Semester

V

Swami Keshvanand Institute of Technology, Management & Gramothan, Jaipur

Name of the Programme: B. Tech. in Computer Science and Engineering (IoT)	**Year**: III	**Semester**: V
Course Name: Embedded System Design	**Course Code**: CIUL501	**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 Embedded Systems**: Overview of Embedded Systems, comparison between microprocessor and micro-controller. General architecture of microcontrollers and timing diagrams, Timers and counters, Typical hardware interface controllers (I/O Ports, Tri-state buffers, USART and USB, DMA), Memory organization in 8051 microcontroller, System buses and interfacing concepts.	9
3	**Assembly Language Programming for 8051:** Introduction to Assembly Language Programming, Instruction Set Architecture of 8051, Addressing Modes in 8051, Type of interrupts, ISR, access to ISR, interrupts in micro-controller 8051, Context saving, Context switching, Shared data, atomic operation to resolve share data problem, critical section, Interrupt latency.	9
4	**Program Modelling Concept:** Program Models, DFG Models, State machine Programming models for event-controlled program flow, Modelling of multiprocessor systems.	8
5	**Interfacing Peripherals with 8051**: Interfacing of LEDs & Switches with 8051, LCD and Keyboard Interfacing, ADC, DAC, And Sensor Interfacing. Interfacing of Serial Communication Devices (USART), Interfacing External Memory (RAM/ROM) with 8051.	9
6	**Introduction to Real-Time Operating Systems (RTOS)**: RTOS tasks, Schedular and scheduling techniques, shared data reentrancy, priority inversion, semaphores, inter task communication (Mail box, message queue, pipes, named pipes), timers & timer functions, and events, ISR handling in RTOS, Hard & soft real time systems, Software design using RTOS for embedded systems, Task division requirement in RTOS.	9
	Total	**45**

Text Books:

1. M. A. Mazidi and J. G. Mazidi, The 8051 Microcontroller and Embedded Systems. Low Price ed., 2nd impression. New Delhi, India: Pearson Education, 2007.
2. R. Kamal, Embedded Systems: Architecture, Programming and Design. New Delhi, India: Tata McGraw-Hill Publishing Company Limited, 4th Ed., 2020.

Reference Books:

1. K. V. K. K. Prasad, Embedded Systems / Real-Time Systems. New Delhi, India: Dreamtech Publications.
2. T. D. Morton, Embedded Microcontrollers. Low Price ed., Reprint 2005.
3. F. Vahid and T. Givargis, Embedded System Design. Student ed., Reprint 2006. Hoboken, NJ, USA: John Wiley.

Prerequisite:

1. Fundamentals of microprocessors and microcontrollers, assembly language, operating systems, and computer organization and architecture.

Swami Keshvanand Institute of Technology, Management & Gramothan, Jaipur

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

Swami Keshvanand Institute of Technology, Management & Gramothan, Jaipur

Name of the Programme: B. Tech. in Computer Science and Engineering (IoT)	**Year**: III	**Semester**: V
Course Name: Automata Theory and Compiler Design	**Course Code**: CIUL503/ CAUL503/ CDUL503	**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).

Swami Keshvanand Institute of Technology, Management & Gramothan, Jaipur

Name of the Programme: B. Tech. in Computer Science and Engineering (IoT)	**Year**: III	**Semester**: V
Course Name: Artificial Intelligence	**Course Code**: CIUL504/ CSUL404/ CDUL504/ ITUL404	**Credit**: 2
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 AI, history and philosophical foundations, Agents and Environment, Problem solving, Examples of problems, Blind Search: Depth first search, Breadth first search and their variants, Uniform cost search; Informed search: heuristic function, hill climbing, best first search, A* and AO* search. Basic concepts of constraint satisfaction problem, constraint optimization problem, evaluation function; Game trees, Mini-Max search, Expectimax, alpha-beta pruning.	9
3	**Knowledge Representation:** Introduction to KR, Knowledge Agents, Predicate logic, and resolution. Rule-based system, forward reasoning and conflict resolution, backward reasoning and its use; Introduction to Fuzzy Logic.	7
4	**Probabilistic Reasoning:** Handling uncertainty: sources of uncertainty; Probabilistic inference: conditional, marginal, joint distribution; Markov Model, Hidden Markov Model. Bayes' rule, Naïve Bayes and its limitations, Bayesian Belief Network (BBN).	6
5	**Planning:** Planning problem, planning with state space search, planning graphs, planning example – partial-order planning, block world.	3
6	**Applications of AI:** Natural Language Processing, Expert Systems, Computer Vision, Robotics, Recommendation Systems.	4
	Total	**30**

Text Books:

1. E. Rich and K. Knight, Artificial Intelligence, 5th ed. New Delhi, India: Affiliated East-West Press, 2025.
2. S. Russell and P. Norvig, Artificial Intelligence: A Modern Approach, 4th ed. Noida, India: Pearson Education, 2022.

Reference Books:

1. D. W. Patterson, Introduction to Artificial Intelligence and Expert Systems. New Delhi, India: Prentice Hall of India, 2015.
2. D. Khemani, A First Course in Artificial Intelligence, New Delhi, India: McGraw-Hill Education, 6th Reprint, 2018.

Prerequisite:

Data Structures and Algorithms, Discrete Mathematics, Probability and Statistics

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Name of the Programme: B. Tech. in Computer Science and Engineering (IoT)	**Year**: III	**Semester**: V
Course Name: DevOps Practices and Principles	**Course Code**: CIUL511/ CSUL511/ CDUL614/ CAUL614	**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 (IoT)	**Year**: III	**Semester**: V
Course Name: Cryptography and Network Security	**Course Code**: CIUL512/ CSUL503/ CAUL512/ CDUL512/ 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.

Swami Keshvanand Institute of Technology, Management & Gramothan, Jaipur

Name of the Programme: B. Tech. in Computer Science and Engineering (IoT)	**Year**: III	**Semester**: V
Course Name: Embedded System Design Lab	**Course Code**: CIUP520	**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.	List of Experiments
1.	Get familiar with the microcontroller (hardware testing) kit and understand the different hardware components used in the kit.
2.	Write a program in 'C' to access a port in the microcontroller and blink the LED connected to it, from the program. Draw various patterns of your choice on the LED block.
3.	Write a program in 'C' to access a port in the microcontroller and blink the LED connected to it from the program. Use the built-in timer to provide the appropriate delay for blinking. Draw various patterns of your choice on the LED block and timer functions.
4.	An LCD interface is provided in the hardware kit. Write a program in 'C' to use the LCD to display your name and then scroll the name in the line and across the line.
5.	Modify the program written for exp. No. 4 such that the program accesses a switch connected to a port of the microcontroller and displays "SWITCH PRESSED" when the switch is pressed and displays "SWITCH NOT PRESSED" when the switch is not pressed.
6.	An ADC interface is provided in the hardware kit. Write a program in 'C' to use the ADC to display the equivalent digital value accessed by its channels. The display should be available on the LCD interface.
7.	A temperature sensor interface is provided in the hardware kit. Write a program in 'C' to access the digital value as sensed by the temperature sensor and convert it into an equivalent digital value. The sensor sends the value to the controller in serial format. This value should also be displayed on the LCD interface.
8.	Interface a DAC and generate Triangular and Square waveforms.
9.	Display the Hex digits 0 to F on a 7-segment LED interface, with an appropriate delay.
10.	Interface a Stepper motor and rotate it in clockwise and anti-clockwise direction by 8051 Microcontroller.

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Name of the Programme: B. Tech. in Computer Science and Engineering (IoT)	**Year**: III	**Semester**: V
Course Name: Machine Learning Lab	**Course Code**: CIUP521	**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 (IoT)	**Year**: III	**Semester**: V
Course Name: Compiler Design Lab	**Course Code**: CIUP522	**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 (IoT)	**Year**: III	**Semester**: V
Course Name: Programming for Problem Solving-I Lab	**Course Code**: CIUP523	**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

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Name of the Programme: B. Tech. in Computer Science and Engineering (IoT)	**Year**: III	**Semester**: VI
Course Name: Design and Analysis of Algorithms	**Course Code**: CIUL601/ CSUL501/ CAUL501/ CDUL501/ 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 (IoT)	**Year**: III	**Semester**: VI
Course Name: Internet of Things	**Course Code**: CIUL602/ CSUL701/ CDUL602/ CAUL602/ 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

Cloud and Data Management

Swami Keshvanand Institute of Technology, Management & Gramothan, Jaipur

Name of the Programme: B. Tech. in Computer Science and Engineering (IoT)	**Year**: III	**Semester**: VI
Course Name: IoT with Cloud Computing	**Course Code**: CIUL603	**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 Cloud Computing**: Overview of Cloud Computing, Characteristics of Cloud Computing, Cloud Deployment Models- Public, Private, Hybrid, Community, Cloud Service Models: IaaS, PaaS, SaaS, Overview Cloud Platforms: AWS, GCP, Microsoft Azure.	6
3	**IoT Data Management and Analytics in the Cloud:** Data Management in IoT- IoT data sources, types, and challenges, Data ingestion, storage, and processing in the cloud, Data integration and interoperability issues in IoT environments IoT Analytics in the Cloud- Introduction to data analytics and machine learning for IoT- Predictive analytics, anomaly detection.	7
4	**Introduction to IoT Architecture:** Overview of IoT applications and Platforms- Edge Computing, Fog Computing, Cloud IoT Architecture, IoT Cloud Services Overview, Industrial IoT.	5
5	**Security and Privacy in IoT and Cloud Computing**: IoT Security Challenges, Security Protocols for IoT, TLS, DTLS, Secure MQTT communication Privacy Considerations in IoT, Cloud Security Issues, Identity and Access Management (IAM).	5
6	**IoT Cloud Platforms**: Business Considerations for IoT Cloud Platforms, Technical Considerations for IoT Cloud Platforms, Introduction to Dashboards and Web Portals, Comparison of Google IoT Core, AWS IoT Core, and Azure IoT Hub Challenges in Selecting IoT Cloud Platforms.	6
	Total	**30**

Text Books:

1. J. K. Verma, D. K. Saxena, V. González-Prida Díaz, and V. Shendryk, Eds., Cloud IoT: Concepts, Paradigms, and Applications, 1st ed. Boca Raton, FL, USA: Chapman & Hall/CRC Press, 2023.
2. A. Basu, Building IoT Systems: Design Scalable IoT Systems from Edge to Cloud, 1st ed. Berkeley, CA, USA: Apress, 2025.

Reference Books:

1. C. Savaglio, G. Fortino, M. C. Zhou, and J. Ma, Eds., Device-Edge-Cloud Continuum: Paradigms, Architectures and Applications, 1st ed. Cham, Switzerland: Springer, 2023.
2. K. N. Mishra and S. C. Pandey, Cloud-IoT Technologies in Society 5.0, 1st ed. Cham, Switzerland: Springer, 2023.
3. R. Buyya, C. Vecchiola, S. Thamarai Selvi, S. Poojara, and S. N. Srirama, Mastering Cloud Computing: Foundations and Applications Programming, 2nd ed. Cambridge, MA, USA: Elsevier, 2026.

Prerequisites: Basic understanding of computer networks, communication protocols, databases, and Internet of Things (IoT) concepts.

Swami Keshvanand Institute of Technology, Management & Gramothan, Jaipur

Name of the Programme: B. Tech. in Computer Science and Engineering (IoT)	**Year**: III	**Semester**: VI
Course Name: Deep Learning	**Course Code**: CIUL611/ CDUL603/ CSUL603/ CAUL603/ 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 (IoT)	**Year**: III	**Semester**: VI
Course Name: Parallel and Distributed Computing	**Course Code**: CIUL612/ CSUL612/ CAUL612/ CDUL612/ 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 (IoT)	**Year**: III	**Semester**: VI
Course Name: Wireless Networks	**Course Code**: CIUL611/ CSUL512/ ITUL614	**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 dissemination, 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: Students should have basic knowledge of Computer Networks and Data Structures & Algorithms. Familiarity with fundamental concepts of Operating Systems is desirable

Name of the Programme: B. Tech. in Computer Science and Engineering (IoT)	**Year**: III	**Semester**: VI
Course Name: Social Network Analysis	**Course Code**: CIUL614/ CSUL614/ CAUL511/ CDUL511	**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

Basic understanding of Databases, Cloud, and Big Data, Python programming, Probability and Statistics, Machine Learning

Swami Keshvanand Institute of Technology, Management & Gramothan, Jaipur

Name of the Programme: B. Tech. in Computer Science and Engineering (IoT)	**Year**: III	**Semester**: VI
Course Name: Design and Analysis of Algorithms Lab	**Course Code**: CIUP620	**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 Computer Science and Engineering (IoT)	**Year**: III	**Semester**: VI
Course Name: Internet of Things Lab	**Course Code**: CIUP621	**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	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 (IoT)	**Year**: III	**Semester**: VI
Course Name: Deep Learning Lab	**Course Code**: CIUP622	**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 (IoT)	**Year**: III	**Semester**: VI
Course Name: Advance Java Lab	**Course Code**: CIUP623	**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.

Swami Keshvanand Institute of Technology, Management & Gramothan, Jaipur

Name of the Programme: B. Tech. in Computer Science and Engineering (IoT)	**Year**: III	**Semester**: VI
Course Name: Programming for Problem Solving-II Lab	**Course Code**: CIUP624	**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