Shri Vile Parle Kelavani Mandal's

Dwarkadas J. Sanghvi College of Engineering

(Autonomous College Affiliated to the University of Mumbai)

Scheme and detailed syllabus

Second Year B.Tech

in

Computer Science and Engineering (IoT and Cyber Security with Blockchain Technology)

(Semester IV)

Prepared by:- Board of Studies in Computer Science & Engineering

(IoT and Cyber Security with Blockchain Technology)

With effect from the Academic Year: 2023-2024

Scheme for Second Year B. Tech. B.Tech. CSE (IoT and Cybersecurity with Blockchain Technology) Semester IV (Autonomous) (Academic Year 2023-2024)

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	DJS22ICC401	Statistics for Engineers	3	-	3	35	--	35	65	--	--	--	65	100
	DJS22ICL401	Statistics for Engineers Laboratory	--	2	1	--	25	25	--	--	--	--	--	25
2	DJS22ICC402	Computer Networks	3	--	3	35	--	35	65	--	--	--	65	100
	DJS22ICL402	Computer Networks Laboratory	--	2	1	--	25	25	--	25	--	-	25	50
3	DJS22ICC403	Applied Cryptography	3	--	3	35	--	35	65	--	--	--	65	100
	DJS22ICL403	Applied Cryptography Laboratory	--	2	1	--	25	25	--	--	--	25	25	50
4	DJS22ICC404	Design & Analysis of Algorithms	3	--	3	35	--	35	65	--	--	--	65	100
	DJS22ICL404	Design & Analysis of Algorithms Laboratory	--	2	1	--	25	25	--	--	--	25	25	50
5	DJS22ICC405	Embedded System and IoT	3	--	3	35	--	35	65	--	--	--	65	100
	DJS22ICL405	Embedded system and IoT Laboratory	--	2	1	--	25	25	--	25	--	-	25	50
6	DJS22ICL406	Web application Development Laboratory	--	4	2	--	25	25	--	--	--	25	25	50
7	DJS22A2	Constitution of India	1	--	--	--	--	--	--	--	--	--	--	--
8	DJS22ILLA2	Innovative Product Development II (A)	--	2	--	--	--	--	--	--	--	--	--	--
		Total	16	16	22	175	150	325	325	50	--	75	450	775

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

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

Course: Statistics for Engineers (DJS22ICC401)

Course: Statistics for Engineers Lab (DJS22ICL401)

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. Apply the concepts of probability and distributions to some case studies.
2. Interpret and predict the basic statistical model for given data using simple linear regression.
3. Demonstrate sampling distributions and estimate statistical parameters.
4. Develop hypothesis based on data and perform testing using various statistical techniques.
5. Perform analysis of variance on data.
6. Apply the concept of Markov Process

Detailed Syllabus: (unit wise)		
Unit	**Description**	**Duration**
1	**Random Variables and Probability Distributions**: Concept of a Random Variable, Discrete Probability Distributions, Continuous Probability Distributions, Statistical Independence. **Discrete Probability Distributions**: Binomial Distribution, Poisson distribution. **Continuous Probability Distributions**: Normal Distribution, Areas under the Normal Curve, Applications of the Normal Distribution, Normal Approximation to the Binomial.	**8**

2	**Simple Linear Regression and Correlation:** Introduction to Linear Regression, The Simple Linear Regression Model, Least Squares and the Fitted Model, Properties of the Least Squares Estimators, Inferences Concerning the Regression Coefficients, Prediction, Simple Linear Regression Case Study	**5**
3	**Sampling distribution**: Random Sampling, Sampling Distributions, Sampling Distribution of Means and the Central limit theorem, population distribution, Z - distribution, Student's t-distribution, F-Distribution, Chi-square distribution.	**4**
4	**Statistical Estimation and Test of Hypothesis**: **Estimation Theory**: 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. **Confidence interval**: Population mean, difference between two population means, population proportion, difference between two population proportions, variance, ratio of variances of two populations. Test of Hypothesis: 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. **Parametric Test**: Test the 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 using z-statistics and t-statistics. Test the equality of population variance using F-statistics. **Non-parametric Test**: Test of independence, goodness of fit using chi-square statistics	**11**

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.	**5**
6	**Stochastic Processes and Markov Chains**: Introduction to Stochastic processes- Markov process. Transition Probability, Transition Probability Matrix, First order and Higher order Markov process, n step transition probabilities, Markov chain, Steady state condition, Markov analysis	**6**
	Total	**39**

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.
4	To calculate probability using probability distribution.
5	To perform correlation and simple regression analysis on given data.
6	To verify central limit theorem.
7	To study sampling distributions and their parameters.
8	To perform statistical estimation tests on data.
9	To calculate confidence interval for different parameters.
10	To perform hypothesis test using Z statistics and t statistics.
11	To perform hypothesis test using Chi square.
12	To perform ANOVA on given data.
13	To perform POST-HOC Analysis (Tukey's Test) on given data.
14	To perform Markov Analysis 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. Probability - Statistics and Random Processes by T. Veerarajan, McGraw Hill Education. 3rd edition, 2017.
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.
5. An Introduction to statistics with Python , Thomas Hasalwanter , Springer,2016

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.
4. Introduction to Probability and Statistics for Engineers and Scientists, Sheldon M Ross, Elsevier, fifth edition, 2014.

Evaluation Scheme:

Semester End Examination (A):

Theory:

1. Question paper will be based on the entire syllabus summing up to 65 marks.
2. Total duration allotted for writing the paper is 2 hrs.

Continuous Assessment (B):

Theory:

1. One term test of 20 marks and one term test/presentation/assignment/course project / group discussion/ any other of 15 marks will be conducted during the semester.
2. Total duration allotted for writing each of the paper is 1 hr.

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 Blockchain Technology **S.Y. B.Tech.** **Semester: IV**

Course: Computer Networks (DJS22ICC402)

Course: Computer Networks Laboratory (DJS22ICL402)

Prerequisite: Digital Logic

Objectives:

1. To get familiar with contemporary issues and challenges of various protocol designs in layered architecture.
2. To assess the strengths and weaknesses of various routing protocols.
3. To explore the issues and challenges of protocols design while delving into TCP/IP protocol suite.
4. To become familiar with Wireless technologies.

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. Exemplify the working of networking protocols at data link layer.
3. Design the network using IP addressing and subnetting / supernetting schemes.
4. Compare and analyze the transport layer protocols and various congestion control algorithms.
5. Recognition of different Application layer protocols.
6. Explore the concepts of Wireless technologies.

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.	**4**
2	**Physical Layer:** Introduction to Digital Communication System: Guided Transmission Media: Twisted pair, Coaxial, Fiber optics. Unguided media: Bluetooth. Data Encoding techniques.	**4**
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.	**8**
5	**Transport Layer:** The Transport Service, Port Addressing, Transport service primitives, Berkeley Sockets, Connection management (Handshake, Teardown), UDP, TCP, TCP Congestion Control: Slow Start **Application Layer**: DNS, HTTPS, SMTP, Telnet, FTP.	**8**
6	**Wireless Technologies:** Wireless Technologies: Bluetooth: Concept of Piconet, Scatternet, Protocol Stack Connection establishment Zigbee: Components, Protocol Stack, Architecture & Network Topologies.	**5**
	Total	**39**

Sr. No	List of Laboratory Experiments: (Minimum any eight experiments)
1	Execute and evaluate network administration commands and demonstrate their use in different network scenarios.
2	Installation & Configuration of Network Simulator (NS2) in Linux/Windows Environment.
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 Congestion Control algorithms.
8	Write a program to find out class of a given IP address, subnet mask & first & last IP address of that block.
9	Implement the socket programming for client server architecture.
10	Write a program to build client-server architecture on different computers. Implement TCP-UDP scenario in NS2/NS3.
11	Install and configure Network Management/ Monitoring Tools.(e.g NMap)
12	Case study on Bluetooth and Zigbee 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. Behrouz A. Forouzan, Firouz Mosharraf, Computer Networks: A Top-Down Approach, Mc Graw Hill, 2023

2. Dhanashree K. Toradmalle, Computer Networks and Network Design, Wiley, 2020

Web resources:

1. https://www.netacad.com/courses/networking/networking-essentials
2. https://www.coursera.org/learn/computer-networking.
3. https://www.edx.org/course/introduction-to-networking.

Online Courses: NPTEL / Swayam :

1. https://nptel.ac.in/courses/106/105/106105081.
2. https://nptel.ac.in/courses/106105183.
3. https://onlinecourses.swayam2.ac.in/cec21_cs04/preview.

Evaluation Scheme:

Semester End Examination (A):

Theory:

1. Question paper will be based on the entire syllabus summing up to 65 marks.
2. Total duration allotted for writing the paper is 2 hrs.

Laboratory:

Oral examinations will be based on the entire syllabus.

Continuous Assessment (B):

Theory:

1. Two term tests of 20 marks and 15 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. Total 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): 5 marks

iii. Attendance (Theory + Practical):5 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 Blockchain Technology **S.Y. B.Tech.** **Semester: IV**

Course: Applied Cryptography (DJS22ICC403)

Course: Applied Cryptography Laboratory (DJS22ICL403)

Prerequisite: Computer Networks

Objectives:

1. To introduce classical encryption techniques and concepts of modular arithmetic and number theory.
2. To learn the fundamental concepts of cryptography.
3. To explore the working principles and utilities of various cryptographic algorithms including secret key cryptography, hashes and message digests, and public key algorithms.
4. To develop the ability to use existing cryptographic utilities to build programs for secure communication.

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

1. Understand the system security goals and concepts, acquire the fundamental knowledge of modular arithmetic and number theory.
2. Acquire the knowledge of various cryptographic techniques.
3. Apply different encryption and decryption techniques to solve problems related to confidentiality.
4. Learn and demonstrate the security concepts of public-key cryptography.
5. Understand and effectively apply diverse hashing techniques to address authentication challenges.
6. Attain proficiency in digital signature schemes and digital certificates, facilitating their effective application in secure communication systems.

Detailed Syllabus: (unit wise)		
Unit	**Description**	**Duration**
1	**INTRODUCTION** An Overview of Information Security: Goals for Security, Security threat and vulnerability, Cyber security models (the CIA triad, the star model) , Cryptographic attack, service and mechanism. **NUMBER THEORY** Modular Arithmetic, Euclidean Algorithm, Prime Numbers, Relatively Prime Numbers, Primitive Roots, Fermat's Little Theorem, Euler Totient Function, Extended Euclidean Algorithm, Chinese Remainder Theorem, Discrete Logarithms, Index Calculus Algorithm.	**09**
2	**FUNDAMENTALS OF CRYPTOGRAPHY** Introduction, plain text and cipher text, Classical Encryption techniques, Symmetric cipher model, mono-alphabetic and polyalphabetic substitution techniques: Vigenere cipher, playfair cipher, Hill cipher, Affine Cipher, transposition techniques: keyed and keyless transposition ciphers.	**05**
3	**SYMETRIC-KEY ENCRYPTION** Block Ciphers Stream Ciphers, Homomorphic encryption, Feistel Ciphers, Data Encryption Standard (DES), Cracking DES, Triple DES, Modes of Operation, Advanced Encryption Standard (AES), Modern Block Cipher, RC5, cryptanalysis, Weak Keys.	**08**
4	**PUBLIC-KEY CRYPTOGRAPHY** Public-Key Cryptography, Knapsack Cryptosystem, RSA Cryptosystem, Attack on RSA, ELGamal cryptosystem, Security of ElGamal, Diffie—Hellman Key Exchange, Elliptic Curve Cryptography [ECC]	**07**
5	**CRYPTOGRAPHIC HASH FUNCTIONS:** Cryptographic Hash Functions – MD5, attack on MD5, SHA-1, SHA-3, SHA-256,SHA-512 MAC, HMAC	**05**
6	**DIGITAL SIGNATURE SCHEMES and DIGITAL CERTIFICATES** Digital Signature – Process, Services, Attacks on Digital Signature, Digital Signature Schemes – RSA, El Gamal, Digital certificate, Chain of certificate, PKI, Quantum Cryptography	**05**
	Total	**39**

List of Laboratory Experiments:	
Sr. No.	**Suggested Experiments**
1	Implement the Caeser Cipher Tech using socket programming.
2	Implement Columnar Transposition Technique using socket programming.
3	Implement Vigenère Cipher Technique using socket programming.
4	Implement Affine Cipher techniques.
5	Implement own encryption technique which consist of novel substitution and Transposition approach.
6	Implement Playfair Cipher Technique.
7	Implement Hill Cipher Technique.
8	Implementation of Simplified DES Encryption and decryption.
9	Implement simplified AES DES Encryption and decryption.
10	Implement DES key generation Techniques.
11	Implement AES Key Generation Techniques.
12	Implementation and analysis of RSA crypto system
13	Implement Knapsack Cryptosystem.
14	Implementation of Diffie Hellman Key exchange algorithm
15	Implementation of Message digest using MD5.
16	Implementation of Message digest using SHA-1
17	Implementation of Digital Signatures in Cryptography
18	Case Study /Seminar: Topic beyond syllabus related to topics covered.

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, Cryptography and Network Security, Principles and Practice, 6th Edition, Pearson Education, March 2013.

2. Behrouz A. Ferouzan, ―Cryptography & Network Security, Tata McGraw Hill.

3. Bernard Menezes, ―Cryptography & Network Security, Cengage Learning.

4. Network Security Bible, Eric Cole, Second Edition, Wiley.

Reference Books:

1. Applied Cryptography, Protocols Algorithms and Source Code in C, Bruce Schneier, Wiley.

2. Cryptography and Network Security, Atul Kahate, Tata Mc Graw Hill.

Web resources:

1. Data Encryption standard: https://www.geeksforgeeks.org/data-encryption-standard-des-set-1

2. Advance Encryption standard: https://www.tutorialspoint.com/cryptography/advanced_encryption_standard.htm

3. Digital Signature: http://www.javatpoint.com/java-digital-signature

4. Challenge Response Protocols: https://www.tutorialspoint.com/challenge-responseauthentication-mechanism-cram.

Online Courses: NPTEL / Swayam

1. https://nptel.ac.in/courses/106106221.

2. https://www.coursera.org/learn/crypto.

3. https://www.coursera.org/specializations/introduction-applied-cryptography.

Evaluation Scheme:

Semester End Examination (A):

Theory:

1. Question paper will be based on the entire syllabus summing up to 65 marks.

2. Total duration allotted for writing the paper is 2 hrs.

Continuous Assessment (B):

Theory:

1. One term test of 20 marks and one term test/presentation/assignment/course project / group discussion/ any other of 15 marks will be conducted during the semester.
2. Total duration allotted for writing each of the paper is 1 hr.

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 allocation of marks for laboratory work and tutorials shall adhere to the pre-established rubric parameters.

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 Blockchain Technology **S.Y. B.Tech.** **Semester: IV**

Course: Design & Analysis of Algorithms (DJS22ICC404)

Course: Design & Analysis of Algorithms Laboratory (DJS22ICL404)

Pre-requisite: Computer Programming, Data structure

Course Objectives: The objective of the course is to introduce important algorithmic design paradigms and approaches for effective problem solving. To analyze the algorithm for its efficiency to show its effectiveness over the others. In addition, the concepts of tractable and intractable problems and the classes P, NP and NP-complete problems will be introduced.

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

1. Analyze the performance of algorithms using asymptotic analysis.
2. Solve the problem using appropriate algorithmic design techniques.
3. Able to prove that certain problems are NP-Complete.

Detailed Syllabus: (Unit wise)

Unit	Description	Duration
1	**Introduction:** Introduction to Asymptotic Analysis, Analysis of control statements and loops, solving recurrence relations using tree, substitution, master method, analysis of quick sort and merge sort Problem Solving using divide and conquer algorithm - Max-Min problem, Strassen's Matrix Multiplication.	8
2	**Greedy Method:** Introduction, control abstraction, Problem solving using - fractional knapsack problem, activity selection problem, job sequencing with deadline, find and union, Minimum Spanning trees (Kruskal's algorithm, Prim's algorithm), Single source shortest path (Dijkstra's algorithm), coin change problem.	7

3	**Dynamic Programming:**Introduction, principle of optimality, Components of dynamic programming, characteristics of dynamic programming, Fibonacci problem, Coin Changing problem, 0/1 knapsack (table and set method), Multistage graphs, All pairs shortest paths (Floyd Warshall Algorithm), Single source shortest path (Bellman-Ford Algorithm), Matrix Chain Multiplication, Optimal binary search tree (OBST-successful and unsuccessful search), Travelling salesperson problem, Johnson' algorithm for Flow shop scheduling, Longest Common Subsequence (LCS).	10
4	**Backtracking:** Introduction, Basics of backtracking, N–queen problem, Sum of subsets, Graph coloring, Hamiltonian cycles Generating permutation. Branch-and-Bound: Introduction, Control abstraction-LC BB, FIFO BB, LIFO BB, Properties,FIFO BB, LIFO BB, LC BB, Fifteen Puzzle problem, 0/1 Knapsack problem, Travelling Salesman problem, Job Sequencing with Deadline	**7**
5	**String Matching Algorithms** Introduction, The naive string-matching algorithm, The Rabin Karp algorithm, String matching with finite automata, The Knuth Morris Pratt algorithm	**3**
6	**Basics of Computational Complexity** Complexity classes: The class P and NP, Polynomial reduction, NP Completeness Problem, NP-Hard Problems, NP Completeness problem 04 using Travelling Salesman problem (TSP), Approximation algorithm using TSP	**4**
	Total	**39**

Suggested List of Experiments (any 10 to 12):	
Sr. No.	**Suggested Experiments**
1	Implementation of Min Max algorithm
2	Implementation of Strassen's Matrix Multiplication.
3	Implementation of Karatsuba algorithm for long integer multiplication
4	Fractional Knapsack implementation using greedy approach

5	Implementation of Activity selection using greedy approach
6	Implementation of Kruskal's/ Prim's algorithm using greedy approach
7	Implementation of job sequencing with deadline using greedy approach
8	Implementation of other greedy algorithms eg: tree vertex split, subset cover, container loading, coin changing, optimal; merge patterns (Huffman tree)
9	Implementation of Single source shortest path (Dijkstra's algorithm)
10	Implementation of Bellman Ford algorithm using Dynamic programming
11	Implementation of Longest Common Subsequence algorithm using Dynamic programming
12	Implementation of Travelling Salesperson problem using Dynamic programming
13	Implementation of multistage graphs/ all pair shortest path using dynamic programming.
14	Implementation of N-queen problem using Backtracking
15	Implementation of 15 Puzzle problem using Backtracking
16	Implementation of Knuth Morris Pratt string matching algorithm

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

Books Recommended:

Text Books:

1. Michael T. Goodrich , Roberto Tamassia ," Design and Analysis of Algorithms, An Indian Adaptation", Wiley Publication, 2021.
2. Anany Levitin, "Introduction to the Design and Analysis of Algorithms", Pearson Education, 3rd Edition, 2011
3. 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 will be based on the entire syllabus summing up to 65 marks.
2. Total duration allotted for writing the paper is 2 hrs.

Laboratory:

1. Oral and Practical examinations will be based on the entire syllabus including the practical's performed during laboratory sessions.

Continuous Assessment (B):

Theory:

1. One term test of 20 marks and one term test/presentation/assignment/course project / group discussion/ any other of 15 marks will be conducted during the semester.

2. Total duration allotted for writing each of the paper is 1 hr.

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 allocation of marks for laboratory work and tutorials shall adhere to the pre-established rubric parameters.

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 Blockchain Technology **S.Y. B.Tech.** **Semester: IV**

Course: Embedded System and IoT (DJS22ICC405)

Course: Embedded System and IoT Laboratory (DJS22ICL405)

Prerequisite:

1. Basics of Programming
2. Digital Logic Design and Applications

Objectives:

1. To Understand the definition and significance of the Internet of Things
2. To conceptualize the architectural issues of a Microcontroller.
3. To learn programming techniques used for IoT.
4. To emphasis on design of ES based applications.

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

1. Understand the architecture of 8051 microcontrollers.
2. Implement interfacing with ARM, Arduino and Raspberry Pi.
3. Understand Internet of Things fundamentals.
4. Explore applications in areas of IoT using sensors and actuators.
5. Use IoT communication models and protocols.
6. Utilize Edge analytics to perform data stream mining.

Detailed Syllabus: (unit wise)		
Unit	**Description**	**Duration**
1	**The Microcontroller Architecture:** Introduction to 8051 Microcontroller, Architecture, Pin configuration, Memory organization, Input /Output Ports, Counter and Timers, Serial communication, Interrupts.	**4**
2	**Architecture:** Basic ARM architecture, ARM organization core Data flow Model, ARM register organization, current program register organization. Pin configuration and architecture Arduino, Introduction to Raspberry Pi, Understanding SoC architecture and SoCs used in Raspberry Pi, Pin Description of Raspberry Pi, On-board components of Rpi **Microcontroller Applications:** Interfacing matrix keyboard and Seven segments LED display, LCD Interfacing, ADC Interfacing, DC motor interfacing.	**8**
3	**Emergence of IoT:** IoT Growth- A statistical View, Application area of IoT, Characteristics of IoT,Things in IoT, IoT stack, Enabling Technologies, IoT challenges, IoT levels, Cyber physical systems versus IoT, Wireless sensor Network with IoT.	**7**
4	**Sensors and Actuators in** **IoT Sensors:** Definition and classification of sensors, Sensors for different IoT applications, working principle of temperature (LM35), pressure (BMP 280), MQ-02/05 Gas Sensor, Obstacle Sensor, Ultrasonic Sensor, Gyro Sensor, LDR Sensor, GPS Sensor Medical Sensor: Heartbeat & Pulse Sensor **Actuators:** Motors – Servo, DC, Stepper; Relay – SPDT, DPDT, Solenoid	**7**
5	**IoT model and protocols** **IoT Reference Model** , IoT Levels Various Operating System TinyOS, Contiki OS, RTOS Protocol Classification, MQTT, XMPP, DDS, AMQP, CoAP, REST,6LoWPAN. **IoT Routing Protocols**, Data-centric and Flat-Architecture Protocols, Flooding, Gossiping, SPIN, SPIN PP, SPIN EC, SPIN BC,	**8**

	Hierarchical Protocols, LEACH, QoS-Based Protocols.	
6	**Edge Analytics:** Near Real Time Sensor Stream Processing Introduction, Streaming Data, Data stream management systems, Edge Analytics. Overview of Edge computing, Cloud computing, Fog computing.	**5**
	Total	**39**

List of Laboratory Experiments:

Sr. No	Experiment
1	Tutorial based on current trends and advancements on IoT
2	Study, discussion, and installation of ARM/Arduino/ESP 32/ RPi
3	Interfacing the sensor with ARM/Arduino / ESP 32 / RPi
4	Interfacing the motor drivers with ARM/ Arduino / ESP 32 / RPi
5	Real time data analysis using sensors, processors, and gateway
6	Interfacing the camera module with ARM/ Arduino / ESP 32 / RP
7	Implementation of IoT system Using Messaging and Transport
8	Implementation of data transfer using wireless devices
9	Write a program for ESP8266 DHT11/DHT22 Temperature and Humidity Web Server with Arduino IDE.
10	To study and implement IoT Data processing using Pandas
11	Configuration and using the cloud platform.
12	To study and implement IoT Data processing using Pandas
13	To study and demonstrate working of 6LoWPAN in Contiki OS (simulator)
	Any other experiment may be included, which would help the learner to understand the topic/concept.

Books Recommended:

Text books:

1. Shriram Vasudevan, Abhishek Nagarajan, RMD Sundaram, ”Internet of Things”, Wiley Publication, Second Edition, 2020.

2. Surya Durbha, Jyoti Joglekar, “Internet of Things”, Oxford University Press, First Edition, 2021.

3. M. A. Mazidi, J. G. Mazidi and R. D. Mckinlay, "The 8051 Microcontroller & Embedded systems", Pearson Publications, Second Edition 2006.

4. C. Kenneth J. Ayala and D. V. Gadre, "The 8051 Microcontroller & Embedded system using assembly & 'C'", Cengage Learning, Edition 2010.

Reference Books:

1. RFID and the Internet of Things, by Herve Chabanne, Wiley publication,2011 .

2. Embedded system design A Unified hardware/software Introduction, Frank Vahid, Tony Givargis, Wiely, 2006 .

3. Embedded System Architecture, Programming and Design, Raj Kamal, McGraw Hill, 2017.

Web resources:

1. Embedded Systems Academy- https://www.embedded-sys.com/plus/
2. Embedded Systems Basics by Tutorials point- https://www.tutorialspoint.com/embedded_systems/index.htm
3. Embedded Systems Programming Course by Udemy- https://www.udemy.com/course/introduction-to-embedded-systems/
4. Course on- Introduction to Embedded Systems Software and Development Environments- https://www.coursera.org/learn/introduction-embedded-systems

Online Courses: NPTEL/SWAYAM

1. NPTEL: Prof. Prabhakar, IISc Bangalore, Design for Internet of Things, https://onlinecourses.nptel.ac.in/noc21_ee85/preview
2. NPTEL: Sudip Misra, IIT Khargpur, Introduction to IoT: Part-1, https://nptel.ac.in/courses/106/105/106105166/

Evaluation Scheme:

Semester End Examination (A):

Theory:

1. Question paper will be based on the entire syllabus summing up to 65 marks.
2. Total duration allotted for writing the paper is 2 hrs.

Laboratory:

1. Oral examination will be based on the entire syllabus.

Continuous Assessment (B):

Theory:

1. One term test of 20 marks and one term test/presentation/assignment/course project / group discussion/ any other of 15 marks will be conducted during the semester.
2. Total duration allotted for writing each of the paper is 1 hr.

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 allocation of marks for laboratory work and tutorials shall adhere to the pre-established rubric parameters.

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 Blockchain Technology **S.Y. B.Tech.** **Semester: IV**

Course: Course: Web Application Development Laboratory (DJS22ICL406)

Prerequisite: Knowledge of

1. Basic Programming Skills
2. Knowledge of Internet and Networking

Objectives:

The objective of this course is to

1. To orient students to Web Programming fundamental
2. To develop hands-on skills in building dynamic and interactive web applications using modern web development technologies and frameworks.
3. To enhance problem-solving abilities and encourage creativity and innovation in designing and implementing web applications
4. To Work collaboratively on web development projects to enhance teamwork, communication, and project management skills

Outcomes: On successful completion of this course, student should be able to:

1. Understand Web Programming fundamental.
2. Apply technologies required for web applications.
3. Design and develop responsive and user-friendly web applications.
4. Build dynamic and interactive web applications.
5. Design and Validate web applications for conformance to latest W3C markup and accessibility standards.
6. Apply new web development frameworks to develop mini project.

Detailed Syllabus: (unit wise)

Unit	Description	Duration
1	**Web Programming Fundamentals** Introduction to Web Programming, Installation of IDE, Introduction to basic structure of a website, Title, Script, Link & meta tags. Understanding of headings, paragraphs. Image and Anchor tags, Understanding Lists & Tables, Forms and Input tags, PHP connection code to db, Local server setup and uses, Inline and block elements, Ids and Classes concept, Working of web browser, XML introduction, HTTP protocol, Json introduction	**05**
2	**Static web page design –HTML, CSS and CSS3** HTML entities and semantic tags. HTML Media, Video, Audio, Plugins. HTML API's (Geolocation, Web Storage, SSE, etc) Concepts of CSS: Introduction to CSS, Inline, Internal and External CSS, Selectors, Developer tools in chrome, CSS Box model, margin, padding, fonts, colors, Borders, backgrounds, Float and clear, links, buttons Creating Navigation menu, display property, positions (absolute, relative, fixed & sticky), visibility, z-index, flexbox, web units, media queries, pseudo selectors, shadow properties, Introduction to animation and key frames, responsive properties, Introduction to bootstrap 4 & 5	**05**
3	**Client side scripting – JavaScript** Introduction to Javascript (Frontend & backend), writing in-browser javascript & developer console. Variables, Data types, Operators, String and String functions, scope, conditional statements, functions, loops, DOM library functions, Event Listeners, arrow functions.	**08**
4	**NodeJs** NodeJs introduction and installation, First app, Asynchronous programming, Callback concept, Event loops, REPL, Event emitter, Networking module, Buffers, Streams, File system, Web module.serving HTML files using NodeJs, Node package manager, Basics of Express and Postman	**06**

5	**Introduction to Angular** Angular Development Environment, Basic Angular Component and Template, Data Binding and Event Handling, Fetching Data from APIs and Displaying using HTTP Client, Routing and Navigation, Forms, Form Validation, Authentication and Authorization, Testing Angular Components and Services, Implementing in Angular Applications	**06**
6	**Introduction to ReactJs and Advance React** Introduction and Installation, understanding JSX, Prop & Prop Types, Understanding State and Event Handling, TextUtils, Functional componentsRefs, Use effects, Hooks, Flow architecture, Model-View Controller framework, Flux, Bundling the application. Webpack	**09**
	Total	**39**

List of Laboratory Experiments: (Minimum any ten experiments)	
Sr. No.	**Suggested Experiments**
1	HTML, HTML5: a. Creating a Basic Web Page Using HTML and HTML5 tags b. Incorporating Multimedia Elements with HTML5 (e.g., Audio, Video) c. Building a Navigation Menu using HTML5 Semantic Elements
2	XML: a. Creating XML Documents and Validating XML Syntax b. Creating XML-based Web Services c. Converting XML to JSON and vice versa
3	CSS: a. Enhancing User Interfaces with CSS Transitions and Animations b. Creating Responsive Layouts with CSS Grid
4	CSS3: a. Design a responsive web page using media queries and CSS3 b. Implementing CSS3 Filters and Effects for Visual Enhancements

5	Bootstrap: a. Building a Responsive Layout with Bootstrap Grid System b. Styling Buttons and Forms using Bootstrap Components c. Implementing Bootstrap Dropdowns and Accordions for Content Organization
6	JavaScript: a. Creating Interactive Web Elements with JavaScript Event Handling b. Implementing Form Validation using JavaScript c. Building Dynamic Content with JavaScript DOM Manipulation
7	Program to design a calculator using JavaScript.
8	NodeJs: a. Setting up a Node.js Development Environment b. Creating and Running a Simple Node.js Server c. Building a RESTful API with Node.js and Express
9	Working with Databases in Node.js (e.g., MongoDB, MySQL)
10	Postman: a. Introduction to Postman and API Testing Basics b. Sending GET Requests and Handling Response Data in Postman c. Testing POST Requests and Data Validation with Postman d. Writing and Executing Test Scripts in Postman
11	Angular: a. Creating Dynamic and Responsive User Interfaces with Angular Directives b. Building Forms and Performing Form Validation in Angular c. Deploying an Angular Application to a Web Server
12	ReactJs: a. Setting up a React Development Environment b. Implementing Component State and Handling User Interactions in React c. Fetching Data from APIs and Displaying it in React d. Testing React Components and Hooks
13	Advance React: a. Building React Components with Flux Data Flow b. Implementing Model-View-Controller in React with State Management Libraries c. Implementing Controllers for Handling User Interactions in React MVC

14	Webpack: a. Setting up a Webpack Development Environment b. Configuring Webpack for Bundling JavaScript Modules c. Handling CSS and Style Assets with Webpack
15	Mini Project – Complete website development using client and server side technologies.

Books Recommended:

Textbook Books:

1. DT Editorial Services, "HTML5 Black Book", 2nd Edition, Dreamtech Press, 2016.

2. Ben Frain, "Responsive Web Design with HTML5 and CSS3", 2nd Edition, Packt Publishing, 2015.

3. Steve Suehring, "JavaScript Step by Step", 3rd Edition, Pearson Education, 2013.

4. Stoyan Stefanov, "React Up Running Building Web Applications", 1st Edition, O'Reilly Media Inc.,2016.

5. David Sklar, "Learning PHP 5", 1st Edition, O'Reilly Media Inc., 2004.

Reference Books:

1. Benjamin LaGrone, "HTML5 and CSS3 Responsive Web Design Cookbook", 1st Edition, Packt Publishing, 2013.

2. DT Editorial Services, "Web Technologies: Black Book", 1st Edition, Dreamtech Press, 2018.

3. Christopher Schmitt, Kyle Simpson, "HTML5 Cookbook", 1st Edition, O'Reilly Media Inc., 2011.

4. Uttam K. Roy, "Web Technologies", 1st Edition, Oxford University Press, 2010.

5. Greg Sidelnikov, "React. Js Book: Learning React JavaScript Library from Scratch", 1st Edition, Independently Published, 2017.

6. Luke Welling; Laura Thomson, "PHP and MySQL Web Development", 5th Edition, Addison-Wesley Professional PTG, 2017.

Web resources:

1. https://www.coursera.org/learn/html-css-javascript-for-web-developers?action=enroll
2. https://reactjs.org/tutorial/tutorial.html
3. https://react-redux.js.org/introduction/quick-start

4. https://webpack.js.org/
5. https://developer.mozilla.org/en-US/
6. https://www.w3schools.com/
7. https://css-tricks.com/
8. https://www.smashingmagazine.com

Online Courses:NPTEL/Swayam

1. Web Technologies - Prof. Soumya Kanti Ghosh , Course link: Web Technologies - NPTEL
2. Introduction to Modern Application Development - Prof. Soumya Kanti Ghosh, Course link: Introduction to Modern Application Development - NPTEL
3. Web Development with Django - Prof. Vimal Kumar, Course link: Web Development with Django - NPTEL
4. Web Development - Prof. Balaji Sampath, Course link: Web Development - NPTEL
5. Modern Web Applications with AngularJS - Prof. Sridhar Iyer, Course link: Modern Web Applications with AngularJS – NPTEL

Evaluation Scheme:

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 web application development. This helps them to apply the knowledge gained during laboratory sessions to solve real time problems.

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. Mini project: 10 Marks
iii. Attendance: 5 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 Blockchain Technology **S.Y. B.Tech.** **Semester: IV**

Course: Constitution of India(DJS22A2)

Objectives:

1. To provide basic information about Indian constitution.
2. To identify individual role and ethical responsibility towards society.
3. To understand human rights and its implications.

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

1. Have general knowledge and legal literacy and thereby to take up competitive examinations.
2. Understand state and central policies, fundamental duties.
3. Understand Electoral Process, special provisions.
4. Understand powers and functions of Municipalities, Panchayats and Co- operative Societies.
5. Understand Engineering ethics and responsibilities of Engineers.
6. Understand Engineering Integrity & Reliability.

Environmental Studies (DJS22A2)		
Unit	**Description**	**Duration**
1	**Introduction to the Constitution of India** The Making of the Constitution and Salient features of the Constitution. Preamble to the Indian Constitution Fundamental Rights & its limitations.	**02**
2	**Directive Principles of State Policy:** Relevance of Directive Principles State Policy Fundamental Duties. Union Executives – President, Prime Minister Parliament Supreme Court of India.	**03**

3	**State Executives:** Governor, Chief Minister, State Legislature High Court of State. Electoral Process in India, Amendment Procedures, 42nd, 44th, 74th, 76th, 86th & 91stAmendments.	**03**
4	**Special Provisions:** For SC & ST Special Provision for Women, Children & Backward Classes Emergency Provisions. Human Rights: Meaning and Definitions, Legislation Specific Themes in Human Rights- Working of National Human Rights Commission in India, Powers and functions of Municipalities, Panchayats and Co – Operative Societies.	**03**
5	**Scope & Aims of Engineering Ethics:** Responsibility of Engineers Impediments to Responsibility. Risks, Safety and liability of Engineers, Honesty, Integrity & Reliability in Engineering	**03**
	Total	**14**

Books Recommended:

Text books:

1. Durga Das Basu: "Introduction to the Constitution on India", (Students Edn.) Prentice – Hall EEE, 19th/ 20th Edn., 2001

2. Charles E. Haries, Michael S Pritchard and Michael J. Robins "Engineering Ethics" Thompson Asia, 2003-08-05.

Reference Books:

1. M.V.Pylee, "An Introduction to Constitution of India", Vikas Publishing, 2002.

2. M.Govindarajan, S.Natarajan, V.S.Senthilkumar, "Engineering Ethics", Prentice – Hall of India Pvt. Ltd. New Delhi, 2004

3. Brij Kishore Sharma," Introduction to the Constitution of India", PHI Learning Pvt. Ltd., New Delhi, 2011.

4. Latest Publications of Indian Institute of Human Rights, New Delhi

Website Resources:

1. www.nptel.ac.in
2. www.hnlu.ac.in
3. www.nspe.org
4. www.preservearticles.com

Prepared by Checked by Head of the Department Principal

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

Course: Innovative Product Development II (DJS22ILLA2)

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 the team or as the leader.

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 finalization of the product selected.

Second shall be on finalization 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.