Teaching and Examination Scheme

Second Year B. Tech. CSE (IoT and Cyber Security with Block Chain Technology) Semester IV (Autonomous) (Academic Year 2022-2023)

Sr	Course Code	Course	Teaching Scheme (hrs.)			Continuous Assessment (A)			Semester End Assessment (B)					Aggregate (A+B)
			Th	P/T /L	Credits	Th	T/W	Total CA (A)	Th	O	P	O & P	Total SEA(B)	
1	DJ19ICC401	Statistics for Engineers	3	-	3	25	--	25	75	--	--	--	75	100
	DJ19ICL401	Statistics for Engineers Laboratory	--	2	1	--	25	25	--	--	--	--	--	25
2	DJ19ICC402	Operating Systems	3	--	3	25	--	25	75	--	--	--	75	100
	DJ19ICL402	Operating Systems Laboratory	--	2	1	--	25	25	--	--	--	25	25	50
3	DJ19ICC403	Computer Networks	3	--	3	25	--	25	75	--	--	--	75	100
	DJ19ICL403	Computer Networks Laboratory	--	2	1	--	25	25	--	--	--	25	25	50
4	DJ19ICC404	Analysis of Algorithms	3	--	3	25	--	25	75	--	--	--	75	100
	DJ19ICL404	Analysis of Algorithms Laboratory	--	2	1	--	25	25	--	--	--	25	25	50
5	DJ19ICC405	Introduction to IoT	3	--	3	25	--	25	75	--	--	--	75	100
	DJ19ICL405	Introduction to IoT Laboratory	--	2	1	--	25	25	--	--	--	25	25	50
6	DJ19ICL406	Programming Laboratory II (Java and Advanced Java Programming)	--	4	2	--	25	25	--	--	--	25	25	50
7	DJ19A5	Environmental Studies	1	--	--	--	--	--	--	--	--	--	--	--
8	DJ19A4	Innovative Product Development II (A)	--	2	--	--	--	--	--	--	--	--	--	--
		Total	16	14	22	125	150	275	375	--	--	125	500	775

Th	Theory	**T/W**	Term work
P	Practical	**O**	Oral
T	Tutorial	O&P	Oral & Practial

Program: B.Tech. CSE in IoT and Cyber Security with Block Chain Technology **S.Y.B.Tech. Semester: IV**

Course: Statistics for Engineers (DJ19ICC401)

Course: Statistics for Engineers Lab (DJ19ICL401)

Prerequisite:

1. Calculus
2. Descriptive Statistics
3. Basics of probability

Objectives:
To build the strong foundation in statistics which can be applied to analyse data and make predictions.

Outcomes: On completion of the course, learner will be able to:

1. Interpret data using descriptive statistics.
2. Demonstrate sampling distributions and estimate statistical parameters.
3. Develop hypothesis based on data and perform testing using various statistical techniques.
4. Perform analysis of variance on data.
5. Examine relations between data.

Detailed Syllabus: (unit wise)

Unit	Description	Duration
1	**Probability, Random variables:** Probability: Conditional probability, mutually and pair wise independent events, Bayes' theorem. Random variables: Discrete random variable, probability mass function, discrete distribution function, continuous random variable, probability density function, continuous distribution function, mathematical expectation, moment generating function, two-dimensional random variable and its joint probability mass and density function, marginal distribution function.	**8**
2	**Probability distributions:** Discrete probability distribution: Binomial distribution, Poisson distribution. Continuous probability distribution: Normal distribution (Detailed study).	**7**
3	**Sampling distribution and Estimation**: Sampling distribution: Central limit theorem, population distribution, Chi-square distribution, Z - distribution, Student's t-distribution, F-Distribution. Statistical Estimation: Characteristics of estimators, consistency, unbiasedness, unbiased estimates, efficient estimates, sufficient estimators, point estimates, interval estimates, determination of sample size for estimating mean and proportions, estimates of population parameters, probable error.	**7**
4	**Hypothesis Testing for data driven decision making:** Hypothesis testing: Test of significance, null and alternative hypothesis, type I and type II error, factors affecting Type II error, probability of Type II error, power of test, p Value, critical region, level of significance.	**11**

	Confidence interval: Population mean, difference between two population means, population proportion, difference between two population proportions, variance, ratio of variances of two populations. Tests using z-statistics: difference between sample proportion and population proportion, difference between two sample proportion, difference between sample mean and population mean with known σ and unknown σ, difference between two sample means, one tailed and two tailed tests. Test using t-statistics: difference between sample mean and population mean, difference between two independent sample means, difference between means from the same group. Test using F-statistics: equality of population variance Test using chi-square statistics: test of independence, goodness of fit.	
5	**Analysis of Variance (ANOVA) for data analysis:** Sample size calculation, one way ANOVA, POST-HOC Analysis (Tukey's Test), randomized block design, two-way ANOVA.	**6**

List of Laboratory Experiments: (Minimum any eight using Python)	
Sr. No.	**Suggested Experiments**
1	To perform descriptive statistics on data.
2	To visualize descriptive statistics on data.
3	To perform correlation on given data.
4	To calculate probability using probability distribution.
5	To prove central limit theorem.
6	To study sampling distributions and their parameters.
7	To perform statistical estimation tests on data.
8	To calculate confidence interval for different parameters.
9	To perform goodness of fit using Kolmogorov-Smirnov test and Anderson Darling test.
10	To perform hypothesis test using Z statistics.
11	To perform hypothesis test using t statistics.
12	To perform hypothesis test using F statistics.
13	To perform hypothesis test using Chi square.
14	To perform ANOVA on given data.
15	To perform POST-HOC Analysis (Tukey's Test) on given data.

Any other experiment based on syllabus may be included, which would help the learner to understand topic/concept.

Books Recommended:

Text books:

1. Statistical Methods, S. P. Gupta, Sultan Chand, 2021, 46th revised edition.
2. An Introduction to Statistics with Python, Thomas Hasalwanter, Springer, 2016.
3. Think Stats: Probability and Statistics for Programmers, Allen B. Downey, Green Tea Press, 2011.
4. Testing Statistical Hypotheses, E. L. Lehmann, Joseph P. Romano, Springer, 2008, third edition.

Reference Books:

1. Fundamentals of mathematical statistics, S. C. Gupta, V. K. Kapoor, Sultan Chand, 2020, 12th edition.
2. Practical Statistics for data scientists 50+ Essential Concepts Using R and Python, Peter Bruce, Andrew Bruce, Peter Gedeck, Orelly, second edition, 2020.
3. Statistics, Freedman, David, Robert Pisani, Roger Pervis, W. W. Norton, 2007.

Evaluation Scheme:

Semester End Examination (A):

Theory:

1. Question paper will be based on the entire syllabus summing up to 75 marks.
2. Total duration allotted for writing the paper is 3 hrs.

Continuous Assessment (B):

Theory:

1. Two term tests of 25 marks each will be conducted during the semester out of which; one will be a compulsory term test (on minimum 02 Modules) and the other can either be a term test or an assignment on live problems or a course project.
2. Total duration allotted for writing each of the paper is 1 hr.
3. Average of the marks scored in both the two tests will be considered for final grading.

Laboratory: (Term work)

Term work shall consist of minimum 8 experiments.

The distribution of marks for term work shall be as follows:

i. Laboratory work (Performance of Experiments): 15 Marks
ii. Journal documentation (Write-up and/or Assignments): 10 marks

The final certification and acceptance of term work will be subject to satisfactory performance of laboratory work and upon fulfilling minimum passing criteria in the term work.

Prepared by Checked by Head of the Department Principal

Program: B.Tech. CSE in IoT and Cyber Security with Block Chain Technology **S.Y. B.Tech.** **Semester: IV**

Course: Operating Systems (DJ19ICC402)

Course: Operating Systems Laboratory (DJ19ICL402)

Prerequisite: Basic Computer Fundamentals

Objectives: The objective of this course is to understand the structure, functions and characteristics of operating systems

Outcomes: On completion of the course, learner will be able to:

1. Describe the various operating systems architectures.
2. Apply appropriate memory management, process scheduling and disk scheduling methods.
3. Identify the need of concurrency and apply appropriate method to solve the concurrency or deadlock problem.
4. Differentiate between various IoT operating system architectures.

Detailed Syllabus: (unit wise)		
Unit	**Description**	**Duration**
1	**Operating System Architecture:** Basic functions and services, System calls, Types of Operating Systems: Batch, multiprogramming. Multitasking, time sharing, parallel, distributed & real -time O.S. Case Study on Linux OS.	**06**
2	**Process Management:** Process Concept, Process states, Process control, Threads, Uni-processor Scheduling: Types of scheduling: Pre-emptive, Non pre-emptive, Scheduling algorithms: FCFS, SJF, RR, Priority.	**06**
3	**Memory Organization**: Memory Hierarchy, Main Memory, Cache Memory, Memory Mapping, cache coherence. Memory Management: Memory partitioning: Fixed and Variable Partitioning, Memory Allocation: Allocation Strategies (First Fit, Best Fit, and Worst Fit), Fragmentation, Swapping, Virtual Memory, Paging. Segmentation, Demand paging and Page replacement policies.	**08**
4	**Concurrency control:** Principles of Concurrency, Mutual Exclusion: S/W approaches, H/W Support, Semaphores, Monitors, Classical Problems of Synchronization: Producer and Consumer problem and solution. **Deadlock:** Principles of deadlock, Deadlock Prevention, Deadlock Avoidance, Deadlock Detection, Dining Philosopher problem.	**10**
5	**File and I/O management:** File and I/O Organization, Operating System Design issues, I/O Buffering, Disk Scheduling (FCFS, SCAN, C-SCAN, SSTF), RAID.	**05**
6	**IoT operating System:** Ubuntu OS**,** Contiki OS, TinyOS, RIoT, Windows 10 IoT.	**04**

List of Laboratory Experiments: (Minimum any eight experiments should be implemented using any programming language)	
Sr. No.	**Suggested Experiments**
1	Explore the internal commands of Linux and Write shell scripts to do the following: Display top 10 processes in descending order Display processes with highest memory usage. Display current logged in user and logname. Display current shell, home directory, operating system type, current path setting, current working directory. Display OS version, release number, kernel version. Illustrate the use of sort, grep, awk, etc.
2	Implement file system calls in linux.
3	Implement various page replacement policies
4	Implement CPU scheduling algorithms like FCFS, SJF, Round Robin etc.
5	Implement Best Fit, First Fit and Worst Fit Memory allocation policy.
6	Implement Producer -Consumer problem with Semaphore.
7	Implement order scheduling in supply chain using Banker's Algorithm
8	Implement Disk Scheduling Algorithms.
9	Implement Multithreading.
10	Running and Testing Applications for Contiki OS Using Cooja Simulator
11	Using the CPU-OS simulator analyze and synthesize the following: a. Process Scheduling algorithms. b. Thread creation and synchronization. c. Deadlock prevention and avoidance.

Any other experiment based on syllabus may be included, which would help the learner to understand topic/concept.

Books Recommended:

Text Books

1. William Stallings, Operating System: Internals and Design Principles, Prentice Hall, 8th Edition, 2014, ISBN-10: 0133805913 • ISBN-13: 9780133805918.

2. Abraham Silberschatz, Peter Baer Galvin and Greg Gagne, Operating System Concepts, John Wiley & Sons , Inc., 9th Edition, 2016, ISBN 978-81-265-5427-0

3. Andrew Tannenbaum, Operating System Design and Implementation, Pearson, 3rd Edition,2006.

Reference Books:

1. Maurice J. Bach, "Design of UNIX Operating System", PHI ,2016

2. Achyut Godbole and Atul Kahate, Operating Systems, Mc Graw Hill Education, 3rd Edition,2017

3. The Linux Kernel Book, Remy Card, Eric Dumas, Frank Mevel, Wiley Publications.

URL:

1. http://www.contiki-os.org/
2. http://www.tinyos.net/
3. https://www.riot-os.org/
4. https://developer.microsoft.com/en-gb/windows/iot/

Online Courses: NPTEL / Swayam

1. Introduction to Operating system fundamentals by Prof. Chester Rebeiro, IIT Madras

https://nptel.ac.in/courses/106106144

Evaluation Scheme:

Semester End Examination (A):

Theory:

1. Question paper will be based on the entire syllabus summing up to 75 marks.
2. Total duration allotted for writing the paper is 3 hrs.

Continuous Assessment (B):

Theory:

1. Two term tests of 25 marks each will be conducted during the semester out of which; one will be a compulsory term test (on minimum 02 Modules) and the other can either be a term test or an assignment on live problems.
2. Total duration allotted for writing each of the paper is 1 hr.
3. Average of the marks scored in both the two tests will be considered for final grading.

Laboratory: (Term work)

Term work shall consist of minimum 8 experiments.

The distribution of marks for term work shall be as follows:

i. Laboratory work (Performance of Experiments): 15 Marks

ii. Journal documentation (Write-up and/or Assignments): 10 marks

The final certification and acceptance of term work will be subject to satisfactory performance of laboratory work and upon fulfilling minimum passing criteria in the term work.

Prepared by Checked by Head of the Department Principal

Program: B.Tech. CSE in IoT and Cyber Security with Block Chain Technology **S.Y. B.Tech.** **Semester: IV**

Course: Computer Networks (DJ19ICC403)

Course: Computer Networks Laboratory (DJ19ICL403)

Prerequisite: Digital Logic

Objectives:

To get familiar with contemporary issues and challenges of various protocol designing in layered architecture and performance analysis of routing and transport layer protocols for various applications.

Outcomes: On completion of the course, learner will be able to:

1. Demonstrate the concepts of data communication at physical layer and compare ISO - OSI model & TCP/IP model.
2. Demonstrate the working of networking protocols at data link layer.
3. Design of network using wired and wireless LAN.
4. Compare and analyze the performance of various routing protocols.
5. Compare and analyze the transport layer protocols and various congestion control algorithms.
6. Explore various IoT protocols at application layer.

Detailed Syllabus: (unit wise)		
Unit	**Description**	**Duration**
1	**Introduction to Networking:** Introduction to computer network, network application, network software and hardware components, Network topology, design issues for the layers. Reference models: Layer details of OSI, TCP/IP models.	**04**
2	**Physical Layer:** Introduction to Digital Communication System: Guided Transmission Media: Twisted pair, Coaxial, Fiber optics. Unguided media: Bluetooth. Data Encoding techniques.	**04**
3	**Data Link Layer:** Design Issues: Framing, Error Control: Error Detection and Correction (Hamming Code, CRC, Checksum), Flow Control: Stop and Wait, Sliding Window (Go Back N, Selective Repeat), Medium Access Control Sublayer: Channel Allocation problem, Multiple Access Protocol (Aloha, Carrier Sense Multiple Access (CSMA/CA, CSMA/CD), Wired LANS: Ethernet, Wireless LAN, Wireless sensor Network.	**10**

4	**Network Layer:** Network Layer design issues, Communication Primitives: Unicast, Multicast, Broadcast. IPv4 Addressing (Classfull and Classless),IPv4 Protocol, Network Address Translation (NAT) Routing algorithms : Link state routing, Distance Vector Routing Protocols - ARP,RARP, ICMP, IGMP Congestion control algorithms: Open loop congestion control, Closed loop congestion control, Token & Leaky bucket algorithms. **Network layer IoT protocol: IPV6, 6LowPAN**	**10**
5	**Transport Layer:** The Transport Service, Port Addressing, Transport service primitives, Berkeley Sockets, Connection management (Handshake, Teardown), UDP, TCP, TCP Congestion Control: Slow Start	**06**
6	**Application Layer:** DNS, HTTPS, SMTP, Telnet, FTP. **Application layer IoT Protocol: CoAP protocol, MQTT protocol.**	**05**

List of Laboratory Experiments:	
Sr. No.	**Suggested Experiments**
1	A. Study of LAN topology. B. Study of various Network devices.
2	Installation & Configuration of Network Simulator (NS2) in Linux environment. -Study of different topologies and create duplex link in NS2.
3	Building of wired & wireless topology using NS2.
4	Write a program to implement A) Error Detection and Correction B. Framing
5	Implement Stop and Wait protocol in NS2.
6	Write a program to implement Sliding Window Protocols- Selective Repeat, Go Back N.
7	Write a program to implement any one Routing Protocol.
8	Write a program to find out class of a given IP address, subnet mask & first & last IP address of that block.
9	Write a program to implement Congestion Control algorithms.
10	Write a program to build client-server model on different computers. Implement TCP-UDP scenario in NS2/NS3.
11	Install and configure Network Management/ Monitoring Tools.
12	Case study on IoT protocol.

Any other experiment based on syllabus may be included, which would help the learner to understand topic/concept.

Books Recommended:

Text Books

1. Andrew S. Tanenbaum, David J. Wetherall, - Computer Networks, Pearson Education, 6th edition 2021
2. Behrouz A. Forouzan, -Data Communications and Networking‖, TMH ,5th edition 2017
3. Oliver C Ibe - Fundamentals of Data Communication Networks, Wiley Publications ,1st edition 2017.
4. James F. Kurose, Keith W. Ross, -Computer Networking, A Top-Down Approach Featuring the Internet‖, Pearson Education, 6th edition 2017.

Reference Books

1. S.Keshav,- An Engineering Approach To Computer Networking, Pearson Education, 3rd edition 2010.
2. Natalia Olifer& Victor Olifer,- Computer Networks: Principles, Technologies & Protocols for Network Design, Wiley India, 2011.
3. Larry L.Peterson, Bruce S. Davie,- Computer Networks: A Systems Approach, Second Edition (The Morgan Kaufmann Series in Networking),2012.

Evaluation Scheme:

Semester End Examination (A):

Theory:

1. Question paper will be based on the entire syllabus summing up to 75 marks.
2. Total duration allotted for writing the paper is 3 hrs.

Continuous Assessment (B):

Theory:

1. Two term tests of 25 marks each will be conducted during the semester out of which; one will be a compulsory term test (on minimum 02 Modules) and the other can either be a term test or an assignment on live problems or a course project.
2. Total duration allotted for writing each of the paper is 1 hr.
3. Average of the marks scored in both the two tests will be considered for final grading.

Laboratory: (Term work)

Term work shall consist of minimum 8 experiments.

The distribution of marks for term work shall be as follows:

i. Laboratory work (Performance of Experiments): 15 Marks
ii. Journal documentation (Write-up and/or Assignments): 10 marks

The final certification and acceptance of term work will be subject to satisfactory performance of laboratory work and upon fulfilling minimum passing criteria in the term work.

Prepared by Checked by Head of the Department Principal

Program: B.Tech. CSE in IoT and Cyber Security with Block Chain Technology **S.Y. B.Tech.** **Semester: IV**

Course: Analysis of Algorithms (DJ19ICC404)

Course: Analysis of Algorithms Laboratory (DJ19ICL404)

Prerequisite: C Programming**,** Data Structure Concepts

Objectives:

1. To provide mathematical approach for Analysis of Algorithms
2. To solve problems using various algorithmic strategies
3. To analyze algorithms for solving problems

Outcomes: On completion of the course, learner will be able:

1. Analyze running time and space complexity of an algorithm.
2. Apply and analyze divide and conquer strategy to solve problems.
3. Apply the concept of Greedy method to solve all feasible solutions of problems.
4. Apply the concept of dynamic programming strategy to find optimal solution of problem.
5. Understand the concepts of backtracking, branch and bound to represent solution by state space tree.
6. Understand and Apply string matching techniques.

Detailed Syllabus: (Unit wise)

Unit	Description	Duration
1	**Introduction to analysis of algorithms** Introduction to Time and Space Complexity, Analysis of Selection Sort, Insertion Sort, Recurrences: Recursion Tree Method, Substitution method, Master's theorem. Randomised algorithm**:** Las Vegas and Monte Carlo algorithm	**9**
2	**Divide and Conquer** Analysis of Quick sort, Merge sort, Min-Max algorithm, Finding Median, Efficient algorithms for Integer arithmetic (Euclid's algorithm, Karatsuba's algorithm for integer multiplication, fast exponentiation), Strassen's matrix multiplication	**7**
3	**Greedy Approach** General strategy, Knapsack problem, Single Source shortest path: Dijkstra Algorithm, Job sequencing with deadlines, Minimum Spanning Tree (Prim's and Kruskal Algorithm)	**7**

4	**Dynamic Programming** General strategy, 0/1 knapsack, Multistage graph, Single Source Shortest Path, All Pair Shortest Path, Travelling salesman problem, Longest common subsequence problem, Optimal binary search tree (OBST), Flow shop scheduling	**6**
5	**Backtracking Strategy and Branch-and-Bound** **Backtracking Strategy:** General strategy Backtracking: N-queen problem, sum of subset problem, Graph coloring,. **Branch-and-Bound:** LC-search - Control abstraction, Properties, Least-cost answer node, 15-puzzle problem, Traveling salesperson problem	**7**
6	**String Matching Algorithms** Brute-Force String matching algorithm, The naive string matching algorithm, The Rabin Karp algorithm, String matching with finite automata, The knuth Morris Pratt algorithm	**3**

List of Laboratory Experiments: (Minimum any 8 experiments should be implemented using any programming language)

Sr. No.	Suggested Experiments
1	Write a program to implement a. selection sort with analysis. b. insertion sort with analysis.
2	Write a program to implement quick sort with analysis.
3	Write a program to implement merge sort with analysis.
4	Write a program to implement Prim's and Kruskal's algorithm for finding MST.
5	Write a program to implement Job sequencing with deadlines.
6	Write a program to implement a. 0/1 knapsack. b. Greedy Knapsack
7	Write a program to implement Longest common subsequence of given pattern
8	Write a program to implement a. Single source shortest path b. All pair shortest path
9	Write a program to implement N Queen problem.
10	Write a program to implement Sum of Subset problem.
11	Write a program to implement Travelling Salesperson problem
12	Write a program to implement a. The Naive String matching Algorithm

	b. The Rabin Karp algorithm

Any other experiment based on syllabus may be included, which would help the learner to understand topic/concept

Books Recommended:

Text Books:

1. Anany Levitin, "Introduction to the Design and Analysis of Algorithms", Pearson Education, 3rd Edition, 2011
2. Ellis Horowitz, Sartaj Sahni , S. Rajsekaran. "Fundamentals of computer algorithms", University Press, 2nd Edition 2012

Reference Books:

1. T.H.Coreman , C.E. Leiserson,R.L. Rivest, and C. Stein, "Introduction to algorithms", PHI publication 3rd edition , 2009
2. S. K. Basu, "Design Methods and Analysis of Algorithm" , PHI ,2nd edition.
3. John Kleinberg, Eva Tardos, "Algorithm Design" , Pearson ,1st edition 2013.
4. Michael T. Goodrich, Roberto Tamassia, "Algorithm Design", Wiley Publication, 1st edition 2013
5. S. Sridhar,"Design and Analysis of Algorithms", Oxford University Press,2014

Online Courses: NPTEL / Swayam

1. Fundamental Algorithms: Design And Analysis, Prof. Sourav Mukhopadhyay, IIT Kharagpur, **Course link:** **https://onlinecourses.nptel.ac.in/noc23_cs39/preview**

2. Design and Analysis of Algorithms, Prof. Abhiram G Ranade, Prof. Ajit A Diwan, Prof. Sundar Viswanathan, IIT Bombay, **Course link:** https://nptel.ac.in/courses/106101059

3. Design and Analysis of Algorithms, IIT Madras,

Course link: https://nptel.ac.in/courses/106106131

Evaluation Scheme:

Semester End Examination (A):

Theory:

1. Question paper based on the entire syllabus summing up to 75 marks.
2. Total duration allotted for writing the paper is 3 hrs.

Laboratory:

1. Oral & Practical examination will be based on the entire syllabus including, the practical's performed during laboratory sessions.

Continuous Assessment (B):

Theory:

1. Two term tests of 25 marks each will be conducted during the semester out of which; one will be a compulsory term test (on minimum 02 Modules) and the other can either be a term test or an assignment on live problems.
2. Total duration allotted for writing each of the paper is 1 hr.
3. Average of the marks scored in both the two tests will be considered for final grading.

Laboratory: (Term work)

Laboratory work will be based on **DJ19ICL404** with minimum 08 experiments to be incorporated.

The distribution of marks for term work shall be as follows:

i. Laboratory work (Performance of Experiments): 15 Marks
ii. Journal Documentation (Write-up and Assignments: 10 marks

The final certification and acceptance of term work will be subject to satisfactory performance of laboratory work and upon fulfilling minimum passing criteria in the term work.

Prepared by Checked by Head of the Department Principal

Program: B.Tech. CSE in IoT and Cyber Security with Block Chain Technology **S.Y. B.Tech.** **Semester: IV**

Course: Introduction to IoT (DJ19ICC405)

Course: Introduction to IoT Laboratory (DJ19ICL405)

Prerequisite:

1. Basics of Programming
2. Basic Electrical Engineering

Objectives:

1. To explore the role of sensors and actuators and their working principles.
2. Impart the knowledge of sensors and embedded systems
3. Facilitate use of hardware and software technologies related to Internet of Things.
4. Provide the knowledge of IoT communication models and protocols.
5. Develop skills to relate the IoT technologies for practical IoT applications

Outcomes: On completion of the course, learner will be able to:

1. Describe applications in areas of IoT using sensors and actuators.
2. Explain working principle of sensors for measurement of physical quantities.
3. Get hand-on exposure to different IoT processors and controller.
4. Develop and deploy IoT system prototype with enhanced IoT Technologies.
5. Use IoT communication models and protocols.
6. Design and develop small IoT applications to create smart objects

Detailed Syllabus: (unit wise)		
Unit	**Description**	**Duration**
1	**Emergence of IoT and Concept of Smart Things/Objects** Various definitions of IoT,Multidisciplinary nature, Standardisation,'Things' in IoT, Smart Things, Machine-to-Machine technology and IoT, Characteristics and applications of IoT, Advantages and disadvantages of IoT,Security issues in the IoT	**4**
2	**Sensors and Actuators in IoT** **Sensors:**Definition and classification of sensors, working principle of temperature (LM35), pressure (BMP 280), light and proximity sensing, IMU sensor (MPU 9250), Medical Sensor: Heartbeat & Pulse **Actuators:** Motors – Servo, DC, Stepper; Relay – SPDT, DPDT, Solenoid	**8**

3	**Introduction to Arduino and Raspberry Pi** Pin configuration and architecture, Device and platform features, Concept of digital and analog ports, Familiarizing with Arduino Interfacing Board and its types, Introduction to Embedded C and Arduino platform Introduction to Raspberry Pi, Comparison of various Rpi Models, Understanding SoC architecture and SoCs used in Raspberry Pi, Pin Description of Raspberry Pi, On-board components of Rpi	**7**
4	**IoT model and protocols** IoT Reference Model ,IoT Levels & Deployment Templates, IoT Level 1, IoT Level 2, IoT Level 3, IoT Level 4, IoT Level 5, IoT Level 6, Protocol Classification, MQTT, 6LoWPAN IoT Routing Protocols, Data-centric and Flat-Architecture Protocols, Flooding, Gossiping, Sensor Protocols for Information via Negotiation (SPIN), SPIN PP, SPIN EC (Energy Conserve), SPIN BC, Hierarchical Protocols, LEACH, QoS-Based Protocols	**8**
5	**IoT applications :** **IoT for Entertainment and wearables:** Bluetooth Headset, Fitness, Smart Watch, location and Tracking – Personal navigation Device **IoT for Manufacturing:** Flow Optimization, Real Time Inventory, Asset Tracking Process, Analytics (pH, Gas, Concentration, Force& Humidity)- portable data terminal, **IoT for Employee safety** : Fire and safety detector, Predictive Maintenance, Firmware Updates **IoT for healthcare :** Remote Monitoring-ECG, Ambulance Telemetry, Drug Tracking, Hospital Asset Tracking, Access Control, Predictive Maintenance **IoT for Logistics & Supply chain**: Retail Supply chain control, NFC Payment, Intelligent shopping application, Smart product management,	**6**
6	**Cloud Platforms for IoT** Virtualization concepts and Cloud Architecture, Cloud computing benefits, Cloud Cloud IoT platforms - ThingSpeak API, **IoT in Fog and Edge Computing:** Overview of Fog and Edge Computing, Definition, Difference between Fog and Cloud, Related Paradigms and Technologies like MCC, MEC, Edge Computing, Taxonomy of Fog Computing, Different dimensions of Fog computing Advantages and Applications. Edge Computing: Architecture of Edge Computing, Benefits, Applications	**6**
	Total	**39**

List of Laboratory Experiments: (Minimum any eight experiments)	
Sr. No.	**Suggested Experiments**
1	Evaluating characteristics of temperature sensors - semiconductor, RTD, thermistor etc. (e.g. LM35, Pt – 100/1000, MLX 90614)

2	Evaluating characteristics of 9 DOF (accelerometer + gyro + magnetometer) module – MPU 9250.
3	Using Android based app (like MATLAB Mobile) to log mobile sensor data, interpret and analyze the same, for eg counting footsteps using accelerometer data; measuring distance & speed using GPS data etc.
	Arduino
4	Interfacing to Arduino based platform for IR based sensor for obstacle detection
5	Interfacing to Arduino for Seven segment display
6	Interfacing to Arduino for Piezo sensor
7	Interfacing to Arduino for PIR sensor
	Raspberry Pi
4	Interfacing to Raspberry pi zero 2W, based platform ultrasonic sensor for distance measurement.
6	Interfacing to Raspberry pi zero 2W, based platform IMU sensor for obtaining acceleration, orientation and magneto-metric data.
7	Interfacing to Raspberry pi zero 2W, based platform passive infra-red (PIR) sensor for human proximity detection.
8	Interfacing Raspberry pi zero 2W, based platform micro-servo motors (typically SG90 9g micro-servo motors)
9	Interfacing to Raspberry pi zero 2W, based platform temperature sensor like LM35 for ambient temperature indication.
10	Interfacing to Raspberry pi zero 2W, based platform a temperature and humidity sensor – typically BME280, for precision ambient humidity indication.
11	Mini Project based on Module No 5: IoT Applications and contents of entire syllabus: Group of 3-4 students will complete Mini project based on real life Applications /problems which would help the learner to understand topic /concept .

Any other experiment based on syllabus may be included, which would help the learner to understand topic/concept.

Books Recommended:

Text Books:

1. Surya S. Durbha, Jyoti Joglekar; Internet of Things, Oxford University Press, 2021.
2. Jacob Fraden, Handbook of Modern Sensors: Physics, Designs, and Applications Fourth Edition, Springer, 2010.
3. Curtis D. Johnson, Process Control Instrumentation Technology, PHI, 7th Edition.
4. D.V. S. Murthy, Transducers and Instrumentation, PHI Learning, 2nd Edition, 2013.
5. Internet of Things: A Hands-On Approach by Arshdeep Bahga and Vijay Madisett Universities Press.

6. Internet of Things, Architecture and Design Principles by Raj Kamal, Mc Graw Hill Education
7.Internet of Things by Srinivasa K.G., Siddesh G.M., Hanumantha Raju R., CENGAGE publication.

Reference Books:

1. Nathan Ida, Sensors, Actuators and their Interfaces: A Multidisciplinary Introduction, Second Edition, IET Control, Robotics and Sensors Series 127, 2020
2. Nadim Maluf, Kirt Williams, Introduction to Microelectromechanical Systems Engineering, Artech House, 2004.
3. C.S. Rangan, G.R. Sarma, V.S. Mani, Instrumentation Devices and System, TMH, 1997.
4. Perry Lea, Internet of Things for Architects: Architecting IoT solutions by implementing sensors, communication infrastructure, edge computing, analytics, and security, Packt Publications, Reprint 2018.
5. D. Patranabis – Sensor and Transducers, Second Edition, Prentice Hall, New Delhi, 2003
6. Ramon Pallas Areny, John G. Webster, Sensors and Signal Conditioning, Second Edition, John Wiley and Sons, 2000.
7. M. H. Rashid, Power Electronics: Devices, Circuits and Applications, Pearson, Fourth Edition 2014.

Online Courses: NPTEL / Swayam

1. Sensors and Actuators By Prof. Hardik Jeetendra Pandya, IISc Bangalore: https://nptel.ac.in/courses/108/108/108108147/
2. Design for Internet of Things by Prof. P V Prabhakar, IISc Bangalore: https://onlinecourses.nptel.ac.in/noc21_ee85/announcements?force=true
3. Embedded Systems Design by Prof Anupam Basu, IIT Kharagpur: https://nptel.ac.in/courses/106/105/106105159/

Evaluation Scheme:

Semester End Examination (A):

Theory:

1. Question paper will be based on the entire syllabus summing up to 75 marks.
2. Total duration allotted for writing the paper is 3 hrs.

Continuous Assessment (B):

Theory:

1. Two term tests of 25 marks each will be conducted during the semester out of which; one will be a compulsory term test (on minimum 02 Modules) and the other can either be a term test or an assignment on live problems or a course project.

2. Total duration allotted for writing each of the paper is 1 hr.
3. Average of the marks scored in both the two tests will be considered for final grading.

Laboratory: (Term work)

Term work shall consist of minimum 8 experiments and Mini project.

The distribution of marks for term work shall be as follows:

i. Laboratory work (Performance of Experiments): 10 Marks
ii. Journal documentation (Write-up and/or Assignments): 5 marks
iii. Mini project:10 Marks

The final certification and acceptance of term work will be subject to satisfactory performance of laboratory work, and upon fulfilling minimum passing criteria in the term work.

Prepared by Checked by Head of the Department Principal

Program: B.Tech. CSE in IoT and Cyber Security with Block Chain Technology **S.Y. B.Tech.** **Semester: IV**

Course: Programming Laboratory II (Java and Advanced Java Programming) (DJ19ICL406)

Prerequisite: Knowledge of
1. Programming Language C.

Objectives:
The objective of this course is to
1. Make students familiar with basic, Object Oriented features of JAVA and SOLID principles.
2. expose students to analyse a problem statement, develop suitable logic and implement it in JAVA.
3. enable students to design and develop GUI applications.

Outcomes: On successful completion of this course, student should be able to:
1. Develop applications by applying SOLID principles as well as appropriate Object-Oriented concepts and APIs.
2. Debug a given code, rectify the errors to get the desired output.
3. Make suitable modifications to programs as per user requirements for solving real world problems.
4. Develop GUI applications using modern APIs (JAVAFX, swings, etc.)
5. Work effectively as a member of a team.

Detailed Syllabus: (unit wise)

Unit	Description	Duration
1	**Fundamental of Java Programming** Overview of procedure and object-oriented Programming, Java Designing Goals, Features of Java Language. Introduction to the principles of object-oriented programming SOLID principles for designing Keywords: Single Responsibility Principle, Open-Closed Principle, Liskov Substitution Principle, Interface Segregation Principle, Dependency Inversion Principle, Data types, Variables, Operators, Expressions, Types of variables and methods. Control Statements, Iteration Statements, Arrays: Irregular arrays , I/O Basics.	08

2	**Classes, Objects and Array of Object** Classes & Objects: Class Fundamentals: Assigning Object Reference Variables, passing parameters to Methods and Returning parameters from the methods, pass by value, reference, static and non-static members Nested and Inner Classes, Recursion, finalize (), Method overloading Constructors: Parameterized Constructors, copy constructor, default, non-parameterized, Constructors overloading.	**06**
3	**Inheritance, Interface and Packages** Inheritance Basics, Types of Inheritance in Java, Concept of Super and sub class, inheriting Data members and Methods, Role of Constructors in inheritance, making methods and classes final, Method overriding, Dynamic Method Dispatch (static and dynamic polymorphism), Abstract classes and methods. Interface and implementation, Interfaces vs. Abstract classes. Packages – Steps for defining, creating and accessing a Package, importing packages, java.util.Vector.	**08**
4	**Exception Handling and Multithreading** Exception handling Mechanism: try, catch, throw, throws and finally, user defined exceptions Multithreading: Need of Multithreading, Java thread Model, thread Lifecycle, thread class Methods, Implementing Runnable, extending thread, synchronizing threads, synchronized Statement, Critical Factor in Thread –Deadlock	**06**
5	**Java Swings and Event Handling** Introducing Swing: AWT vs Swings, Components and Containers, Swing Packages, A Simple Swing Application, Painting in Swing, Designing Swing GUI Application using Buttons, JLabels, Checkboxes, Radio Buttons, JScrollPane, JList, JComboBox, Trees, Tables Scroll pane Menus and Toolbars. Event-Driven Programming in Java, Event- Handling Process, Event Handling Mechanism, The Delegation Model of Event Handling, Event Classes, Event Sources, Event Listeners, Adapter Classes as Helper Classes in Event Handling.	**12**
6	**Java Collections and Generics** Collections Framework List, Set, Sorted Set, Queue, Deque, Map, Iterator, List Iterator, and Enumeration. Array List, Linked List, HashSet, Linked HashSet, Tree Set, Array Deque, Priority Deque, Enum Set, Abstract Collection, Abstract List, Abstract Queue, Abstract Set, and Abstract Sequential List. Map, Map Entry, Sorted Map, and Navigable Map HashMap, Linked HashMap, Tree Map, Identity HashMap, Weak HashMap, and Enum Map. Comparator, RandomAccess interfaces as well as Observable class **Generics** Basic generics, bounded type parameters, type inference, wildcards, type erasure.	**12**

List of Laboratory Experiments: (Minimum any ten experiments)	
Sr. No.	**Suggested Experiments**
1	Write java programs to understand Expressions, Variables, Basic Math operations.
2	Write java programs to demonstrate different decision-making statements.
3	Write java program to demonstrate input output using command line arguments, buffered reader and data input stream reader.
4	Write a java program to implement Arrays (1D, 2D, irregular).
5	Write a java program to implement Basic String Operations & String Methods.
6	Write a java program to implement Functions, Recursion.
7	Write java programs to demonstrate classes, objects, array of objects
8	Write java programs to demonstrate call by value and call by reference.
9	Write java programs to demonstrate static non static members, nested and inner classes.
10	Write java programs to demonstrate different Object-oriented features: a) Classes & objects b) Constructors c) Inheritance & Polymorphism.
11	Write java programs to demonstrate the concept of abstract classes and interfaces.
12	Write java programs to import inbuilt packages as well as create and import user defined packages.
13	Write java programs to handle exceptions using Exception Handling Mechanism
14	Write java programs to implement multithreading
15	Write java programs to understand GUI designing and database operations (Programs based on GUI designing using swings/ modern APIs)
16	Write java programs to understand java collections
17	Write java program to implement generics.

Books Recommended:

Textbook Books:

1. Herbert Schildt, “Java-The Complete Reference”, 11th Edition, Tata McGraw Hill Publication, 2018.
2. E. Balguruswamy, “Programming with Java: A Primer”, Fifth edition, Tata McGraw Hill Publication, 2017.

Reference Books:

1. D.T. Editorial Services, “Java 8 Programming Black Book”, Dreamtech Press, 2015.

2. H. M. Deitel, P. J. Deitel, S. E. Santry, "Advanced Java 2 Platform How to Program", 2nd Edition, Prentice Hall, 2007.
3. Script Demics, "Learn to Master JAVA", from Star EDU solutions, 2017.

Evaluation Scheme:

Laboratory:

Practical and oral examination will be based on the entire syllabus including, the practical's performed during laboratory sessions and guided mini project covering the relevant concepts of object-oriented programming. This helps them to apply the OOP knowledge gained during classroom sessions to solve real time problems.

Laboratory: (Term work)

1. Term work shall consist of at least 10 experiments based on the above list.
2. Mini project

The distribution of marks for term work shall be as follows:
i Laboratory work (Performance of Experiments, Write-up): 15 marks
ii Mini project / presentation/ assignment/Quiz: 35 marks
The final certification and acceptance of term work will be subject to satisfactory performance of laboratory work and upon fulfilling minimum passing criteria in the term work.

Prepared by Checked by Head of the Department Principal

Program: B.Tech. CSE in IoT and Cyber Security with Block Chain Technology **S.Y. B.Tech.** **Semester: IV**

Course: Environmental Studies (DJ19A5)

Pre-requisite: Interest in Environment and its impact on Human

Objectives:

1. Understand environmental issues such as depleting resources, pollution, ecological problems and the renewable energy scenario.
2. Familiarise environment related legislation

Outcomes: On completion of the course, learner will be able to:

1. Understand how human activities affect environment
2. Understand the various technology options that can make a difference
3. Apply what they have learnt to their own self in different day-to-day settings in real life, at least a beginning would be made in this direction.

Environmental Studies (DJ19A5)		
Unit	**Description**	**Duration**
1	**Social Issues and Environment:** Ecological footprint and Carrying Capacity, Depleting nature of Environmental resources such as soil, water minerals and forests, Carbon emissions and Global Warming.	**04**
2	**Technological Growth for Sustainable Development:** Social, Economical and Environmental aspects of Sustainable Development, Renewable Energy Harvesting, Concept of Carbon credit, Green Building, Power and functions of Central Pollution Control Board and State Pollution Control Board.	**04**
3	**Green Technology:** History, Agenda, and Challenges Ahead. Sustainable Cloud Computing, and Risk Management, Sustainable Software Design, Data Center Energy Efficiency, Thin-Client and Energy Efficiency.	**05**

Books Recommended:

Text books:

1. Environmental Studies From Crisis to Cure, R. Rajagopalan, 2012
2. Textbook for Environmental Studies For Undergraduate Courses of all Branches of Higher Education, Erach Bharucha
3. Green Information Technology A Sustainable Approach, Mohammad Dastbaz, Colin Pattinson,

Babak Akhgar, Morgan and Kaufman, Elsevier, 2015.

Reference Books:

1. Information Technologies in Environmental Engineering: New Trends and Challenges, Paulina Golinska, Marek Fortsch, Jorge Marx-Gómez, Springer, 2011.

Prepared by Checked by Head of the Department Principal

Program: B.Tech. CSE in IoT and Cyber Security with Block Chain Technology **S.Y. B.Tech.** **Semester: IV**

Course: Innovative Product Development II (DJ19A4)

Objectives:

1. To acquaint the students with the process of identifying the need (considering a societal requirement) and ensuring that a solution is found out to address the same by designing and developing an innovative product.
2. To familiarize the students with the process of designing and developing a product, while they work as part of a team.
3. To acquaint the students with the process of applying basic engineering fundamentals, so as to attempt at the design and development of a successful value added product.
4. To inculcate the basic concepts of entrepreneurship and the process of self-learning and research required to conceptualise and create a successful product.

Outcome: Learner will be able to:

1. Identify the requirement for a product based on societal/research needs.

2. Apply knowledge and skills required to solve a societal need by conceptualising a product, especially while working in a team.

3. Use standard norms of engineering concepts/practices in the design and development of an innovative product.

4. Draw proper inferences through theoretical/ experimental/simulations and analyse the impact of the proposed method of design and development of the product.

5. Develop interpersonal skills, while working as a member of theteam or as theleader.

6. Demonstrate capabilities of self-learning as part of the team, leading to life-long learning, which could eventually prepare themselves to be successful entrepreneurs.

7. Demonstrate product/project management principles during the design and development work and also excel in written (Technical paper preparation) as well as oral communication.

Guidelines for the proposed product design and development:

- Students shall form a team of 3 to 4 students (max allowed: 5-6 in extraordinary cases, subject to the approval of the department review committee and the Head of the department).
- Students should carry out a survey and identify the need, which shall be converted into conceptualisation of a product, in consultation with the faculty supervisor/head of department/internal committee of faculty members.
- Students in the team shall understand the effective need for product development and accordingly select the best possible design in consultation with the faculty supervisor.
- Students shall convert the best design solution into a working model, using various components drawn from their domain as well as related interdisciplinary areas.
- Faculty supervisor may provide inputs to students during the entire span of the activity, spread over 2 semesters, wherein the main focus shall be on self-learning.
- A record in the form of an activity log-book is to be prepared by each team, wherein the team can record weekly progress of work. The guide/supervisor should verify the recorded notes/comments and approve the same on a weekly basis.
- The design solution is to be validated with proper justification and the report is to be compiled in a standard format and submitted to the department. Efforts are to be made by the students to try and publish a technical paper, either in the institute journal, "Techno Focus: Journal for Budding Engineers" or at a suitable publication, approved by the department research committee/ Head of the department.
- The focus should be on self-learning, capability to design and innovate new products as well as on developing the ability to address societal problems. Advancement of entrepreneurial capabilities and quality development of the students through the year long course should ensure that the design and development of a product of appropriate level and quality is carried out, spread over two semesters, i.e. during the semesters III and IV.

Guidelines for Assessment of the work:

- The review/ progress monitoring committee shall be constituted by the Head of the Department. The progress of design and development of the product is to be evaluated on a continuous basis, holding a minimum of two reviews in each semester.
- In the continuous assessment, focus shall also be on each individual student's contribution to the team activity, their understanding and involvement as well as responses to the questions being raised at all points in time.
- Distribution of marks individually for the both reviews as well as for the first review during the subsequent semester shall be as given below:
- Marks awarded by the supervisor based on log-book : 20
- Marks awarded by review committee : 20
- Quality of the write-up : 10 In the last review of the semester IV, the marks will be awarded as follows.

- Marks awarded by the supervisor (Considering technical paper writing) : 30
- Marks awarded by the review committee : 20 Note- A Candidate needs to secure a minimum of 50% marks to be declared to have completed the audit course. Review/progress monitoring committee may consider the following points during the assessment.
- In the semester III, the entire design proposal shall be ready, including components/system selection as well as the cost analysis. Two reviews will be conducted based on the presentation given by the student's team.

First shall be for finalisation of the product selected.

Second shall be on finalisation of the proposed design of the product.

In the semester IV, the expected work shall be procurement of components/systems, building of the working prototype, testing and validation of the results based on work completed in semester III.

- First review is based on readiness of building the working prototype.
- Second review shall be based on a presentation as well as the demonstration of the working model, during the last month of semester IV. This review will also look at the readiness of the proposed technical paper presentation of the team.

The overall work done by the team shall be assessed based on the following criteria;

1. Quality of survey/ need identification of the product.

2. Clarity of Problem definition (design and development) based on need.

3. Innovativeness in the proposed design.

4. Feasibility of the proposed design and selection of the best solution.

5. Cost effectiveness of the product.

6. Societal impact of the product.

7. Functioning of the working model as per stated requirements.

8. Effective use of standard engineering norms.

9. Contribution of each individual as a member or the team leader.

10. Clarity on the write-up and the technical paper prepared.

The semester reviews (III and IV) may be based on relevant points listed above, as applicable.

Guidelines for Assessment of Semester Reviews:

- The write-up should be prepared as per the guidelines given by the department.
- The design and the development of the product shall be assessed through a presentation and demonstration of the working model by the student team to a panel of Internal and External Examiners, preferably from industry or any research organisations having an experience of more than five years, approved by the Head of the Institution.
- The presence of the external examiner is desirable only for the 2nd presentation in semester IV. Students are compulsorily required to present the outline of the technical paper prepared by them during the final review in semester IV.

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