Semester

V

Swami Keshvanand Institute of Technology, Management & Gramothan, Jaipur

Name of the Programme: B. Tech. in Computer Science and Engineering (AI)	**Year**: III	**Semester**: V
Course Name: Design and Analysis of Algorithms	**Course Code**: CAUL501/ CSUL501/ CDUL501/ CIUL601/ ITUL501	**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.

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Name of the Programme: B. Tech. in Computer Science and Engineering (AI)	**Year**: III	**Semester**: V
Course Name: Machine Learning	**Course Code**: CAUL502/ CSUL502/ CDUL502/ CIUL502/ ITUL502	**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 TensorFlow: 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

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Name of the Programme: B. Tech. in Computer Science and Engineering (AI)	**Year**: III	**Semester**: V
Course Name: Automata Theory and Compiler Design	**Course Code**: CAUL503/ CDUL503/ CIUL503	**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 Automata Theory as a foundation for Compiler Design:** alphabets, strings, Kleene closure, languages, DFA and NFA with their equivalence, and regular expressions with conversions to finite automata; compiler basics: translators, compiler vs interpreter, phases of compilation, lexical analysis (tokens, input buffering), error handling, and bootstrapping.	9
3	**Context Free Grammars (CFG):** Introduction to CFG, constructing a CFG, derivations and languages, parse tree, ambiguous grammar **Parsing:** Introduction to parsing. Top-down parsing, LL grammars & 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:** 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	7
	Total	**45**

Text Books:

1. K. L. P. Mishra and N. Chandrasekaran, *Theory of Computer Science: Automata, Languages and Computation*, 3rd ed., PHI Learning Pvt. Ltd., New Delhi, 2007, reprinted 2022.
2. A. V. Aho, M. S. Lam, R. Sethi, and J. D. Ullman, *Compilers: Principles, Techniques, and Tools*, 2nd ed., Pearson Education, 2006, reprinted 2022–2023.

Reference Books:

1. J. C. Martin, *Introduction to Languages and the Theory of Computation*, 4th ed., McGraw-Hill, 2010.
2. K. C. Louden, *Compiler Construction: Principles and Practice*, 1st ed., Cengage Learning, 2012.
3. D. Grune et al., *Modern Compiler Design*, 2nd ed., Springer, 2012.

Prerequisite: Basic knowledge of Discrete Mathematics (sets, relations, functions).

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

Understanding of programming and application deployment

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Name of the Programme: B. Tech. in Computer Science and Engineering (AI)	**Year**: III	**Semester**: V
Course Name: Social Network Analysis	**Course Code**: CAUL511/ CSUL614/ CDUL511/ CIUL614	**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	**Foundations of Network Science and Tools: Analysis Steps in social network analysis** - network definition, manipulation, calculation, visualization. Graph terminology, Social networks, Technological networks, Sampling and data characteristics. **Introduction to NetworkX**: Installing and importing NetworkX, creating graphs using NetworkX, Adding and removing nodes and edges, Basic graph analysis using NetworkX.	10
3	**Network Structure, Measures, and Evolution:** Network Measures - Degree Centrality, Betweenness Centrality, Closeness Centrality, Eigenvector Centrality, Clustering Coefficient**. Network Growth Models**: Random Graph Models (Erdos-Renyi Model), Preferential Attachment Model, Scale-Free Networks, Small World Networks.	7
4	**Link Analysis, Visualization, and Community Detection:** Link Analysis and Ranking Algorithms**-** Concept of Link Analysis, PageRank Algorithm, HITS Algorithm, Applications in Web Search, Layout Algorithms (Spring, Circular, Random Layouts). **Community Detection**: Introduction to Community Detection, Modularity Concept, Girvan-Newman Algorithm, Louvain Method, Applications of Community Detection.	9
5	**Predictive and Dynamic Network Behavior:**Link Prediction Techniques - Need for Link Prediction, Similarity-based Methods, Machine Learning Approaches for Link Prediction, Cascade Behavior Models: Information Diffusion Models, Independent Cascade Model, Linear Threshold Model. **Network Effects and Information Diffusion**: Viral Marketing Concepts, Spread of Information in Social Networks, Influence Maximization. **Anomaly Detection in Networks**: Types of Anomalies in Networks, Statistical Methods for Anomaly Detection, Machine Learning Methods for Anomaly Detection, Applications in Fraud Detection and Security.	11
6	**Advanced Graph Learning and Applications:**Graph Representation Learning: Need for Graph Embeddings, Node Embedding Techniques, DeepWalk Algorithm, Node2Vec Algorithm, Graph Neural Networks - Introduction to GNN, Graph Convolutional Networks (GCN), Applications of GNN. **Applications and Case Studies**: Social Network Analysis, Recommendation Systems, Fraud Detection, Biological Network Analysis.	7
	Total	**45**

Text Books:

1. T. Chakraborty, Social Network Analysis, 1st ed. Hoboken, NJ, USA: Wiley, 2024.
2. A.-L. Barabási, Network Science, 1st ed. Cambridge, U.K.: Cambridge University Press, 2016.

Reference Books:

1. S. P. Borgatti, M. G. Everett, and J. C. Johnson, Analyzing Social Networks, 3rd ed. Thousand Oaks, CA, USA: SAGE Publications, 2024.
2. J. Scott, Social Network Analysis, 4th ed. Thousand Oaks, CA, USA: SAGE Publications, 2023.
3. S. Yang, F. B. Keller, and L. Zheng, Social Network Analysis: Methods and Examples, 1st ed. Thousand Oaks, CA, USA: SAGE Publications, 2023.

Prerequisite:

1. Basic understanding of Graph Concepts and Algorithms - Dijkstra, Adjacency Matrix, Subgraphs, BFS, DFS, Graph Theory
2. Basic understanding of Databases, Cloud, and Big Data, Python programming, Probability and Statistics, Machine Learning

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Name of the Programme: B. Tech. in Computer Science and Engineering (AI)	**Year**: III	**Semester**: V
Course Name: Cryptography and Network Security	**Course Code**: CAUL512/ CSUL503/ CDUL512/ CIUL512/ ITUL511	**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, Malware and 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, Mobile Device Security, IEEE 802.11 (Wi-Fi) Standards, and Wireless Security Protocols, including WPA3.	9
6	**E-Mail Security:** Pretty Good Privacy, S/MIME. **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.

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Name of the Programme: B. Tech. in Computer Science and Engineering (AI)	**Year**: III	**Semester**: V
Course Name: Design and Analysis of Algorithms Lab	**Course Code**: CAUP520	**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.

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Name of the Programme: B. Tech. in Computer Science and Engineering (AI)	**Year**: III	**Semester**: V
Course Name: Machine Learning Lab	**Course Code**: CAUP521	**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.

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Name of the Programme: B. Tech. in Computer Science and Engineering (AI)	**Year**: III	**Semester**: V
Course Name: Compiler Design Lab	**Course Code**: CAUP522	**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	Write a LEX program to identify whether a given string is a keyword or not.
2	Write a LEX/C/C++/Python/Java program to Count total no. of keywords in a file. [Taking file from user]
3	Write a LEX/C/C++/Python/Java program to count total no of operators in a file. [Taking file from user]
4	Write a LEX/C/C++/Python/Java program to count the total occurrence of each character in a given file. [Taking file from user]
5	Write a C program to insert, delete and display the entries in the Symbol Table.
6	Write a lex program to count blank spaces, words, lines in a given file.
7	Write a lex program to count the no. of vowels and consonants in a C file.
8	Write a YACC program to recognize strings aaab,abbb using a^nb^n, whereb>=0.
9	Write a YACC program to evaluate an arithmetic expression involving operators +, -, * and /.
10	Write a YACC program to check validity of a strings abcd, aabbcd using grammar $a^nb^nc^md^m$, where n , m>0

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Name of the Programme: B. Tech. in Computer Science and Engineering (AI)	**Year**: III	**Semester**: V
Course Name: Programming for Problem Solving-I Lab	**Course Code**: CAUP523	**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	Time and Space Complexity | Arrays - Basics and Techniques
2	Practice Session – Array-Based Problem Solving (Kadane's Algorithm, Trapping Rain Water, Two Sum, Move Zeroes)
3	Strings – Palindrome, Anagram, Substrings, Reversals
4	Searching Algorithms (Linear Search, Binary Search, Binary Search on Answer Concept)
5	Practice Session – Searching Algorithms (Binary Search Problems)
6	Sorting Algorithms (Bubble Sort, Insertion Sort, Selection Sort)
7	Introduction to Linked Lists (Singly Linked List: Creation, Traversal, Insertion, Deletion)
8	Practice Session – Linked List Problems (Cycle Detection, Reversing Linked List)
9	Doubly and Circular Linked Lists (Operations, Use Cases)
10	Stack Implementation using Class (Reverse stack , Delete mid , insert at bottom , sort a stack ,Reverse stack,Redundant Brackets,Valid Parentheses)
11	Practice Session Stacks- (NSE, PSE, NGE, PGE - Monotonic stack), largest Area in Histogram , Trapping Rainwater, Asteroid Collision
12	Queue Implementation (Circular Queue, Deque) (Stacks- Sum of Subarray minimums , Sum of Subarray Ranges)
13	Introduction to Hashing (HashMap, HashSet, Frequency Counting, Applications in Arrays and Strings)
14	Practice Session – Hashing Problems (Two Sum, Longest Subarray with Sum K)
15	Hashing Problem Solving (Group Anagrams, Subarray with Zero Sum)
16	Recursion Basics (Factorial, Fibonacci, GCD, Sum of Digits)
17	Practice Session – Recursion Problems (Factorial, Fibonacci, GCD)
18	Recursion Advanced | Introduction to Backtracking (Subset Generation, Permutations, N-Queens)
19	Binary Tree Basics (Structure, Properties, Tree Traversals – Inorder, Preorder, Postorder)
20	Practice Session – Binary Tree Traversals
21	Binary Tree Problem Solving (Diameter of Binary Tree, Height, Count, and Sum of Nodes)
22	Binary Search Trees (Insert, Delete, Search, Validation)
23	Practice Session – BST Problems (Insert, Delete, Search)
24	Advanced BST Problems (Kth Smallest and Largest Elements, Converting BST to Sorted DLL)
25	Tree Practice Session (Vertical Order, Top View, Flatten Binary Tree)
26	Heaps (Min Heap and Max Heap, Heapify, Insert, Delete, Applications)
27	Practice Session – Heaps (Heapify, Top K Elements)

Semester

VI

Swami Keshvanand Institute of Technology, Management & Gramothan, Jaipur

Name of the Programme: B. Tech. in Computer Science and Engineering (AI)	**Year**: III	**Semester**: VI
Course Name: Intelligent Algorithms	**Course Code**: CAUL601	**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 Intelligent Algorithms:** Definition and need of Intelligent Algorithms, Historical Context and Evolution, Significance in Modern Computing, Soft Computing vs Hard Computing, Role in optimization and control, Limitations of Traditional Optimization Techniques.	6
3	**Fuzzy Logic:** Biological analogues, Applications, Basic elements of fuzzy systems, Fuzzification, Membership functions, Defuzzification, Fuzzy Inference system.	5
4	**Genetic Algorithms:** Background and Biological Basis, Fundamental Concepts of Genetic Algorithms. Genetic Structure, Representation & Workflow. Selection Mechanisms & Genetic Operators. **Applications & Case Studies:** Genetic Algorithms in Search and Optimization, GA-based Clustering Algorithm, Image Processing and Pattern Recognition. Real-World Implementations.	7
5	**Swarm Algorithm:** Particle Swarm algorithms - particle movement concept, particle swarm optimization, variable length PSO, applications of PSO. Artificial Bee Colony algorithms - ABC basics, ABC in optimization, applications of Bee algorithms.	6
6	**Optimization Algorithm:** Ant Colony Optimization (ACO) algorithms, Grey Wolf Optimization, Exploration vs exploitation in optimization algorithms.	5
	Total	**30**

Text Books:

1. A. Y. Zomaya, Handbook of Nature-Inspired and Innovative Computing. Berlin, Germany: Springer, 2006.
2. T. J. Ross, Fuzzy Logic with Engineering Applications, 4th ed. Hoboken, NJ, USA: Wiley, 2016.

Reference Books:

1. X.-S. Yang, Nature-Inspired Optimization Algorithms, 2nd ed. Amsterdam, Netherlands: Elsevier, 2020.
2. O. Castillo and P. Melin, Eds., New Horizons for Fuzzy Logic, Neural Networks and Metaheuristics. Cham, Switzerland: Springer, 2024.
3. S. Mirjalili, Grey Wolf Optimizer: A Pack of Solutions for Your Optimization Problems. Amsterdam, Netherlands: Elsevier, 2026.

Prerequisite:

1. Fundamentals of Programming, Data Structures, Probability and Statistics.
2. Basic concepts of Artificial Intelligence and Optimization.

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Name of the Programme: B. Tech. in Computer Science and Engineering (AI)	**Year**: III	**Semester**: VI
Course Name: Internet of Things	**Course Code**: CAUL602/ CSUL701/ CDUL602/ CIUL602/ ITUL701	**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 IoT:** Definition, Characteristics, Applications, Challenges, Basics of Networking, Layered Network Model, Data Link Layer Addressing, Network Link Layer Addressing, Basics of WSN, M2M communication, Cyber Physical System.	9
3	**IoT Sensing, Actuation and Processing:** Sensors, Sensor Characteristics, Sensorial Deviations, Sensing Types, Sensing Considerations, Humidity sensors, Ultrasonic sensors, Temperature sensors, Proximity Sensors, Infrared sensors, Actuators, Actuator Types, Actuators Characteristics, IoT Processing Topologies and Types.	10
4	**IoT Connectivity Technologies:** IEEE 802.15.4, Zigbee, Wi-Fi, Bluetooth, LoRa, NB - IoT, RFID, NFC, Sigfox, Z-Wave, Cellular Network (4G LTE, 5G).	8
5	**IoT Communication Protocols:** Infrastructure Protocols- IPv6, RPL, 6LoWPAN, Data Protocols- MQTT, CoAP, AMQP, XMPP, SOAP, REST, WebSocket.	9
6	**Case study of IoT Applications:** Home automation, Smart Cities, Agricultural IoT, Vehicular IoT, Healthcare IoT, Internet of battlefield things, Internet of drones.	8
	Total	**45**

Text Books:

1. S. Misra, A. Mukherjee, and A. Roy, Introduction to the Internet of Things. Cambridge, U.K.: Cambridge University Press, 2021.
2. A. Bahga and V. Madisetti, Internet of Things: A Hands-On Approach. New Delhi, India: Orient Blackswan Private Limited, 2015.

Reference Books:

1. R. Buyya and A. V. Dastjerdi, Eds., Internet of Things: Principles and Paradigms. Amsterdam, Netherlands: Elsevier, 2016.
2. D. Hanes, G. Salgueiro, P. Grossetete, R. Barton, and J. Henry, IoT Fundamentals: Networking Technologies, Protocols, and Use Cases for the Internet of Things. Indianapolis, IN, USA: Cisco Press, 2017.
3. S. Misra, C. Roy, and A. Mukherjee, Introduction to Industrial Internet of Things and Industry 4.0. Boca Raton, FL, USA: CRC Press, 2020.

Prerequisite:

1. Computer Networks
2. Embedded Systems
3. Cloud and Data Management

Swami Keshvanand Institute of Technology, Management & Gramothan, Jaipur

Name of the Programme: B. Tech. in Computer Science and Engineering (AI)	**Year**: III	**Semester**: VI
Course Name: Deep Learning	**Course Code**: CAUL603/ CSUL603/ CDUL603/ CIUL611/ ITUL611	**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 & 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. I. 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: The course requires foundational knowledge of mathematics (linear algebra, probability, and calculus), proficiency in Python programming, understanding of data structures, and basic concepts of machine learning and artificial intelligence.

Swami Keshvanand Institute of Technology, Management & Gramothan, Jaipur

Name of the Programme: B. Tech. in Computer Science and Engineering (AI)	**Year**: III	**Semester**: VI
Course Name: Image Processing	**Course Code**: CAUL611/ CSUL611/ CDUL611/ CIUL611/ ITUL603	**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, midpoint Circle Drawing Algorithm.	8
3	**2D & 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.

Fundamental concepts of Linear Algebra and Probability.

Swami Keshvanand Institute of Technology, Management & Gramothan, Jaipur

Name of the Programme: B. Tech. in Computer Science and Engineering (AI)	**Year**: III	**Semester**: VI
Course Name: Parallel and Distributed Computing	**Course Code**: CAUL612/ CSUL612/ CDUL612/ CIUL612/ ITUL512	**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 Book:

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. Operating System
2. Computer Networking
3. Computer Architecture and Organization

Swami Keshvanand Institute of Technology, Management & Gramothan, Jaipur

Name of the Programme: B. Tech. in Computer Science and Engineering (AI)	**Year**: III	**Semester**: VI
Course Name: Blockchain	**Course Code**: CAUL613/ CSUL613/ CDUL613/ ITUL613	**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 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, Ledger. **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
2. Cryptography
3. Distributed System

Swami Keshvanand Institute of Technology, Management & Gramothan, Jaipur

Name of the Programme: B. Tech. in Computer Science and Engineering (AI)	**Year**: III	**Semester**: VI
Course Name: DevOps Practices and Principles	**Course Code**: CAUL614/ CSUL511/ CDUL614/ CIUL511	**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 DevOps & Lifecycle:** DevOps Introduction, Goals & Benefits of DevOps, DevOps Lifecycle, Roles & Responsibilities of DevOps Engineer, DevOps Principles (Collaboration, Automation, Continuous Improvement, Monitoring), Agile vs DevOps, Infrastructure as Code (IaC) Concepts.	8
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.	8
4	**Continuous Integration:** Introduction to Continuous Integration (CI), CI Workflow, CI Tools Overview. **Jenkins & Build Automation:** Introduction to Jenkins, Jenkins Architecture (Master-Agent/Controller-Node), Jenkins Dashboard Overview, Jenkins Job/Pipeline Concepts (Freestyle vs Pipeline), Jenkinsfile Basics, Build Automation Concepts, Automated Testing in CI Pipeline, Continuous Feedback in CI Process.	9
5	**Continuous Deployment & 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.	9
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.	10
	Total	**45**

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: Basic knowledge of Programming Concepts, Familiarity with Operating Systems

Swami Keshvanand Institute of Technology, Management & Gramothan, Jaipur

Name of the Programme: B. Tech. in Computer Science and Engineering (AI)	**Year**: III	**Semester**: VI
Course Name: Internet of Things Lab	**Course Code**: CAUP620	**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	Introduction to Raspberry Pi. Perform the following experiments using R-Pi. a. Light an LED through a Python program. b. Get input from two switches and switch on the corresponding LEDs. c. Flash an LED at a given on-time and off-time cycle, where the two times are taken from a file.
2	Design a 4-bit counter using Python on Raspberry Pi.
3	Perform the following experiments using R-Pi. a. Flash an LED based on cron output (acts as an alarm). b. Switch on a relay at a given time using cron, where the relay's contact terminals are connected to a load.
4	Control the electrical appliance remotely using the MQTT protocol.
5	Interface a 16×2 LCD using the I2C protocol with the Raspberry Pi.
6	Interface Temperature & Humidity sensor using Raspberry Pi and send the data over the ThingSpeak cloud infrastructure.
7	Write a program in Python to drive a servo motor at different angles, starting from 30 degrees and ending around 180 degrees. Also, provide negative angle rotation using different delays.
8	Write a program to control the step size of the stepper motor and control the direction and speed of the stepper motor.
9	Design a system that blinks an LED when you detect motion in an area using a PIR sensor.
10	a) Design a system to measure the distance of an object using an Ultrasonic sensor. b) Interface the LDR sensor to measure light intensity.

Swami Keshvanand Institute of Technology, Management & Gramothan, Jaipur

Name of the Programme: B. Tech. in Computer Science and Engineering (AI)	**Year**: III	**Semester**: VI
Course Name: Deep Learning Lab	**Course Code**: CAUP621	**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)** Autoencoders
6	Mini Project: **The student will design a complete application, such as:** • Medical image classification • Fraud detection • Speech recognition • Smart surveillance

Swami Keshvanand Institute of Technology, Management & Gramothan, Jaipur

Name of the Programme: B. Tech. in Computer Science and Engineering (AI)	**Year**: III	**Semester**: VI
Course Name: Image Processing Lab	**Course Code**: CAUP622	**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.

Swami Keshvanand Institute of Technology, Management & Gramothan, Jaipur

Name of the Programme: B. Tech. in Computer Science and Engineering (AI)	**Year**: III	**Semester**: VI
Course Name: Advance Java Lab	**Course Code**: CAUP623	**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.

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Name of the Programme: B. Tech. in Computer Science and Engineering (AI)	**Year**: III	**Semester**: VI
Course Name: Programming for Problem Solving-II Lab	**Course Code**: CAUP624	**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	Introduction to Greedy Algorithms – Concept, greedy choice property, optimal substructure, when greedy works/fails
2	Classic Greedy Problems – Activity Selection, Job Sequencing, Fractional Knapsack (logic + implementation)
3	Advanced Greedy Problems – Huffman Encoding, Minimum Platforms, Coin Change, Interval scheduling (Greedy vs DP comparison)
4	Introduction to Dynamic Programming – Overlapping subproblems, optimal substructure, recursion vs DP
5	DP Fundamentals – Memoization vs Tabulation, state definition, transition formulation
6	1D DP Problems – Fibonacci, Climbing Stairs, House Robber, basic DP optimizations
7	2D DP Problems – 0/1 Knapsack, Subset Sum, Coin Change (DP), table visualization
8	String DP – Longest Common Subsequence (LCS), Longest Common Substring, Edit Distance
9	Introduction to Graphs – Graph representations, BFS, DFS, traversal applications
10	Core Graph Algorithms – Shortest Path (BFS, Dijkstra), Cycle Detection, Topological Sort
11	Advanced Graph Topics – Minimum Spanning Tree (Kruskal, Prim), DP on DAGs, practice problems
12	Union-Find (DSU), SCC (Kosaraju/Tarjan), Bellman-Ford & Floyd-Warshall, Bridges & Articulation Points with mixed interview practice.
13	Disjoint Set Union (DSU) → Union by Rank, Path Compression, Cycle Detection, Connected Components, Practice Problems
14	Number Theory Basics → Sieve of Eratosthenes, Prime Factorization, Precomputation Techniques, Practice Problems
15	GCD & LCM → Euclidean Algorithm, Properties, Applications in Problems, Practice Questions
16	Modular Arithmetic → Mod Properties, Binary Exponentiation (Fast Power), Large Number Computation
17	Modular Inverse → Fermat's Theorem, Modular Division, Implementation + Practice
18	Bit Manipulation Basics → Bitwise Operators, Set/Unset/Toggle Bits, Power of 2, Count Set Bits
19	Advanced Bit Manipulation → XOR Properties, Subset Tricks, XOR-Based Problems
20	Trie Data Structure → Insert, Search, Prefix Matching, Implementation + Practice
21	Trie + Bit Manipulation → XOR Trie, Maximum XOR Pair Problems
22	Segment Tree Basics → Build Tree, Range Queries (Sum), Implementation
23	Segment Tree Advanced → Min/Max Queries, Lazy Propagation (Introduction), Updates
24	Segment Tree Practice → Mixed Problems (Range Queries + Updates), Competitive Level Practice
25	Codeforces Practice 1 → Solve 2 Easy + 2 Medium Problems, Focus on Speed & Accuracy
26	Codeforces Practice 2 → Solve 3–4 Mixed Problems, Pattern Recognition
27	Final Mock Contest → 2-Hour Contest Simulation + Post-Contest Analysis & Upsolving