: VI
Course Name: Image Processing	**Course Code**: ITUL603/ CSUL611/ CAUL611/ CDUL611/ CIUL611/	**Credit**: 3
Max Marks: 100	**CIE:** 40	**SEE:** 60
End Term Exam Time: 3 Hrs.	**Teaching Scheme:** CI (45) + TW & SL (45) = 90 hrs. per semester	

Module No.	Contents	Classroom Instruction (CI) Hours
1	**Introduction:** Objective, Scope, Outcome of the Course and Prerequisite.	1
2	**Fundamentals of Computer Graphics:** Introduction to Computer Graphics, Applications of Computer Graphics, Components of Graphics System, Random Scan and Raster Scan Systems. Color model, chromaticity diagram. **Graphics Primitives and Algorithms:** Line Drawing Algorithms- DDA, Bresenham's Algorithm, mid point Circle Drawing Algorithm.	8
3	**2D and 3D Transformations and Viewing:** Transformations: Translation, Rotation, Scaling, Reflection, Shearing, Homogeneous Coordinate Systems, Windowing and Viewport Transformation, Clipping Algorithms- Cohen-Sutherland Line Clipping, Sutherland-Hodgman Polygon Clipping.	9
4	**Fundamentals of Digital Image Processing:** Introduction, applications, representation of gray scale, binary and color images, Steps in Digital Image Processing, components of image processing system, Sampling & Quantization.	7
5	**Image Enhancement:** Spatial Domain Methods, Image Smoothing and Sharpening Filters, Intensity Transformation Function, Histogram Processing. **Image Restoration:** Image degradation and restoration process, degradation function, Noise models, Noise filters.	10
6	**Extraction:** Low level feature extraction- Edge features- Sobel, Prewitt, Canny, Classical feature extraction- HOG, SIFT, SURF. **Image Segmentation:** Edge and Boundary linking, Hough transforms, Thresholding, Region Based Segmentation, Boundary representation, Boundary Descriptors.	10
	Total	**45**

Text Books:

1. D. Hearn and M. P. Baker, Computer Graphics with OpenGL, 4th ed. Boston, MA, USA: Pearson Education, 2013.
2. R. C. Gonzalez and R. E. Woods, Digital Image Processing, 4th ed. New York, NY, USA: Pearson, 2022.

Reference Books:

1. J. D. Foley, A. van Dam, S. K. Feiner, and J. F. Hughes, Computer Graphics: Principles and Practice, 3rd ed. Boston, MA, USA: Addison-Wesley, 2014.
2. A. K. Jain, Fundamentals of Digital Image Processing. Englewood Cliffs, NJ, USA: Prentice Hall, 1989.

Prerequisite:

1. Understanding of Mathematics, especially Coordinate Geometry and Matrices.
2. Basic understanding of Digital Systems and Logic.
3. Fundamental concepts of Linear Algebra and Probability (for Image Processing).

Swami Keshvanand Institute of Technology, Management & Gramothan, Jaipur

Name of the Programme: B. Tech. in Information Technology	**Year**: III	**Semester**: VI
Course Name: Deep Learning	**Course Code**: ITUL611/ CSUL603/ CAUL603/ CDUL603/ CIUL611	**Credit**: 3
Max Marks: 100	**CIE:** 40	**SEE:** 60
End Term Exam Time: 3 Hrs.	**Teaching Scheme:** CI (45) + TW & SL (45) = 90 hrs. per semester	

Module No.	Contents	Classroom Instruction (CI) Hours
1	**Introduction:** Objective, Scope, Outcome of the Course and Prerequisite.	1
2	**Introduction to deep learning:** Machine Learning and Deep Learning, Deep Learning applications. Artificial Neuron- Biological Neuron, Perceptron, Types of Activation Functions- linear, Tanh, Sigmoid, ReLU, LReLU, EReLU, Architecture of Neural Network, Learning Process in ANN, Feed Forward Network. Gradient Descent and Backpropagation. **Optimization Algorithms:** Gradient descent with momentum, Adagrad, Adadelta, RMSProp, Adam, Regularization, Normalization of Inputs.	10
3	**Computer Vision using Convolution Neural Network (CNN):** Introduction to Computer Vision, CNN Basic Architecture- Image scaling, data Augmentation, Kernel/filter, Image Convolution, Pooling, Flattened, Fully Connected Layer, Dropout. Popular CNN Architectures- LeNet-5, VGG-16, AlexNet, ResNet, Google Net. Object Detection: Bounding Box, Sliding Window-based Object Detection, YOLO.	10
4	**Recurrent neural network (RNN):** CNN V/S RNN, Introduction to Sequence data and applications, RNN- Data Preparation and Vanishing Gradient Problem. Long Short-Term Memory (LSTM) Networks, Gated Recurrent Units, Bidirectional LSTMs, Bidirectional RNNs.	9
5	**Auto-Encoders and Generative Adversarial Networks (Gans):** Auto-encoders: Regularized Auto encoder, Stochastic Encoders and Decoders, Contractive Encoders. Generative Adversarial Networks: Architecture, working and Types: Vanilla GAN, CGAN and DCGAN. Relationship between Autoencoders and GANs.	9
6	**Transfer Learning and Deep Learning Case Studies:** Concept of Transfer Learning, Use of Transfer Learning, Transfer Learning Strategies, **Case Study**: Cat vs Dog detection using transfer learning with VGG 16, Disease Detection from Chest X-Ray Images.	6
	Total	**45**

Text Books:

1. A. K. Das, S. Goswami, P. Mitra, and A. Chakrabarti, Deep Learning, 1st ed. New Delhi, India: Pearson Education, 2021.
2. Goodfellow, Y. Bengio, and A. Courville, Deep Learning. Cambridge, MA, USA: MIT Press, 2016.

Reference Books:

1. S. K. Vasudevan, S. R. Pulari, and S. Vasudevan, Deep Learning: A Comprehensive Guide. Boca Raton, FL, USA: CRC Press, 2022.
2. F. Chollet, Deep Learning with Python. Shelter Island, NY, USA: Manning Publications, 2018.

Prerequisite:

1 . knowledge of mathematics (linear algebra, probability, and calculus), proficiency in Python programming, understanding of data structures.

2. basic concepts of machine learning and artificial intelligence.

Swami Keshvanand Institute of Technology, Management & Gramothan, Jaipur

Name of the Programme: B. Tech. in Information Technology	**Year**: III	**Semester**: VI
Course Name: Natural Language Processing	**Course Code**: ITUL612	**Credit**: 3
Max Marks: 100	**CIE:** 40	**SEE:** 60
End Term Exam Time: 3 Hrs.	**Teaching Scheme:** CI (45) + TW & SL (45) = 90 hrs. per semester	

Module No.	Contents	Classroom Instruction (CI) Hours
1	**Introduction:** Objective, Scope, Outcome of the Course and Prerequisite	1
2	**Fundamentals of NLP and Text Preprocessing:** Overview, Applications, Challenges in NLP, Empirical Laws-Heap's law, Zipf's Law, Type Token Ratio, Text preprocessing: Tokenization, Stop words, Stemming, Lemmatization.	8
3	**Statistical Language Modeling and Sequence Labeling:** Statistical Language Model, Perplexity, Collocation, Term Weighting- Tf-Idf, Part of Speech Tagging, Hidden Markov Model, Viterbi Decoding for HMM, Maximum Entropy, Conditional Random Field, Named Entity Representation (NER).	10
4	**Lexical Semantics and Distributional Representations (with Basic Syntax):** Constituency vs Dependency Structure, Phrase Structure (NP, VP, PP), Basic Parse Trees, Grammatical Relations-Subject, Object, Modifier. WordNet, Wordnet Similarity, Lexical Relations, Word Sense Disambiguation, Distributional Semantics, Semantic Relatedness, Word Vectors, SVD, Word Embedding-BoW, Word2Vec, Glove.	9
5	**Parsing Techniques:** Parsing-Top-Down Parsing, Bottom-Up Parsing, CKY Parsing, Earley Parsing, Probabilistic Context-free Parsing (PCFG), Inside-Outside Probabilities.	8
6	**Neural NLP and Modern Architectures:** Introduction to Neural Language Model - RNN, LSTM, GRU and Attention. Basic understanding of Transformer architecture and pre-trained models such as BERT and GPT.	9
	Total	**45**

Text Books:

1. Daniel Jurafsky and James H Martin, "Speech and Language Processing", 3e, Pearson Education, 2026
2. "Foundations of Statistical Natural Language Processing", Christopher D. Manning Hinrich Schiitze, MIT Press, 2026.

Reference Books:

1. Richard M Reese, Natural Language Processing with Java, OReilly Media, 2015
2. Nitin Indurkhya and Fred J. Damerau, Handbook of Natural Language Processing, Second Edition, Chapman and Hall/CRC Press, 2010
3. Natural Language Processing with Python" by Steven Bird, Ewan Klein, and Edward Loper, O'Reilly Media, 2009
4. The Oxford Handbook of Computational Linguistics, Ruslan Mitkov ed., MIT Press, 2005
5. Sowmya Vajjala, Bodhisattwa Majumder, Anuj Gupta, Harshit Surana "Practical Natural Language Processing", O'Reilly; First edition, 2020.

Prerequisite:

1. Basic Knowledge of Probability
2. Basic Machine Learning algorithms

Swami Keshvanand Institute of Technology, Management & Gramothan, Jaipur

Name of the Programme: B. Tech. in Information Technology	**Year**: III	**Semester**: VI
Course Name: Blockchain	**Course Code**: ITUL613/: CSUL613/ CAUL613/ CDUL613	**Credit**: 3
Max Marks: 100	**CIE:** 40	**SEE:** 60
End Term Exam Time: 3 Hrs.	**Teaching Scheme:** CI (45) + TW & SL (45) = 90 hrs. per semester	

Module No.	Contents	Hours
1	**Introduction:** Objective, Scope, Outcome of the Course and Prerequisite.	1
2	**Fundamentals of Blockchain Technology:** Limitations of traditional centralized systems, Evolution of blockchain technology- Blockchain 1.0, Blockchain 2.0, Blockchain 3.0, Key features- Decentralization, Transparency, Immutability, Distributed Ledger, Advantages and limitations of blockchain.	8
3	**Cryptographic Foundations of Blockchain:** Hash functions and properties, Public-Key-Cryptography, Digital Signature, Merkle trees and Merkle root verification, Distributed hash tables (DHT). **Blockchain Architecture:** Architecture and components, Block structure and block linking mechanism, Types of blockchains, Blockchain layers and their functions.	8
4	**Consensus Protocols:** Need for consensus, Byzantine Generals Problem, Consensus protocols in blockchain, Proof of work (PoW)- working principle, mining process, difficulty adjustment, Proof of stake (PoS)- validator selection, staking, rewards and penalties, Comparison of PoW vs PoS (security, scalability, energy efficiency), Other consensus Protocol: Delegated Proof of Stake, Proof of Authority, Practical Byzantine Fault Tolerance (PBFT).	9
5	**Bitcoin Blockchain:** Introduction and design principles, Bitcoin blockchain structure and genesis block, Bitcoin transactions- inputs, outputs, Unspent Transaction Output (UTXO) model, Transaction lifecycle and validation, Mining process, block creation, and block rewards and halving, Bitcoin wallets and address types, Security aspects and limitations of Bitcoin.	10
6	**Smart Contracts:** Introduction to smart contracts, Smart contract characteristics and lifecycle, **Ethereum**: Ethereum architecture and components, Ethereum accounts and transactions, Ethereum Virtual Machine (EVM), Gas and transaction execution, Decentralized Applications (DApps), Blockchain applications- Finance, Supply Chain, Healthcare, Governance.	9
	Total	**45**

Text Books:

1. I. Bashir, Mastering Blockchain: A Deep Dive into Distributed Ledgers, Consensus Protocols, Smart Contracts, DApps, Cryptocurrencies, Ethereum, and More, 4th ed. Birmingham, U.K.: Packt Publishing, 2023.
2. A. Narayanan, J. Bonneau, E. Felten, A. Miller, and S. Goldfeder, Bitcoin and Cryptocurrency Technologies: A Comprehensive Introduction, 2nd ed. Princeton, NJ, USA: Princeton University Press, 2024.

Reference Books:

1. M. Swan, Blockchain: Blueprint for a New Economy, 1st ed. Sebastopol, CA, USA: O'Reilly Media, 2015.
2. S. Nakamoto, "Bitcoin: A Peer-to-Peer Electronic Cash System," Bitcoin Whitepaper, 2008.
3. S. Kumar and A. Saxena, Blockchain Technology: Concepts and Applications, 2nd ed. Hoboken, NJ, USA: Wiley, 2022.
4. B. Singhal, G. Dhameja, and P. S. Panda, Beginning Blockchain: A Beginner's Guide to Building Blockchain Solutions, 2nd ed. Berkeley, CA, USA: Apress, 2022.
5. A. M. Antonopoulos, Mastering Bitcoin: Programming the Open Blockchain, 3rd ed. Sebastopol, CA, USA: O'Reilly Media, 2023.

Prerequisite:

1. Fundamentals of Database Systems, Cryptography and Distributed System

Swami Keshvanand Institute of Technology, Management & Gramothan, Jaipur

Name of the Programme: B. Tech. in Information Technology	**Year**: III	**Semester**: VI
Course Name: Wireless Networks	**Course Code**: ITUL614/CSUL512/ CIUL613	**Credit**: 3
Max Marks: 100	**CIE:** 40	**SEE:** 60
End Term Exam Time: 3 Hrs.	**Teaching Scheme:** CI (45) + TW & SL (45) = 90 hrs. per semester	

Module No.	Contents	Classroom Instruction (CI) Hours
1	**Introduction:** Objective, Scope, Outcome of the Course and Prerequisite.	1
2	**Introduction To Ad-Hoc Network**: Difference between cellular network and ad-hoc network, Introduction to ad-hoc network- definition, characteristics, feature, issue and applications, Mobility models- Indoor and outdoor, Ad- hoc wireless internet, Basic idea of various ad-hoc networks (MANET, VANET, FANET and SANET).	8
3	**Routing Protocols:** Introduction, design issue, and goals, Routing Metrics, Classification of routing protocols- Proactive, Reactive, Table driven On-demand, hybrid, hierarchical, Power-aware and QoS aware routing.	10
4	**Introduction to Sensor Network:** Comparison of sensor network with ad-hoc network, Characteristics, design issue and challenges, advantages and applications, Enabling technologies for sensor network, Classification of sensor networks and their limitations. **Basic Architecture Framework:** Physical Layer, Basic Components, Source Encoding, Channel Encoding, Modulation, Network Architecture-Sensor Network Scenarios, Optimization Goals and Figures of Merit, Gateway Concepts.	10
5	**MAC protocols:** Introduction, design Issues, goals and classification, Contention based protocols- with reservation mechanisms and scheduling mechanisms, S-MAC protocol, B-MAC protocols, IEEE standards: 802.11a, 802.11b, 802.11g, 802.15, 802.15.4 and Zigbee. **Dissemination protocol:** Dissemination protocol for large sensor network, Data gathering and Data fusion, Quality of a sensor network.	9
6	**Sensor Network Platforms and Tools:** Operating system and execution environment, Node level Software platforms - TinyOS and nesC, Node-level Simulators - NS2 and its extension to sensor networks.	7
	Total	**45**

Text Books:

1. W. Dargie and C. Poellabauer, Fundamentals of Wireless Sensor Networks: Theory and Practice. Hoboken, NJ, USA: John Wiley & Sons, 2010.
2. A. Nimbalkar and D. Deshmukh, Ad Hoc and Wireless Sensor Network, 1st ed. Pune, India: Technical Publications, 2021.

Reference Books:

1. S. Misra, I. Woungang, and S. C. Misra, Guide to Wireless Sensor Networks. London, U.K.: Springer, 2012.
2. K. Sohraby and D. Minoli, Wireless Sensor Networks: Technology, Protocols, and Applications. Hoboken, NJ, USA: Wiley-InterScience, 2007.
3. C. S. R. Murthy and B. S. Manoj, Ad Hoc Wireless Networks: Architectures and Protocols, 2nd ed. Noida, India: Pearson Education, 2011.
4. C. M. Cordeiro and D. P. Agrawal, Ad Hoc and Sensor Networks: Theory and Applications. Singapore: World Scientific Publishing, 2011.

Prerequisite: 1 . Basic knowledge of Computer Networks and Data Structures and Algorithms.

2.Understanding of fundamental concepts of Operating Systems is desirable

Swami Keshvanand Institute of Technology, Management & Gramothan, Jaipur

Name of the Programme: B. Tech. in Information Technology	**Year**: III	**Semester**: VI
Course Name: DevOps Engineering Lab	**Course Code**: ITUP620	**Credit**: 1
Max Marks: 100	**CIE:** 40	**SEE:** 60
End Term Exam Time: 3 Hrs.	**Teaching Scheme:** LI (30) = 30 hrs. per semester	

S. No.	Experiments
1.	Understand basic linux commands and shell scripting.
2.	Git Setup and Repository Management (Combined Lab):Install and configure Git; perform basic operations (init, add, commit, status, log); clone repository and perform push and pull.
3.	Docker Installation and Basic Commands: Install Docker and execute commands: docker pull, run, images, ps.
4.	Docker Container Lifecycle Management: Create containers, start/stop/restart containers, manage images and expose ports.
5.	Kubernetes Deployment (Minikube): Install Minikube and deploy a simple containerized application using Pods.
6.	Jenkins Setup and CI Pipeline: Install and configure Jenkins; create a basic job and integrate it with Git.
7.	Build Automation & CI Basics: Create a simple project and perform basic build and test automation.
8.	CI/CD Pipeline Design: Design a basic CI/CD pipeline flow including stages: Code → Build → Test → Deploy (manual simulation).
9.	Monitoring using Prometheus and Grafana: Install Prometheus and Grafana; create a dashboard to monitor application metrics.
10.	End-to-End CI/CD Pipeline: Build a Docker image and deploy an application on Kubernetes.

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Name of the Programme: B. Tech. in Information Technology	**Year**: III	**Semester**: VI
Course Name: Competitive Programming Lab	**Course Code**: ITUP621	**Credit**: 1
Max Marks: 100	**CIE:** 60	**SEE:** 40
End Term Exam Time: 3 Hrs.	**Teaching Scheme:** LI (30) = 30 hrs. per semester	

S. No.	Experiments
1.	API Rate Limiter (Sliding Window).
2.	Distributed Task Scheduler.
3.	Search Autocomplete Engine.
4.	Real-Time Leaderboard.
5.	File Deduplication System.
6.	Sliding Window Stock Analytics.
7.	Smart Ride Matching System.
8.	Network Packet Routing.
9.	Fraud Detection Engine.
10.	Memory Allocation Simulator.
11.	Version Control Diff Tool.
12.	Distributed Cache (LRU).
13.	Order Fulfillment Optimization (Amazon-style).
14.	Longest Duplicate Substring.
15.	Unique Paths with Obstacles.

Name of the Programme: B. Tech. in Information Technology	**Year**: III	**Semester**: VI
Course Name: Deep Learning Lab	**Course Code**: ITUP622	**Credit**: 1.5
Max Marks: 100	**CIE:** 60	**SEE:** 40
End Term Exam Time: 3 Hrs	**Teaching Scheme:** LI (45) = 45 hrs. per semester	

S. No.	Experiments
1	Develop a multilayer feedforward neural network for classification and evaluate performance using: a) Different activation functions b) Different optimizers
2	Build a convolutional neural network for image classification and experiment with: a) Different filter sizes b) Different pooling techniques
3	Develop an image classification model using transfer learning with: a) A pretrained CNN model b) A custom CNN model Compare accuracy and training time.
4	Develop a sequential deep learning model for prediction using: a) Simple Recurrent Neural Network (RNN) b) Long Short-Term Memory (LSTM)
5	Write a program to generate synthetic data using: a) Generative Adversarial Networks (GANs) b) Auto encoders
6	Mini Project: The student will design a complete application, such as: a) Medical image classification b) Fraud detection c) Speech recognition d) Smart surveillance

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Name of the Programme: B. Tech. in Information Technology	**Year**: III	**Semester**: VI
Course Name: Image Processing Lab	**Course Code**: ITUP623	**Credit**: 1.5
Max Marks: 100	**CIE:** 60	**SEE:** 40
End Term Exam Time: 3 Hrs.	**Teaching Scheme:** LI (45) = 45 hrs. per semester	

S. No.	Experiments
1	Write a program to draw objects such as Flag, bouncing ball using inbuilt graphics functions and Display Drivers.
2	Write a program to draw a line using DDA algorithm & Bresenham's line algorithm.
3	Write a program to draw a circle using the Midpoint circle algorithm.
4	Write a program to implement 2D & 3D Transformations: Translation, Rotation, Scaling, Reflection, and Shearing.
5	Write a program to: a. Read, display, and save an image in different formats. b. Perform image histogram plotting and histogram equalization.
6	Write a program to: a. Perform Geometric transformations. This experiment shows image rotation, scaling, and translation. b. To convert the original image into its mirror image by applying horizontal or vertical reflection and analyze the effect of geometric transformation on image orientation.
7	Write a program to: a. Convert the original image into its negative image by applying intensity transformation and analyze the effect of inversion on image appearance and details. b. Perform image enhancement using smoothing (average/median) filters.
8	Write a program to: a. Implement image restoration using noise removal techniques. b. Implement image thresholding for segmentation.
9	Write a program to: a. Detect edges using Sobel, Prewitt, and Canny operators. b. To apply erosion and dilation operations on an image and observe their impact on image structure.
10	Write a program to implement and analyze feature extraction techniques using HOG, SIFT, and SURF algorithms for detecting and describing important features in digital images.

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Name of the Programme: B. Tech. in Information Technology	**Year**: III	**Semester**: VI
Course Name: Mobile Application Development Lab	**Course Code**: ITUP624	**Credit**: 1
Max Marks: 100	**CIE:** 60	**SEE:** 40
End Term Exam Time: 3 Hrs.	**Teaching Scheme:** LI (30) = 30 hrs. per semester	

S. No.	Experiments
1.	To understand Android Studio project architecture, create a "Hello World" application, so that students get an idea about the Android Studio IDE.
2.	Design simple GUI application e.g. calculator and implement its logic, to apply understanding of different layouts and how the data is transferred from front end to back end and how business logic is performed on it.
3.	Create an application with a login module, to implement authentication process and navigation between activities using Intents in android App.
4.	Create an Android Application Integrating REST API to fetch and display employee data of an organization (JSON based).
5.	Create an Android application to design responsive UI using Material Design components like registration form.
6.	Create an Android application for database creation using SQlite Database, so that application data can be stored at permanent storage of mobile devices like storing data of a user.
7.	Develop a Location-based application using GPS with runtime permissions to display the current location of the user.
8.	Design an Android app that allows the user to capture an image, compress it to reduce size, store it locally, and display it within the application.
9.	Introduction to Flutter and Dart: Installation of Flutter SDK and Dart SDK.
10.	Develop a simple cross-platform mobile application (e.g., counter or login screen) using Flutter widgets and hot reload.