Shri Vile Parle Kelavani Mandal's

Dwarkadas J. Sanghvi College of Engineering

(Autonomous College Affiliated to the University of Mumbai)

Scheme and detailed syllabus

Third Year B.Tech

in

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

(Semester V)

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

(IoT and Cyber Security with Blockchain Technology)

With effect from the Academic Year: 2025-2026

Shri Vile Parle Kelavani Mandal's
DWARKADAS J. SANGHVI COLLEGE OF ENGINEERING
(Autonomous College Affiliated to the University of Mumbai)
NAAC Accredited with "A" Grade (CGPA: 3.18)

Scheme for Third Year Undergraduate Program in Computer Science and Engineering (IoT and Cyber Security with Block Chain Technology) : Semester V (Autonomous) Academic Year (2025-2026)

Sr. No.	Course Code	Course	Teaching Scheme			Continuous Assessment (A)						Semester End Examination (B)						Aggregate (A+B)	Credits
			Theory (hrs.)	Practical (hrs.)	Tutorial (hrs.)	Term Test 1 (TT1) -a	Term Test 2 (TT2) - b	Assg/CP/GD /Presentation/ Quiz) - c	Total (a+b+c)	Term work	CA Total	Duration	Theory	Oral	Pract	Oral & Pract	SEE Total		
1	DJS23BCPC501	Embedded System and IoT	3	--	--	15	15	10	40	--	40	2	60	--	--	--	60	100	3
	DJS23BLPC501	Embedded System and IoT Laboratory	--	2	--	--	--	--	--	25	25	2	--	25	--	--	25	50	1
2	DJS23BCPC502	Applied Cryptography	3	--	--	15	15	10	40	--	40	2	60	--	--	--	60	100	3
	DJS23BLPC502	Applied Cryptography Laboratory	--	2	--	--	--	--	--	25	25	2	--	--	--	25	25	50	1
3	DJS23BCPC503	Introduction to Blockcham Technology	2	--	--	15	15	10	40	--	40	2	60	--	--	--	60	100	2
	DJS23BLPC503	Introduction to Blockchain Technology Laboratory	--	2	--	--	--	--	--	25	25	2	--	25	--	--	25	50	1
4	DJS23BLPC504	Web application Development Laboratory	--	2	--	--	--	--	--	25	25	2	--	--	--	25	25	50	1
5	DJS23BCPE511	Distributed Computing	3	--	--	15	15	10	40	--	40	2	60	--	--	--	60	100	3
	DJS23BLPE511	Distributed Computing Laboratory	--	2	--	--	--	--	--	25	25	2	--	25	--	--	25	50	1
	DJS23BCPE512	Computer Vision	3	--	--	15	15	10	40	--	40	2	60	--	--	--	60	100	3
	DJS23BLPE512	Computer Vision Laboratory	--	2	--	--	--	--	--	25	25	2	--	25	--	--	25	50	1
	DJS23BCPE513	Cognitive Computing	3	--	--	15	15	10	40	--	40	2	60	--	--	--	60	100	3
	DJS23BLPE513	Cognitive Computing Laboratory	--	2	--	--	--	--	--	25	25	2	--	25	--	--	25	50	1
6	DJS23BCMD501	Artificial Intelligence	3	--	--	15	15	10	40	--	40	2	60	--	--	--	60	100	3
	DJS23BLMD501	Artificial Intelligence Laboratory	--	2	--	--	--	--	--	25	25	2	--	--	--	25	25	50	1
7	DJS23ITHSX10	Environmental Studies	--	--	1	--	--	--	--	25	25	--	--	--	--	--	--	25	1
8	DJS23IPSCX03	Innovative Product Development III	--	2	--	--	--	--	--	25	25	2	--	--	--	25	25	50	1
		Total	14	14	1	75	75	50	200	200	400	24	300	75	0	100	475	875	22

Prepared by | Checked by | Head of the Department | Vice Principal | Principal

PROGRAMME CORE COURSE

Program: B.Tech in Computer Science and Engineering(IoT and Cybersecurity with Block chain Technology)				T.Y.B.Tech				Semester : V	
Course : Embedded System and IoT				Course Code: DJS23BCPC501					
Course: Embedded System and IoT Laboratory				Course Code: DJS23BLPC501					
Teaching Scheme (Hours / week)				Evaluation Scheme					
				Continuous Assessment Marks (A)				Semester End Examination Marks (B)	Total marks (A+B)
Lectures	Practical	Tutorial	Total Credits	Term Test 1	Term Test 2	Assignment	Total	Theory	
				15	15	10	40	60	100
				Term Work				Laboratory Examination	
3	2	--	4	Laboratory Work	Tutorial / Mini project /presentation / Journal/ Practical	Total Term work	Oral	Practical	Oral & Practical	50
				15	10	25	25	--	--	

Prerequisite:
1. Basics of Programming
2. Fundamentals of Sensor and Secured Technologies

Course Objectives: The objective of the course is
1. To emphasis on working of Microcontroller.
2. To Understand the definition and significance of the Internet of Things
3. To provide hands-on experience in designing IoT applications using various sensors, actuators, and cloud-based platforms.
4. To familiarize with IoT communication protocols, data processing techniques, edge analytics, and IoT security challenges.

Course Outcomes: On completion of the course, learner will be able to:
1. Understand the architecture of 8051 microcontrollers.
2. Implement interfacing with ARM, ESP32 and Raspberry Pi.
3. Explore applications in areas of IoT using sensors and actuators.
4. Use IoT communication models and protocols.
5. Utilize Edge analytics to perform data stream mining.
6.Explore various applications and security in IoT.

Detailed Syllabus:

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.	04
2	**Architecture:** Basic ARM architecture, ARM organization core Data flow Model, ARM register organization, current program register organization. Introduction to ESP32, Architecture of ESP32, Introduction to Raspberry Pi, Understanding SoC architecture and SoCs used in Raspberry Pi, Pin Description of Raspberry Pi, On-board components of Rpi.	08
3	**IoT with Sensors and actuators:** IoT Growth- A Statistical View, Application area of IoT, Things in IoT, IoT stack, IoT challenges, Cyber physical systems versus IoT, Wireless sensor Network with IoT, Sensors for different IoT applications, working principle of Soil Moisture Sensor, Gas Sensor, Obstacle Sensor, Gyro Sensor, LDR Sensor, GPS Sensor Medical Sensor: Heartbeat & Pulse Sensor **Actuators:** Motors – Servo, DC, Stepper; Relay – SPDT, DPDT, Solenoid	09
4	**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, Hierarchical Protocols, LEACH, QoS-Based Protocols.	07
5	**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.	06
6	**Applications and Security:** IoT applications: Smart Agriculture: Precision farming, soil monitoring, weather prediction, Smart Healthcare: Remote patient monitoring, wearable sensors, AI diagnostics, Smart Cities: Traffic management, waste management, smart lighting, Industrial IoT (IIoT): Predictive maintenance, automation, robotics, Smart Homes: Home automation, energy management, security systems. IoT Security: IoT Threats and Attack Vectors, Blockchain and IoT Security.	05
	Total	39

List of Laboratory Experiments:	
Sr. No	**Suggested Experiments**
1	To study and explore Tinkercad Simulator Case study based on current trends and advancement in IoT.
2	To implement Motion Detection and Alert System Using PIR Sensor in IoT
3	To implement interfacing of ultrasonic sensor with ESP32.
4	To monitor a weather using ESP32 and Think speak.
5	To implement interfacing of LM35 with Arduino Uno and LCD monitor.
6	To control home devices (LED) using self-hosted page on Amazon AWS.
7	To send email alert using ESP32 via SMTP server.
8	To monitor heart rate using Pulse sensor and Arduino Uno.
9	To implement program for ESP32 DHT11/DHT22 Temperature and Humidity Web Server with Arduino IDE.
10	To perform Soil Moisture Monitoring and Analysis Using IoT Sensors
11	To study and implement IoT Data processing using Pandas
12	Mini project (A group of 3 to 4 students is required to develop an application using IoT sensors and devices and submit report).

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.

5. Brojo Kishore Mishra and Amit Vishwasrao Salunkhe, Internet of Things: Technological Advances and New Applications, CRC 2024.

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:

Continuous Assessment (A)

Theory:

1. Term Test 1 (based on 40 % syllabus) of 15 marks for the duration of 45 min.
2. Term Test 2 (on next 40 % syllabus) of 15 marks for the duration of 45 min.
3. Assignment / course project / group discussion /presentation / quiz/case study for 10 marks.

Laboratory: (Term work)

Term work shall consist of minimum 8 experiments and a 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 (Implementation, Report): 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.

Semester End Examination (B):

Theory:

1. Question paper will be based on the entire syllabus summing up to 60 marks.
2. Total duration allotted for writing the paper is 2 hrs.

Laboratory:

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

Prepared by | Checked by | Head of the Department | Vice Principal | Principal

Program: B.Tech in Computer Science and Engineering(IoT and Cybersecurity with Block Chain Technology)	T.Y. B.Tech	Semester : V
Course: Applied Cryptography	Course Code: DJS23BCPC502	
Course Laboratory: Applied Cryptography Laboratory	Course Code: DJS23BLPC502	

Teaching Scheme (Hours / week)				Evaluation Scheme								
				Continuous Assessment Marks (A)				Semester End Examination Marks (B)				Total Marks (A+B)
Lectures	Practical	Tutorial	Total Credits	Term Test 1	Term Test 2	Assignment	Total	Theory				
				15	15	10	40	60				100
				Term Work				Laboratory Examination				
3	2	–	4	Laboratory Work	Tutorial / Mini project / presentation/ Journal/ Practical		Total Term work	Oral	Practical		Oral & Practical	50
				15	10		25	–	–		25	

Pre-requisite:

1. Mathematics – I
2. Mathematics – II
3. Fundamentals of Sensor and Secured Technologies
4. Computer Networks

Course Objectives: The objective of the course is

1. To introduce classical encryption methods, along with key concepts in modular arithmetic and number theory.
2. To gain a foundational understanding of cryptography and its core principles.
3. To explore the functioning and applications of various cryptographic algorithms
4. To gain skills in using cryptographic tools for secure communication.

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

1. Understand the fundamental principles of number theory and classical encryption techniques.
2. Analyze symmetric-key and public-key cryptosystem techniques for secure communication.
3. Evaluate different cryptographic hash functions in various security contexts.
4. Implement digital signature algorithms and understand digital certificates within a PKI infrastructure

Detailed Syllabus		
Unit	**Description**	**Duration**
1	**Number Theory for Security and Cryptography:** OSI Security Architecture, Modular Arithmetic, Euclidean Algorithm, Prime Numbers, Relatively Prime Numbers, Primitive Roots, Fermat's Little Theorem, Euler Totient Function, Extended Euclidean Algorithm, Chinese Remainder Theorem	07
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.	06
3	**Symetric-Key Encryption:** Block Ciphers, Stream Ciphers, Modes of Operation, Feistel Ciphers, Data Encryption Standard (DES), Cracking DES, Triple DES, Advanced Encryption Standard (AES), Modern Block Cipher, RC5, Cryptanalysis, Weak Keys. **Symetric-Key Distribution:** KDC, Needham-Schroeder Protocol, Diffie-Hellman Key Exchange Algorithm	09
4	**Public-Key Cryptography:** Public-Key Cryptography, Knapsack Cryptosystem, RSA Cryptosystem, Attack on RSA, ELGamal cryptosystem, Security of ElGamal, Elliptic Curve Cryptography [ECC]	06
5	**Cryptographic Hash Functions:** Cryptographic Hash Functions – MD5, attack on MD5, SHA-1, SHA-3, SHA-256, SHA-512 MAC, HMAC, CMAC	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: Definition, Basic Principles of Quantum Mechanics Relevant to Cryptography, Applications and Challenges	06
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/SHA-1
16	Implementation of Digital Signatures in Cryptography

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, 8th Edition, Pearson Education, June 2023.
2. Behrouz A. Ferouzan, —Cryptography & Network Security, Tata McGraw Hill 3rd Edition 2015
3. Bernard L. Menezes — Cryptography, Network Security, and Cyber Laws, Cengage Learning 2018
4. Network Security Bible, Eric Cole, Second Edition, Wiley. 2015

Reference Books:

1. Applied Cryptography, Protocols Algorithms and Source Code in C, Bruce Schneier, Wiley 2015
2. Cryptography and Network Security, Atul Kahate, Tata Mc Graw Hill, Fourth Edition 2019

Web Resources:

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

Ghelokar.

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/challengeresponseauthentication-mechanism-cram.

Online Courses: NPTEL / Swayam

1. Foundations of Cryptography, Prof. Ashish Choudhury, IIIT Bangalore https://nptel.ac.in/courses/106106221.
2. Cryptography I Dan Boneh, Sanfort https://www.coursera.org/learn/crypto.
3. Introduction to Applied Cryptography Specialization Sang-Yoon Chang, University of Colorado https://www.coursera.org/specializations/introduction-applied-cryptography

Evaluation Scheme:

Continuous Assessment (A)

Theory:

1. Term Test 1 (based on 40 % syllabus) of 15 marks for the duration of 45 min.
2. Term Test 2 (on next 40 % syllabus) of 15 marks for the duration of 45 min.
3. Assignment / course project / group discussion /presentation / quiz for 10 marks.

Laboratory: (Term work)

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

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

i. Laboratory work (Performance of Experiments): 15 Marks
ii. Mini Project/ Presentation/ 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.

Semester End Examination (B):

Theory:

1. Question paper will be based on the entire syllabus summing up to 60 marks.
2. Total duration allotted for writing the paper is 2 hrs.

Laboratory:

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

Prepared by **Checked by** **Head of the Department** **Vice Principal** **Principal**

Program: B.Tech in Computer Science and Engineering(IoT and Cybersecurity with Block chain Technology)	**T.Y.B.Tech**	**Semester : V**
Course : Introduction to Blockchain Technology	**Course Code: DJS23BCPC503**	
Course: Introduction to Blockchain Technology Laboratory	**Course Code: DJS23BLPC503**	

Teaching Scheme (Hours / week)				Evaluation Scheme								
				Continuous Assessment Marks (A)				Semester End Examination Marks (B)			Total marks (A+B)
Lectures	Practical	Tutorial	Total Credits	Term Test 1	Term Test 2	Assignment	Total	Theory			
				15	15	10	40	60			100
				Term Work				Laboratory Examination			50
2	2	--	3	Laboratory Work	Tutorial / Mini project / presentation/ Journal/ Practical	Total Term work		Oral	Practical	Oral & Practical	
				15	10	25		25	--	--	

Prerequisite:

1. Fundamentals of Sensor and Secured Technologies
2. Computer Networks

Course Objectives: The objective of the course is

1. To understand emerging Blockchain Technology and its relevance with cryptography.
2. To demonstrate the use of cryptography required for Blockchain.
3. To understand smart contracts, wallets, and consensus protocols.
4. To design and develop Blockchain applications.

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

1. Acquire basic knowledge of Blockchain technology to implement cryptographic primitives useful for Blockchain
2. Understand bitcoin cryptocurrency networks and consensus mechanisms.
3. Design and deploy decentralized applications on Ethereum using Solidity
4. Utilize Hyperledger Fabric tools and SDKs to implement permissioned blockchain solutions.
5. Analyze and implement Smart Transaction Mechanisms.

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Detailed Syllabus:

Unit	Description	Duration
1	**Basic Crypto primitives for Blockchain Technology:** Preview:Introduction to Blockchain Technology The Model of Decentralization, Block structure, Block header, Types of Blockchain: Public, Private and Hybrid Blockchain. Cryptographic Primitives, Cryptographic Hash, Hash Functions, Merkle Tree, Hash Chain, Construction of Chain of Blocks, Digital Signature	06
2	**Bitcoin and Consensus:** Bitcoin P2P network, Transaction flooding in Bitcoin mining, double spending attack, Forks, The Monopoly Problem-51% attack **Consensus:** Consensus Approach, Consensus Algorithms: Proof-of-Stake (PoS), Proof-of-Work (PoW), Proof-of-Burn (PoB), Proof-of-Elapsed Time (PoET), Proof of History (PoH), State Machine Replication as a Consensus, Crash Fault Tolerance, PAXOS, Byzantine Fault Tolerant (BFT), BFT Consensus, Practical BFT	06
3	**Ethereum:** Ethereum and its Components, Ethereum Virtual Machine (EVM), Ethereum Ecosystem, Transaction, Comparison between Bitcoin and Ethereum, test-networks, Smart Contracts, Introduction to solidity programming, Auctions in Ethereum, NFT Auction, Ganache, MetaMask, Hardhat	06
4	**Hyperledger:** Introduction to Hyperledger Fabric, Key features of Hyperledger fabric, Hyperledger Fabric Architecture, Ethereum v/s Hyperledger framework, Fabric Transaction Flow, Hyperledger Tools and Libraries, Hyperledger Fabric Chaincode	04
5	**Decentralized Finance & Smart Transactions:** Blockchain in DeFi: Case Study on any of the Blockchain Platforms, Smart property, Efficient micro-payments, Coupling transactions and payments, Escrow transactions	04
	Total	26

List of Laboratory Experiments:

Sr. No.	Suggested Experiments
1	To create basic Blockchain with sample transactions and print it.
2	To implement Merkle root from the transactions and verify the validity of transactions using it.
3	To implement Proof of Work (PoW) concept in Bitcoin Mining and demonstrating it.
4	To analyse and implement Unspent Transaction Outputs (UTXOs) in Bitcoin and demonstrate the transactions using UTXOs.
5	To create and deploy Smart Contract using Solidity and Remix IDE.
6	To perform Embedding wallet and transaction using Solidity and MetaMask.
7	To implement blockchain using Geth (Go-Ethereum).

Kholkar

8	To implement local Blockchain using tools viz. Ganache and Hardhat.
9	To interacting with the Ethereum Blockchain Using Web3.js
10	Developing and Deploying a Permissioned Blockchain Network using Hyperledger Fabric
11	To install Hyperledger Fabric and demonstrate its usability.
12	To query and invoke transactions on Fabric Test Network.
13	To develop an Ethereum smart contract that locks funds from a buyer to design a secure escrow system.
14	Deploy an Ethereum smart contract representing ownership of an asset and Implement a function to transfer ownership securely using a blockchain transaction.
15	Mini Project (A group of 3 to 4 students is required to develop an application using blockchain technology and submit report).

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

Books Recommended:

Text Books:

1. Imran Bashir , Mastering Blockchain: A deep dive into distributed ledgers, consensus protocols, smart contracts, DApps, cryptocurrencies, Ethereum, and more, 3rd Edition, Packt Publishing, 2020, ISBN: 9781839213199,
2. Kumar Saurabh , Ashutosh Saxena, Blockchain Technology: Concepts and Applications , 1st Edition, Wiley Publication, 2020, ISBN:978-81-265-5766-0
3. S. Shukla, M. Dhawan, S. Sharma, S. Venkatesan, -Blockchain Technology: Cryptocurrency and Applications, Oxford University Press, 2019
4. Cryptography and Network Security – Principles and Practice by William Stallings, Pearson 2017

Reference Books:

1. Antony Lewis, Basics of Bitcoins and Blockchain, Mango Publishing, 2021
2. Yathish R and Tejaswini N, Blockchain for Beginners, Shroff/X-Team, 2019
3. Daniel Drescher, Blockchain Basics, A non-Technical Introduction in 25 Steps, Apress, 2017.
4. Luc Desrosiers, Nitin Gaur, Salman A. Baset, Venkatraman Ramakrishna, Blockchain with Hyperledger Fabric, Packt Publishing, 2020
5. Bikramaditya Singhal, Gautam Dhameja, Priyansu Sekhar Panda, Beginning Blockchain: A Beginner's Guide to Building Blockchain Solutions, Apress, 2018

Web resources:

1. Hyperledger Tutorials - https://www.hyperledger.org/use/tutorials

2. Ethereum Development Resources - https://ethereum.org/en/developers/
3. Solidity Tutorial- https://www.tutorialspoint.com/solidity/index.htm
4. Metamask- https://docs.metamask.io/guide/

Online Courses: NPTEL / Swayam

1. Blockchain and its Applications, By Prof. Sandip Chakraborty, Prof. Shamik Sural IIT Kharagpur
   https://onlinecourses.nptel.ac.in/noc23_cs47/preview
2. Blockchain Architecture Design and Use Cases, By Prof. Sandip Chakraborty & Dr. Praveen Jayachandran | IIT Kharagpur and IBM,
   https://onlinecourses.nptel.ac.in/noc19_cs63/preview
3. Blockchain, By Dr.Mayank Aggarwal ,Gurukul Kangri Vishwavidyalaya,Haridwar
   https://onlinecourses.swayam2.ac.in/aic21_ge01/preview

Evaluation Scheme:

Continuous Assessment (A)

Theory:

1. Term Test 1 (based on 40 % syllabus) of 15 marks for the duration of 45 min.
2. Term Test 2 (on next 40 % syllabus) of 15 marks for the duration of 45 min.
3. Assignment / course project / group discussion /presentation / quiz/ any other for 10 marks.

Laboratory: (Term work)

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

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

i. Laboratory work (Performance of Experiments, Write-up): 15 Marks
ii. Miniproject (Implementation, Report): 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.

Semester End Examination (B):

Theory:

1. Question paper will be based on the entire syllabus summing up to 60 marks.
2. Total duration allotted for writing the paper is 2 hrs.

Laboratory:

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

Prepared by | Checked by | Head of the Department | Vice Principal | Principal

Shri Vile Parle Kelavani Mandal's
DWARKADAS J. SANGHVI COLLEGE OF ENGINEERING
(Autonomous College Affiliated to the University of Mumbai)
NAAC Accredited with "A" Grade (CGPA : 3.18)

Program: B.Tech in Computer Science and Engineering(IoT and Cybersecurity with Block chain Technology)	**T.Y.B.Tech**	**Semester : V**
Course : Web Application Development Laboratory	**Course Code: DJS23BLPC504**	

Teaching Scheme (Hours / week)				**Evaluation Scheme**							
				Continuous Assessment Marks (A)				**Semester End Examination Marks (B)**			**Total marks (A+ B)**
Lectures	**Practical**	**Tutorial**	**Total Credits**	**Term Test 1**	**Term Test 2**	**Assignment**	**Total**	**Theory**			
				--	--	--	--	--			--
				Term Work				**Laboratory Examination**			
--	2	--	1	**Laboratory Work**	**Tutorial / Mini project / presentation/ Journal/ Practical**	**Total Term work**		**Oral**	**Practical**	**Oral & Practical**	50
				15	10	25		--	--	25	

Prerequisite:

1. Object Oriented Programming using Java
2. Python programming

Objectives: The objectives of the course are:

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.
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 completion of the course, learner will be able to:

1. Design and develop responsive and user-friendly web applications.
2. Build dynamic and interactive web applications.

3. Explore new web development technologies.
4. Work effectively as a member of a team to complete mini project.

Detailed Syllabus:		
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	04
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.	04
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.	04

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 .	**05**
6	**Introduction to ReactJs and Advance React :** Introduction and Installation, understanding JSX, Prop & Prop Types, Understanding State and Event Handling, TextUtils, Functional components- Refs, Use effects, Hooks, Flow architecture, Model-View Controller framework, Flux, Bundling the application. **Database Connectivity**: MongoDB Installation, connecting to MongoDB, CRUD Operations, Frontend Integration with React, User Authentication (JWT), Role-based Access Control	**04**
	Total	**26**

List of Laboratory Experiments:	
Sr. No.	**Suggested Experiments**
1	**HTML, HTML5:** a. Create a Basic Web Page Using HTML and HTML5 tags . b. Incorporate Multimedia Elements with HTML5 (e.g., Audio, Video) . c. Build a Navigation Menu using HTML5 Semantic Elements .
2	**XML:** a. Create XML Documents and Validating XML Syntax . b. Create XML-based Web Services. c. Convert XML to JSON and vice versa .
3	**CSS:** a. Enhance User Interfaces with CSS Transitions and Animations . b. Create Responsive Layouts with CSS Grid.
4	**CSS3:** a. Design a responsive web page using media queries and CSS3 . b. Implement CSS3 Filters and Effects for Visual Enhancements .
5	**Bootstrap:** a. Build a Responsive Layout with Bootstrap Grid System . b. Style Buttons and Forms using Bootstrap Components . c. Implement Bootstrap Dropdowns and Accordions for Content Organization .
6	**JavaScript:** a. Create Interactive Web Elements with JavaScript Event Handling .

	b. Implement Form Validation using JavaScript . c. Build Dynamic Content with JavaScript DOM Manipulation . d. Design a calculator using JavaScript
7	**NodeJs:** a. Set up a Node.js Development Environment . b. Create and Running a Simple Node.js Server . c. Build a RESTful API with Node.js and Express .
8	**MongoDB:** Work with Databases in Node.js (e.g., MongoDB) Create an application to demonstrate connection of Node-RED with MongoDB.
9	**Angular:** a. Create Dynamic and Responsive User Interfaces with Angular Directives. b. Build Forms and Performing Form Validation in Angular . c. Deploy an Angular Application to a Web Server .
10	**ReactJs:** a. Set up a React Development Environment . b. Implement Component State and Handling User Interactions in React . c. Fetch Data from APIs and Displaying it in React . d. Test React Components and Hooks .
11	**Advance React:** a. Build React Components with Flux Data Flow . b. Implement Model-View-Controller in React with State Management Libraries . c. Implement Controllers for Handling User Interactions in React MVC.
12	Mini Project – Develop website using MERN stack. Website must include home page, and at least 3 forms (with Validation), use at least HTML5, CSS/Bootstrap, JavaScript, React.js web technologies. Deploy website on live webserver and access through URL.

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

Books Recommended:

Text Books:

1. Haverbeke, M, Eloquent JavaScript: A Modern Introduction to Programming, 3rd Edition, No Starch Press, 2021.
2. Chinnathambi, C., Learning React: Modern Patterns for Developing React Apps, Packt Publishing, 2023.
3. DT Editorial Services, HTML5 Black Book, 2nd Edition, Dreamtech Press, 2016.
4. Ben Frain, Responsive Web Design with HTML5 and CSS3, 2nd Edition, Packt Publishing, 2015.
5. Casciaro, M., and Lavin, M., Node.js Design Patterns, 2nd Edition, Packt Publishing, 2022

6. Stoyan Stefanov, React Up Running Building Web Applications, 1st Edition, O'Reilly Media Inc., 2016.
7. David Sklar, Learning PHP 5, 1st Edition, O'Reilly Media Inc., 2004.

Reference Books:

1. Ho, A., and Prieto, A., Fullstack React: The Complete Guide to ReactJS and Friends, 2nd Edition, Fullstack.io, 2020
2. Benjamin LaGrone, HTML5 and CSS3 Responsive Web Design Cookbook, 1st Edition, Packt Publishing, 2013.
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. Basics of HTML
   https://html-iitd.vlabs.ac.in/exp/introduction-to-html/references.html
2. Master Django Web Development: Hands-On Projects
   https://html-iitd.vlabs.ac.in/exp/introduction-to-html/references.html
3. Web Development courses for Students by IBM
   https://skillsbuild.org/students/course-catalog/web-development
4. Namaste JavaScript Online Available:
   https://www.youtube.com/playlistlist=PLlasXeu85E9cQ32gLCvAvr9vNaUccPVNP
5. Web Development Basics: Introduction to HTML5, CSS, and JavaScript
   https://www.coursera.org/learn/html-css-javascript-for-web-developers
6. Tutorial Tic Tac toe https://reactjs.org/tutorial/tutorial.html
7. React Redux https://react-redux.js.org/introduction/quick-start
8. https://developer.mozilla.org/en-US/

Online Courses:

1. Introduction to Modern Application Development - Prof. Soumya Kanti Ghosh, IIT Madras
   Course link: Introduction to Modern Application Development - Course

2. Modern Application Development Prof. Aamod Sane, Prof. Abhijat Vichare, Prof. Madhavan Mukund
   Course link: Modern Application Development - Course

Evaluation Scheme:

Continuous Assessment (A):

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Laboratory:

1. Term work shall consist of minimum 8 experiments.
2. The distribution of marks for term work shall be as follows:
   i. Laboratory work (Performance of Experiments): 15 Marks
   ii. Mini Project (Implementation and Report): 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

Semester End Examination (B):

Laboratory:

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

Prepared by Checked by Head of the Department Vice-Principal Principal

PROGRAMME ELECTIVE COURSE

Program: B.Tech in Computer Science and Engineering(IoT and Cybersecurity with Block chain Technology)				T.Y.B.Tech				Semester : V			
Course : Distributed Computing				Course Code: DJS23BCPE511							
Course: Distributed Computing Laboratory				Course Code: DJS23BLPE511							
Teaching Scheme (Hours / week)				Evaluation Scheme							
				Continuous Assessment Marks (A)				Semester End Examination Marks (B)			Total marks (A+ B)
Lectures	Practical	Tutorial	Total Credits	Term Test 1	Term Test 2	Assignment	Total	Theory			
				15	15	10	40	60			100
				Term Work				Laboratory Examination			50
3	2	–	4	Laboratory Work	Tutorial / Mini project /presentation/ Journal/ Practical		Total Term work	Oral	Practical	Oral & Practical	
				15	10		25	25	–	–	

Prerequisite:

1. Operating systems.
2. Computer Network.

Course Objectives: The objective of the course is

1. To provide students with contemporary knowledge in distributed systems
2. To empower students with the skills required to analyze, design, and develop distributed applications.
3. To develop expertise in assessing the performance of distributed synchronization algorithms.

Course outcomes: On completion of this course, learner will be able to:

1. Demonstrate knowledge of the basic elements and concepts related to distributed system.
2. Illustrate the middleware technologies that support distributed applications such as RPC, RMI and Object based middleware.
3. Analyze the various techniques used for clock synchronization and mutual exclusion.
4. Showcase the concepts of Resource and Process management and synchronization algorithms.
5. Demonstrate the concepts of Consistency and Replication Management.
6. Apply knowledge of Distributed File Systems to analyze NFS, AFS, and build large-scale distributed applications.

Detailed Syllabus:		
Unit	**Description**	**Duration**
1	**Introduction to Distributed Systems** Characterization of Distributed Systems: Issues, Goals, and Types of distributed systems, Distributed System Models, Hardware concepts, Software Concept. Middleware: Models of Middleware, Services offered by middleware, Client Server model.	06
2	**Communication:** Layered Protocols, Interprocess communication (IPC): MPI, Remote Procedure Call (RPC), Remote Object Invocation, Remote Method Invocation (RMI). Message Oriented Communication, Stream Oriented Communication, Group Communication.	07
3	**Synchronization :** Clock Synchronization, Logical Clocks, Election Algorithms, Mutual Exclusion, Distributed Mutual Exclusion-Classification of mutual Exclusion Algorithm, Requirements of Mutual Exclusion Algorithms, Performance measure. Non Token based Algorithms: Lamport Algorithm, Ricart–Agrawala's Algorithm, Maekawa's Algorithm. Token Based Algorithms: Suzuki-Kasami's Broardcast Algorithms, Singhal's Heurastic Algorithm, Raymond's Tree based Algorithm.	07
4	**Resource and Process Management :** Desirable Features of global Scheduling algorithm, Task assignment approach, Load balancing approach, load sharing approach Introduction to process management, process migration, Threads, Virtualization, Clients, Servers, Code Migration	06
5	**Consistency, Replication and Fault Tolerance:** Introduction to replication and consistency, Data-Centric and Client-Centric Consistency Models, Replica Management. Fault Tolerance: Introduction, Process resilience, Reliable client-server and group communication, Recovery	07
6	**Distributed File Systems and Name Services:** Introduction and features of DFS, File models, File Accessing models, File-Caching Schemes, File Replication, Case Study: Distributed File Systems (DSF), Network File System (NFS), Andrew File System (AFS) Introduction to Name services and Domain Name System, Directory Services, Case Study: The Global Name Service, The X.500 Directory Service	06
	Total	**39**

List of Laboratory Experiments:	
Sr. No.	**Suggested Experiments**
1	Implementing Remote Procedure Calls (RPC) and Remote Method Invocation (RMI) in Client-Server Systems
2	Implementing IPC Techniques for Efficient Process Coordination
3	Implementing Group Communication for Collaborative Systems
4	Designing Efficient Load Balancing Strategies for Scalability
5	Implementing Name Resolution Protocols for Network Communication
6	Implementing and Analyzing Election Algorithms in Distributed Systems
7	Implementing and Analyzing Clock Synchronization Algorithms
8	Implementing Deadlock Detection and Recovery in Distributed Systems
9	Designing and Implementing a Distributed File System
10	Case Study on a system that provides a global naming infrastructure, allowing unique identification of resources across a distributed network.
11	Case Study on distributed file system designed to handle large-scale data storage and retrieval for social media platforms like Facebook, ensuring data availability, fault tolerance, and fast access.
12	Case study analyzing how Google designs and scales its distributed systems, focusing on fault tolerance, scalability, and performance.

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 and Maarten Van Steen, —Distributed Systems: Principles and Paradigms, 4th edition, Word Press 2023.
2. George Coulouris, Jean Dollimore, Tim Kindberg, "Distributed Systems: Concepts and Design", 5th Edition, Pearson Education, 2012.

Reference Books:

1. Distributed Systems An Algorithmic Approach 2Ed By Sukumar Ghosh CRC press 2020.
2. Decentralized Systems and Distributed Computing by Sandhya Avasthi, Suman Lata Tripathi, Namrata Dhanda, and Satya Bhushan Verma Wiley Publication 2024.

Web resoures:

1. Distributed Computing:https://www.coursera.org/courses/distributedcomputing
2. Distributed Systems : https://www.udemy.com/course/building-distributed-systems

Online Courses: Nptel /Swayam Courses:

1. Distributed Systems by Rajiv Mishra IIT Karagpur
   https://onlinecourses.nptel.ac.in/noc21_cs87

Evaluation Scheme:

Continuous Assessment (A)

Theory:

1. Term Test 1 (based on 40 % syllabus) of 15 marks for the duration of 45 min.
2. Term Test 2 (on next 40 % syllabus) of 15 marks for the duration of 45 min.
3. Assignment / course project / group discussion /presentation / quiz/ any other for 10 marks.

Laboratory: (Term work)

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

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

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

Semester End Examination (B):

Theory:

1. Question paper will be based on the entire syllabus summing up to 60 marks.
2. Total duration allotted for writing the paper is 2 hrs.

Laboratory:

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

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 | VicePrincipal | Principal

Program: B.Tech in Computer Science and Engineering(IoT and Cybersecurity with Block chain Technology)	T.Y.B.Tech	Semester : V
Course : Computer Vision	Course Code: DJS23BCPE512	
Course: Computer Vision Laboratory	Course Code: DJS23BLPE512	

Teaching Scheme (Hours / week)				Evaluation Scheme								
				Continuous Assessment Marks (A)				Semester End Examination Marks (B)			Total marks (A+ B)
Lectures	Practical	Tutorial	Total Credits	Term Test 1	Term Test 2	Assignment	Total	Theory			
				15	15	10	40	60			100
				Term Work				Laboratory Examination			50
3	2	--	4	Laboratory Work	Tutorial / Mini project / presentation/ Journal/ Practical	Total Term work		Oral	Practical	Oral & Practical	
				15	10	25		25	–	–	

Prerequisite:

1. Statistics for Engineers.
2. Python Programming Laboratory.

Course Objectives: The objective of the course is

1. To locate and identify specific objects within an image or video.
2. To Divide an image into different segments or regions, each corresponding to different objects or areas.
3. To Understand and analyze movement or actions in a sequence of images.
4. To gain proficiency in morphological operations and image restoration techniques to analyze and enhance image features effectively.

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

1. Apply various point processing techniques to enhance images and improve visual quality.
2. Understand spatial and frequency domain filtering for image smoothing and sharpening using Image Transforms.
3. Design feature detection techniques for edges, corners, and textures of the image.
4. Select Techniques for dividing images into meaningful parts using Morphological operations.
5. Implement advanced image segmentation techniques, including thresholding, region-based segmentation, and boundary identification, to analyze and interpret digital images.
6. Describe the principles of motion analysis in computer vision

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Detailed Syllabus		
Unit	**Description**	**Duration**
1	**Fundamental Steps in Digital Image Processing:** Components of an Image Processing System, Image Sampling and Quantization, Some Basic Relationships Between Pixels.	2
2	**Image Enhancement (point processing):** Image Negative, Thresholding, Gray- level slicing with and without background, power law and log transform, Contrast Stretching, Histogram equalization and Histogram Specification **Image Enhancement in Spatial Domain (Neighbourhood processing):** Low Pass and High Pass filtering for image enhancement, Basics of Spatial Filtering, Generating Spatial Filter Masks–Smoothing and Sharpening Spatial Filtering Image Transforms: 1-D DFT, 2-D Discrete Fourier Transform and Its Inverse, Some Properties of 2D DFT, Walsh -Hadamard, Discrete Cosine Transform, Haar Transform, Slant Transform. **Image Enhancement in Frequency Domain:** The Basics of Filtering in the Frequency Domain, Smoothing and Sharpening frequency domain filters.	11
3	**Morphology:** Erosion and Dilation, Opening and Closing, The Hit or-Miss Transformation. Restoration: Noise models – Mean Filters – Order Statistics – Adaptive filters –wiener filter. **Corner and Interest Point detection:** The Harris Interest Point Operator: Corner Signals and shifts for various geometric configuration, Performance with crossing point and Junctions.	9
4	**Point, Line, and Edge Detection** Detection of Isolated Points, Line detection, edge models, basic and advance edge detection, Edge linking and boundary detection, Canny's edge detection algorithm.	7
5	**Thresholding:** Foundation, Role of illumination, Basic Global thresholding, Otsu's method Region Based segmentation: Region Growing, Region Splitting and merging, Relationships between pixels, Hough transform **Region Identification:** Chain code, simple geometric border representation Fourier Transform of boundaries, Boundary description using segment sequences.	6
6	**Optical Flow and Motion Analysis:** Optical Flow, Interpretation of Optical Fields, Using focus of expansion to avoid collision, Time to adjacency analysis, Basic difficulties with optical flow models, Stero from Motion.	4
Total		39

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List of Laboratory Experiments:	
Sr. No.	**Suggested Experiments**
1	To perform geometric, arithmetic, and logical operations on digital images.
2	Implement spatial domain image enhancement using various point processing techniques.
3	To apply spatial domain image enhancement using different neighbourhood processing techniques.
4	To improve image contrast through histogram equalization.
5	To enhance image contrast using histogram stretching technique.
6	Implement image enhancement techniques in the frequency domain.
7	Apply morphological operations such as erosion and dilation on images.
8	Modify image shapes by applying operations like opening and closing.
9	Implement morphological operations for image analysis and manipulation.
10	To detect image edges using both basic and advanced edge detection techniques.
11	Apply the Haar transform for image processing tasks.
12	Perform image transformations for various image processing applications.
13	Apply Image Transform on the Image.
14	Implement the Horn-Schunck optical flow method for motion estimation.
15	Apply the Lucas-Kanade optical flow method for estimating motion in images.
16	Mini Project (A group of 3 to 4 students is required to develop an application using Image processing and Computer Vison technology and submit report).

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

Books Recommended:

Text Books:

1. Rafel C. Gonzalez and Richard E. Woods, Digital Image Processing, Pearson Education Asia, 4th Edition, 2018.
2. Sanjit Mitra, Digital Signal Processing: A Computer Based Approach, Tata McGraw Hill, 4th Edition, 2013

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3. Richard Szeliski, Computer Vision: Algorithms and Applications, Springer, New York, 2nd edition, 2022.

Reference Books:

1. S. Salivahanan, A. Vallavaraj, C. Gnanapriya, Digital Signal Processing, Tata McGraw Hill Publication 4th Edition, 2019.
2. Arcangelo Distante, Cosimo Distante, Handbook of Image Processing and Computer Vision, Springer International Publishing, 2020
3. E. R. Davies, Computer and Machine Vision: Theory, Algorithms, Academic Press, 4th Edition, 2012.
4. S. Jayaraman, E. Esakkirajan and T. Veerkumar, Digital Image Processing, Tata McGraw Hill Education Private Ltd, 1st Edition, 2017.
5. Anil K. Jain, Fundamentals and Digital Image Processing, Pearson Education, 1st Edition, 2015.

Web Resources:

1. Image Enhancement in Spatial Domain
   https://medium.com/@gokcenazakyol/what-is-image-enhancement-image-processing-3-32a813087e0a
   https://www.pace.edu.in/img/course/Module_2-img.pdf
2. Image Enhancementt in Frequency Domain
   https://iipvapi.com/spatial-domain-and-frequency-domain-for-image-enhancement
3. Image Segmentation
   https://www.ibm.com/topics/image-segmentation
4. Morphological Image Processing
   https://www.cs.auckland.ac.nz/courses/compsci773s1c/lectures/ImageProcessing-html/topic4.htm
5. Image Transforms
   https://homepages.inf.ed.ac.uk/rbf/HIPR2/tranops.htm
6. Optical Flow
   https://www.doc.ic.ac.uk/~dfg/vision/v16.html

Online Courses: NPTEL

1. Digital Image Processing, By Prof. Prabir Kumar Biswas, IIT Kharagpur
   https://onlinecourses.nptel.ac.in/noc22_ee116/preview
2. Computer Vision and Image Processing - Fundamentals and Applications, By Prof. M. K. Bhuyan, IIT Guwahati
   https://onlinecourses.nptel.ac.in/noc24_ee38/preview

Evaluation Scheme:

Continuous Assessment (A)

Theory:

1. Term Test 1 (based on 40 % syllabus) of 15 marks for the duration of 45 min.
2. Term Test 2 (on next 40 % syllabus) of 15 marks for the duration of 45 min.
3. Assignment / course project / group discussion /presentation / quiz/ any other for 10 marks.

Laboratory: (Term work)

Term work shall consist of minimum 8 experiments and a 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 (Implementation, Report): 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.

Semester End Examination (B):

Theory:

1. Question paper will be based on the entire syllabus summing up to 60 marks.
2. Total duration allotted for writing the paper is 2 hrs.

Laboratory:

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

Prepared by | Checked by | Head of the Department | Vice Principal | Principal

Program: B.Tech in Computer Science and Engineering(IoT and Cybersecurity with Block chain Technology)										T.Y.B.Tech			Semester : V
Course : Cognitive Computing										Course Code: DJS23BCPE513			
Course: Cognitive Computing Laboratory										Course Code: DJS23BLPE513			
Teaching Scheme (Hours / week)				Evaluation Scheme									
				Continuous Assessment Marks (A)						Semester End Examination Marks (B)			Total marks (A+B)
Lectures	Practical	Tutorial	Total Credits	Term Test 1	Term Test 2	Assignment	Total			Theory			
				15	15	10	40			60			100
				Term Work						Laboratory Examination			50
3	2	--	4	Laboratory Work		Tutorial / Mini project /presentation/ Journal/ Practical		Total Term work		Oral	Practical	Oral & Practical	
				15		10		25		25	--	--	

Pre-requisite:

1. Python Programming

Objectives: The objective of the course is
1. To understand the key concepts and principles of Cognitive Computing.
2. To preview role of NLP's impact on Cognitive Computing Architectures
3. To apply training and testing procedures for language models for cognitive computing applications.
4. To integrate different cognitive computing methodologies.
5. To explore the full range of applications in Cognitive Computing.

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

1. Understand the fundamentals of Cognitive Computing.
2. Explain the role of NLP in Cognitive Systems
3. Demonstrate understanding of techniques for text-based processing of natural language with respect to morphology.
4. Perform POS tagging for a given natural language and select a suitable language modelling technique based on the structure of the language
5. Verify the syntactic and semantic correctness of sentences using grammar and labelling.
6. Explore the diverse range of applications within cognitive computing.

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Detailed Syllabus: (unit wise)		
Unit	**Description**	**Duration**
1	**Introduction to Cognitive Computing:** Overview of Cognitive Computing, Cognitive Computing - Cognitive Psychology - The Architecture of the Mind, The Nature of Cognitive Psychology, Cognitive architecture, Cognitive processes, The Cognitive Modeling Paradigms, Declarative / Logic based Computational cognitive modeling – connectionist models, Bayesian models. Introduction to Knowledge-Based AI, Human Cognition on AI, Cognitive Architectures	06
2	**Natural language processing in Cognitive systems:** Natural Language Processing in support of a Cognitive System: Role of NLP in a cognitive system, semantic web, Applying Natural language technologies to Business problems. Representing knowledge in Taxonomies and Ontologies: Representing knowledge, Defining Taxonomies and Ontologies, knowledge representation, models for knowledge representation, implementation considerations.	06
3	**Introduction to Natural Language Processing:** Basic Knowledge and Grammar in language processing, Stages in NLP, Ambiguities and its types in English and Indian Regional Languages, Challenges of NLP, Applications of NLP. **Word Level Analysis:** Morphology Analysis –Survey of English Morphology, Inflectional Morphology & Derivational Morphology, Lemmatization, N–Grams, Unigrams/Bigrams Language Models, Corpora, Computing the Probability of Word Sequence, Training and Testing.	08
4	**Syntax Analysis:** Part-Of-Speech Tagging (POS) - Open and Closed Words. Tag Set for English (Penn Treebank), Rule Based POS Tagging, Transformation Based Tagging, Stochastic POS Tagging and Issues –Multiple Tags & Words, Unknown Words. Hidden Markov Model (HMM), Maximum Entropy, And Conditional Random Field (CRF). CFG: Derivations, Constituency, Phrase Structure and Dependency Structure	07
5	**Semantic Analysis and Pragmatics:** Lexical Semantics, Attachment for Fragment of English- Sentences, Noun Phrases,Verb Phrases, Prepositional Phrases, Relations Among Lexemes & Their Senses – Homonymy, Polysemy, Synonymy, Hyponymy, WordNet, Robust Word Sense Disambiguation (WSD), Lexical Disambiguation, Resolving Lexical Ambiguity, Lexical Ambiguity Resolution **Pragmatics:** Discourse –Reference Resolution, Reference Phenomenon, Syntactic& Semantic Constraints on Co Reference	08
6	**Application of cognitive computing:** **Health care application**: Foundations of cognitive computing for healthcare, constituents in healthcare ecosystem and learning from patterns in healthcare data. **Banking & Fraud Prevention**: analyzing transaction patterns, payment fraud, identity theft and money laundering. **Transportation & Logistics**: Dynamic Route Optimization for traffic and weather. **Media and Entertainment:** Cognitive systems recommend tailored content based on user preferences and behavior.	04
	Total	39

List of Laboratory Experiments:	
Sr. No.	**Suggested Experiments**
1	Preprocessing steps in NLP Chunking using NLTK and SPACY
2	Apply various other text preprocessing techniques for any given text : Stop Word Removal, Lemmatization / Stemming.
3	Perform morphological analysis and word generation for any given text.
4	Implement N-Gram model for the given text input.
5	Build a POS tagger using HMM
6	Compare the accuracy of rule-based POS tagging, stochastic POS tagging, and transformation-based tagging. Use a common dataset for evaluation.
7	Compare the effectiveness of syntactic and semantic constraints on reference resolution in a pragmatic context. Evaluate their contribution to resolving reference phenomena.
8	Implement TF-IDF vectors in Natural Language Processing
9	Generate recursive set of sentences using Context Free Grammar Identify the word senses using "synset" in NLTK
10	Implement similarity detection in NLP
11	Implement Named Entity Recognizer for the given text input.
12	Students are supposed to complete any one case study not limited to following list of topics. a) Sequence Prediction b) Chatbot Using Deep Learning c) Traffic Sign Classification d) Automatic Music Generation e) Music Genre Classification f) Text Summarizer

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

Books Recommended:

Text Books

1. Hurwitz, Kaufman, and Bowles, Cognitive Computing and Big Data Analytics, Wiley, First edition, 2015
2 Masood, Adnan, Hashmi, Adnan, "Cognitive Computing Recipes-Artificial, Intelligence Solutions Using Microsoft Cognitive Services and TensorFlow, 2015
3. Speech and Language Processing, 2 nd Edition, Jurafsky and Martin, Prentice Hall, 2000, ISBN: 0130950696

Reference Books

1. Peter Fingar, Cognitive Computing: A Brief Guide for Game Changers, PHI Publication, 2015
2. Gerardus Blokdyk ,Cognitive Computing Complete Self-Assessment Guide, 2018
3. Rob High, Tanmay Bakshi, Cognitive Computing with IBM Watson: Build smart applications using Artificial Intelligence as a service, IBM Book Series, 2019
4. Ayyadevara V K., Reddy Y, Modern Computer Vision with PyTorch: Explore deep learning concepts and implement over 50 realworld image applications, Pakt Publishing, Kindle edition available,2020.
5. Manning C., Schutze H. (latest reprint). Foundations of Statistical Natural Language Processing, The MIT Press, Kindle edition available.1999
6. James Allen. Natural Language Understanding. The Benajmins/Cummings Publishing Company Inc. . ISBN 0-8053-0334-0. 1994
7. Hagiwara M. Real-World Natural Language Processing: Practical applications with deep learning, Manning Publications.2021
8. Kamath U., Liu J., Whitaker J, Deep Learning for NLP and Speech Recognition, Springer, Kindle edition available,2019.

Web resources

1. Natural Language processing

   https://www.coursera.org/specializations/natural-language-processing

2. Google AI

   https://ai.google/get-started/for-developers/

3. Python & NLTK by Udemy

   https://www.udemy.com/course/nlp-natural-language-processing-with-python/

Online Courses: NPTEL / Swayam

1. Natural Language Processing, By Prof. Pawan Goyal, IIT Kharagpur, https://onlinecourses.nptel.ac.in/noc24_cs39/preview
2. Natural Language Processing with Deep Learning in Python https://www.udemy.com/course/natural-language-processing-with-deep-learning-in- python/

Evaluation Scheme:
Continuous Assessment (A)
Theory:

1. Term Test 1 (based on 40 % syllabus) of 15 marks for the duration of 45 min.
2. Term Test 2 (on next 40 % syllabus) of 15 marks for the duration of 45 min.
3. Assignment / course project / group discussion /presentation / quiz/ any other for 10 marks.

Laboratory: (Term work)

Term work shall consist of minimum 8 experiments and a Mini project.
The distribution of marks for term work shall be as follows:

i. Laboratory work (Performance of Experiments, Write-up): 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.

Semester End Examination (B):

Theory:

1. Question paper will be based on the entire syllabus summing up to 60 marks.
2. Total duration allotted for writing the paper is 2 hrs.

Laboratory:

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

Prepared by | Checked by | Head of the Department | Vice Principal | Principal

MULTIDISCIPLINARY MINOR

Program: B.Tech in Computer Science and Engineering(IoT and Cybersecurity with Block chain Technology)	T.Y.B.Tech	Semester : V
Course : Artificial Intelligence	Course Code: DJS23BCMD501	
Course: Artificial Intelligence Laboratory	Course Code: DJS23BLMD501	

Teaching Scheme (Hours / week)				Evaluation Scheme								
				Continuous Assessment Marks (A)				Semester End Examination Marks (B)				Total marks (A+B)
Lectures	Practical	Tutorial	Total Credits	Term Test 1	Term Test 2	Assignment	Total	Theory				
				15	15	10	40	60				100
				Term Work				Laboratory Examination				50
3	2	--	4	Laboratory Work	Tutorial / Mini project / presentation/ Journal/ Practical		Total Term work	Oral	Practical		Oral & Practical	
				15	10		25	--	--		25	

Pre-requisite:

1. Basic programming languages
2. Data Structures

Course Objectives: The objective of the course is:

1. To create a thorough understanding of AI basics and real-time applications in its sub-domains.
2. To explore AI techniques like informed, uninformed and adversarial searching to solve real-life problems in a state space tree representation.
3. To explore various approaches to knowledge representation, reasoning, and planning strategies in AI systems.
4. To understand the scope of Generative Networks in AI.

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

1. Develop a basic understanding of AI building blocks presented in intelligent agents.
2. Design an appropriate problem-solving method for an agent to find a sequence of actions to reach the goal state.
3. Analyze various AI approaches to knowledge– intensive problem solving, reasoning and planning.

4. Understand the concept of planning and analyze different types of planning strategies.
5. Acquire basic knowledge of Expert System.
6. Analyze the working and architecture for Generative Networks.

Detailed Syllabus:

Unit	Description	Duration
1	**Introduction to Artificial Intelligence:** Introduction, History of Artificial Intelligence, Intelligent Systems: categorization of Intelligent System, Components of AI Program, Foundations of AI, Sub-areas of AI, Current trends in AI **Intelligent Agents:** Agents and Environments, The concept of rationality, The nature of environment, The structure of Agents, Types of Agents, Learning Agent.	06
2	**Problem solving:** Solving Problem by Searching: Problem Solving Agent, Formulating Problems, Example Problems. **Uninformed Search Methods:** Breadth First Search (BFS), Depth First Search (DFS), Depth Limited Search, Depth First Iterative Deepening (DFID) **Informed Search Methods:** Greedy Best First Search, A* Search **Stochastic Local Search Algorithms and Optimization Problems:** Hill climbing search, Simulated Annealing, Genetic algorithms, Ant Colony Optimization. **Adversarial Search:** Game Theory, Algorithm Minimax, Alpha-Beta Pruning.	12
3	**Knowledge and Reasoning:** Knowledge based Agents, The WUMPUS World, Inference in FOL, Forward chaining, Backward chaining, Knowledge Engineering in First- Order Logic, Unification, Resolution.	07
4	**Planning:** The planning problem, Planning with State Space Search, STRIPS, Goal Stack Planning, Planning graphs, Partial order planning, Hierarchical Planning.	06
5	**Expert System:** Introduction, Phases in building Expert Systems, ES Architecture, Case Study on MYCIN Rule based system.	04
6	**Generative AI:** Introduction to Gen AI, Overview of generative models and their importance in AI, Fundamentals of Probability theory and generative modeling, Introduction to GANs, Generative Adversarial Network algorithm, VAEs and other generative models. Significance of generative models, Challenges with generative models.	04
	Total	39

List of Laboratory Experiments:	
Sr.No.	**Suggested Experiments**
1	Select a problem statement relevant to AI. Identify the problem PEAS Description Problem formulation
2	To implement BFS/DFS/DFID search algorithms to reach goal state.
3	To implement A* search algorithm to reach goal state.
4	To implement Local Search algorithm: World Block Problem using Hill climbing search
5	To illustrate Game playing.
6	To implement Wumpus world AI Problem.
7	To implement alpha beta pruning.
8	To implement Tic-tac-toe AI Problem.
9	To implement 8-Queens Problem AI Problem.
10	Case study on Planning Problem. Identify and analyze a planning problem
11	To implement Generative Adversarial Network (GAN) algorithm.
12	Case Study on analysis of an AI Application from IEEE, Science Direct, and Scopus-Indexed Journal papers.

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

Books Recommended:

Text Books

1. Stuart J. Russell and Peter Norvig, Artificial Intelligence A Modern Approach ,Fourth Edition" Pearson Education,2022.
2. Saroj Kaushik , Artificial Intelligence, Cengage Learning,1st Edition, 2011.
3. George F Luger, Artificial Intelligence, Pearson Education., 6th Edition,2021.
4. Foster, D., Generative deep learning, O'Reilly Media, Inc. 2022
5. Koller, D. and Friedman, N., Probabilistic graphical models: principles and techniques. MIT press, 2009.

Reference Books

1. Elaine Rich and Kevin Knight ,Artificial Intelligence, Third Edition,2017.
2. Patrick Henry Winston, Artificial Intelligence, Addison-Wesley, Third Edition.1992
3. Lavika Goel , Artificial Intelligence concept and applications, WILEY Publishers, 2021
4. N.P.Padhy , Artificial Intelligence and Intelligent Systems, Oxford University Press. 2005.
5. Dr. Nilakshi Jain., Artificial Intelligence, WILEY Publishers, First Edition,2019.

Web resources:

1. Microsoft AI School- https://www.microsoft.com/en-us/ai
2. Google AI Education- https://ai.google/why-ai/
3. Practical tutorials and courses https://docs.fast.ai/

Thakkar.

Online Courses: NPTEL / Swayam

1. Course on- Fundamentals Of Artificial Intelligence- By Prof. Shyamanta M. Hazarika,IIT Guwahati https://onlinecourses.nptel.ac.in/noc23_ge40/preview
2. Course on - Artificial Intelligence: Search Methods for problem Solving- By Prof. Deepak Khemani , IIT Madras https://onlinecourses.nptel.ac.in/noc23_cs92/preview

Evaluation Scheme:

Continuous Assessment (A)

Theory:

1. Term Test 1 (based on 40 % syllabus) of 15 marks for the duration of 45 min.
2. Term Test 2 (on next 40 % syllabus) of 15 marks for the duration of 45 min.
3. Assignment / course project / group discussion /presentation / quiz/case study for 10 marks.

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.

Semester End Examination (B):

Theory:

1. Question paper will be based on the entire syllabus summing up to 60 marks.
2. Total duration allotted for writing the paper is 2 hrs.

Laboratory:

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

Prepared by | Checked by | Head of the Department | Vice Principal | Principal

Humanities Social Science and Management

Program: B.Tech in Computer Science and Engineering (IoT and Cybersecurity with Block chain Technology)	Third Year B.Tech	Semester : V
Course: Environmental Studies	Course Code: DJS23ITHSX10	

Teaching Scheme (Hours / week)				Evaluation Scheme							
				Continuous Assessment Marks (A)			Semester End Examination Marks (B)				Total marks (A+B)
Lectures	Practical	Tutorial	Total Credits	Term Test 1	Term Test 2	Total	Theory				
				–	--	--	–				–
				Term Work			Laboratory Examination				
–	--	1	1	Laboratory Work	Tutorial / Mini project / presentation/ Journal/ Practical	Total Term work	Oral	Practical	Oral & Practical		25
				-	25	25	–	–	–		

Prerequisite: -

1. Interest in Environment and its impact on Human Calculus.

Course Objectives: The objective of the course is:

1. Familiarise students with environment related issues such as depleting resources, pollution, ecological problems and the renewable energy scenario.
2. Give overview of Green Technology options.

Course 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.

Unit	Detailed Syllabus:	Duration
1	**Air Pollution** Sources of Air pollution. Definition of Air Quality Index and how it is measured.	1
2	**Water Pollution** Sources of water pollution. Ground water pollution and eutrophication.	1
3	**Noise Pollution** Noise pollution and sources. Decibel limits for hospital, library, silence zone.	1
4	**Biodiversity loss** Value of Biodiversity. Endangered species.	1
5	**Deforestation** Product and services provided by forests. Relationship between forests and climate change.	1
6	**Renewable Energy sources** Our energy needs and global energy crisis. Renewable energy sources.	1
7	**Climate change** Greenhouse gases and climate change.	1
8	**Green Technology** Data Center Energy Efficiency, Thin-Client and Energy Efficiency.	1
	Total	8

Text books:

1. Environmental Studies from Crisis to Cure, R. Rajagopalan, Oxford University Press, Second Edition,
2. Textbook of Environmental Studies for Undergraduate Courses, Erach Bharucha for University Grants Commission, New Delhi & Bharti Vidyapeeth Institute of Environment Education and Research.
3. Environmental Pollution: Principles, Analysis and Control; P. Narayanan, CBS Publishers
4. Green Information Technology: A Sustainable Approach, Mohammad Dastbaz, Colin Pattinson, Babak Akhgar, Morgan and Kaufman, Elsevier

Reference Books:

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

Websites:

1. CITES: www.cites.org
2. Convention on Biological Diversity: www.biodiv.org
3. Kalpvriksh: www.kalpvriksh.org
4. Water pollution: http://en.wikipedia.org/wiki/Water_polution
5. Ecosan: www.eco-solutions.org

List of Tutorials

SN.	Tutorial List
1	Case study on Smog.
2	Presentation on Water Pollution (Industrial, Sewage) explaining any specific case.
3	List effects of noise pollution on human health. Measure decibel level in college library, canteen, classroom
4	Case study on effect of pollution on Biodiversity loss.
5	Debate for and against to promote Economic Growth Deforestation is required.
6	Presentation on different Renewable Energy Technologies.
7	Report on major impact of Global warming on Environment giving real examples.
8	Report on advantages and examples of Green Building for Sustainable development, Sustainable Software Design.

Tutorial: (Term work: 25 marks)

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

i. Performance in Tutorial: 15 Marks

ii. Write-up/ Report: 10 marks

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

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Vocational and Skill Enhancement Course

Program: B.Tech in Computer Science and Engineering(IoT and Cybersecurity with Block chain Technology)				T.Y.B.Tech				Semester : V	
Course : Innovative Product Development III				Course Code: : DJS23IPSCX03					
Teaching Scheme (Hours / week)				Evaluation Scheme					
				Continuous Assessment Marks (A)				Semester End Examination Marks (B)	Total marks (A+ B)
Lectures	Practical	Tutorial	Total Credits	Term Test 1	Term Test 2	Assignment	Total	Theory	
				Term Work				Laboratory Examination	
--	2	--	1	Laboratory Work	Tutorial / Mini project / presentation/ Journal/ Practical	Total Term work	Oral	Practical	Oral & Practical	50
						25		--	25	

Objectives: The objective of the course is.

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 conceptualize and create a successful product.

Outcome: On completion of the course, 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 conceptualizing 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.

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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 conceptualization 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 V and VI.

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 term work marks during semester V shall be as given below:
  - Marks awarded by the supervisor based on performance 10
  - Marks awarded by Review Committee 10
  - Quality of Documentation 05

Review/progress monitoring committee may consider the following points during the assessment.

- In the semester V, 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.

Tentative rubrics for reviews will be as follows:
Review 1:

i. Implementation Details & Status (60% project implementation)
ii. Design & System Specifications
iii. Presentation Quality
iv. Contribution as a team member and Punctuality
v. Project Documentation.

Review 2:

i. Implementation Details & Status (90% project implementation)
ii. Draft copy of research paper , draft copy of Copy right or Patent if applicable .

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. 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.

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. Students are compulsorily required to present the outline of the technical paper prepared by them during the final review in semester VI.

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