

T.E. Semester –VI

Choice-Based Credit Grading Scheme with Holistic and Multidisciplinary Education (CBCGS-HME 2023)

B.E. (All Branches)					T.E. (SEM: VI)				
Course Name: Workplace Mental Health					Course Code: HSMC601				
Teaching Scheme (Program Specific)					Examination Scheme (Formative/ Summative)				
Modes of Teaching / Learning / Weightage					Modes of Continuous Assessment/ Evaluation				
Hours Per Week					Theory (100)		Practical / Oral (25)	Term Work (00)	Total
Theory	Tutorial	Practical	Contact Hours	Credits	ISE	IE	ESE	OR	TW
2	-	0	2	2	10	10	30	-	25
ISA: In-Semester Examination- Paper Duration – 1 Hour ESE: End Semester Examination - Paper Duration - 2 Hours The weightage of marks for continuous evaluation of Term work/ Report: Formative (40%), Timely completion of practical (40%) and Attendance/Learning Attitude (20%)									
Prerequisite- Organization and Workplace Scenario, Communication Skills and English language									

Course Objective: The course will enable students to understand and solve mental health issues at the workplace.

Course Outcomes: Upon completion of the course students will be able to:

Sr. No.	Course Outcomes	Cognitive Levels of Attainment as per Revised Bloom's Taxonomy
1	Demonstrate a comprehensive understanding of the foundational concepts and principles related to mental health.	L1, L2, L3
2	Create a supportive work environment by fostering positive relationships, promoting effective communication, and implementing strategies for employee well-being and growth.	L1, L2, L3
3	Understanding of the concept of stress, its causes, and its impact on individuals in both personal and professional contexts.	L1, L2, L3
4	Apply effective communication skills when interacting with individuals experiencing mental health challenges.	L1, L2, L3
5	Understand the relationship between mental health and performance	L1, L2, L3
6	Evaluate the effectiveness of different mental health interventions and resources and make informed decisions regarding their suitability for specific individuals or situations.	L1, L2, L3

Detailed Syllabus (Total No. of Hours: 30):

Module No.	Topics	Hrs.	Cognitive Levels of Attainment as per Revised Bloom's Taxonomy
1	Introduction to Mental Health	04	L1, L2, L3
	1.1. Understanding the importance of mental health at the workplace 1.2. Overview of common mental health disorders and their impact on individuals and organizations 1.3. Recognizing signs and symptoms of mental health issues at the workplace 1.4. Legal and ethical considerations related to mental health at the workplace		
2	Creating a Supportive Work Environment	06	L1, L2, L3
	2.1 Promoting mental health and well-being at the workplace 2.2 Strategies for fostering a positive work culture and reducing stigma 2.3 Implementing policies and procedures that support employee mental health and Providing resources and support for employees with mental health challenges		
3	Stress Management and Work-Life Balance	04	L1, L2, L3
	3.1 Understanding the relationship between stress and mental health 3.2 Identifying common workplace stressors and their impact 3.3 Techniques for managing stress and promoting work-life balance 3.4 Supporting employees in maintaining healthy work-life integration		
4	Mental Health Awareness and Communication Skills	06	L1, L2, L3
	4.1 Enhancing mental health literacy and awareness among employees 4.2 Developing effective communication skills related to mental health discussions and Facilitating open dialogue 4.3 Addressing sensitive issues and providing appropriate support		
5	Positive Thinking, Performance and Mental Health	06	L1, L2, L3

	5.1 How Positive Thinking Impacts Mental Health 5.2 How Positive Thinking Enhances Performance 5.3 The Feedback Loop Between Positive Thinking, Mental Health, and Performance 5.4 Practical Strategies for Connecting Positive Thinking, Performance, and Mental Health		
6	Mental Health Support and Sustainable Development Goals 6.1 Identifying available mental health resources and services 6.2 Developing an organizational mental health support plan; Training managers and supervisors to support employees' mental health 6.3 Accessing external support networks and community resources 6.4 Sustainable Development Goals-3- Health and 8- Decent Work for all	04	L1, L2, L3

Books and References:

Sr. No	Name of the Book	Name of the Author	Publisher	Edition	Year of Publication
1	Mental Health in the Workplace: A Practical Psychiatric Guide	Ronald J. Burke and Cary L. Cooper	Routledge	1st edition	2017
2	Mental Health in the Workplace: Strategies and Tools to Optimize Outcomes	David L. Wieser	Springer	1st edition	2018
3	Promoting Mental Health in the Workplace: Guidelines for Training and Research	Jonathan Houdmont and Stavroula Leka	Wiley-Blackwell	1st edition	2010
4	Mental Health and Work: Impact, Issues, and Good Practices	International Labour Office (ILO)	International Labour Organization	1st edition	2010
5	Mental Health in the Workplace: A Practical Guide for Managers	John M. Lacey	Jessica Kingsley Publishers	1st edition	2007

6	Mental Health in the Workplace: Professional Development for Mental Health Practitioners	Michael A. R. Freeman and Peggy L. Ferguson	Springer Publishing Company	1st edition	2001
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Online References:

Sr. No.	Website Name	URL	Modules Covered
1	Coursera	https://www.coursera.org/learn/positive-psychology-resilience	M 1-M 6
2	WHO	https://www.who.int/teams/mental-health-and-substance-use/promotion-prevention/mental-health-in-the-workplace	M 1-M 6
3	HHH	https://www.nimh.nih.gov/health/topics/workplace-mental-health	M 1-M 6

Semester-VI

Choice Based Credit Grading Scheme with Holistic and Multidisciplinary Education (CBCGS HME 2023)

Proposed TCET Autonomy Scheme (w.e.f. A.Y. 2024-25)

B.E. (Information Technology)								T.E.(SEM : VI)			
Course Name: Data Mining and Business Intelligence								Course Code: PCC-IT 601			
Teaching Scheme (Program Specific)					Examination Scheme (Formative/ Summative)						
Modes of Teaching / Learning / Weightage					Modes of Continuous Assessment / Evaluation						
Hours Per Week					Theory (100)			Practical/Or al (25)	Term Work (25)	Total	
Theor y	Tutoria l	Practical	Conta ct Hour s	Credit s	ISE	IE	ESE	PR	TW	150	
3	-	2	5	4	20	20	60	25	25		
<p style="text-align: center;">ISE: In-Semester Examination - Paper Duration – 1 Hour IE: Innovative Examination ESE: End Semester Examination - Paper Duration - 2 Hours Total weightage of marks for continuous evaluation of Term work/Report: Formative (40%), Timely Completion of Practical (40%) and Attendance /Learning Attitude (20%).</p>											
Prerequisite: Knowledge of databases and data warehousing											

Course Objective: The course intends to deliver the fundamentals of data retrieval as an important tool for enterprise data management which makes students well versed in data retrieval algorithms, methods of evaluation and also provide knowledge on how to gather and analyze large sets of data to gain useful business understanding.

Course Outcomes: Upon completion of the course student will be able to:

Sr. No.	Course Outcomes	Cognitive levels of attainment as per Bloom's Taxonomy	PO	PSO
1	Demonstrate an understanding of data mining concepts, identifying patterns, technologies, applications, and addressing key challenges in the domain..	L1, L2	1,2,9	1
2	Apply data exploration and preprocessing techniques, for effective data analysis.	L1,L2,L3	1,2,4,5,9	1,2
3	Utilize frequent pattern mining methods to discover and evaluate associations in datasets.	L1,L2,L3,L4,L5	1,2,3,4,5,8,9	1,2
4	Develop and implement classification models and assess their performance using accuracy metrics.	L1,L2,L3,L4,L5	1,2,3,4,5,8,9	1,2

5	Perform clustering analyses with partitioning, hierarchical, and density-based methods while addressing outlier detection and evaluation challenges.	L1,L2,L3,L4,L5	1,2,3,4,5,8,9	1,2
6	Construct business intelligence solutions by leveraging BI architecture and decision support systems.	L1,L2,L3,L4,L5,L6	1,2, 3,6,7,8,9,10	1,2

Detailed Syllabus:

Module No.	Topics	Hrs.	Cognitive levels of attainment as per Bloom's Taxonomy
0	Prerequisite	02	---
	Knowledge of databases and data warehousing		
1	Introduction to Data Mining	03	L1, L2
	What is Data Mining; kind of pattern to be mined; technologies used; kind of applications targeted, major issues in Data mining		
2	Data Exploration and Data Preprocessing	08	L1,L2,L3
	Types of Attributes; Statistical Description of Data; Data Visualization; Measuring similarity and Dissimilarity; Why Preprocessing? Data Cleaning; Data Integration; Data Reduction: Attribute subset selection, Histograms, Clustering and Sampling; Data Transformation & Data Discretization: Normalization, Binning, Histogram Analysis and Concept Hierarchy generation		
3	Frequent Pattern Mining	08	L1,L2,L3,L4, L5
	Market Based Analysis, Frequent Itemsets, Closed Itemsets and Association Rules; Frequent Itemset Mining Methods: The Apriori Algorithm for finding Frequent Itemsets using Candidate Generation, Generating Association Rules from Frequent Itemsets, A pattern growth approach for mining Frequent Itemsets; Mining Frequent itemsets using vertical data formats; Which patterns are interesting? Pattern evaluation methods.		
4	Classification	08	L1,L2,L3,L4, L5
	Basic Concepts; Classification Methods; Decision Tree Induction: Attribute Selection Measures, Tree pruning; Bayesian Classification: "Naïve Bayes" Classifier; Rule based classification : using IF-THEN rule for classification; Accuracy and Error measures, Precision, Recall, Holdout, Random Sampling, Cross Validation.		
5	Clustering	08	L1,L2,L3,L4, L5
	Cluster Analysis : Basic Concepts; Partitioning Methods: K-Mean, K- Medoids; Hierarchical Methods: Agglomerative, Divisive, Density-based clustering: DBSCAN; Evaluation of clustering What are outliers? Types, Challenges; Outlier Detection Methods: Supervised, Semi Supervised, Unsupervised, Statistical, Proximity based, Clustering Based.		
6	Business Intelligence	08	L1,L2,L3,L4,

	What is BI? Business Intelligence architecture; Definition of Decision support system, Development of business intelligence system Data retrieval for business application like fraud detection, clickstream mining, market segmentation, retail industry, telecommunication industry, banking & finance, CRM etc.		L5,L6
	Total Hours	45	

List of Experiments:

Practical No.	Type of Experiment	Experiment topic	Hrs	Cognitive levels of attainment as per Bloom's Taxonomy
1	Basic Experiment	Solving exercises in Data Exploration	2	L1, L2,L3
2		Solving exercises in Data preprocessing	2	L1, L2,L3
3	Design Experiment	To Implement of association mining algorithm	3	L1, L2,L3,L4,L5
4		To implement Naive Bayes classifier for classification tasks	2	L1, L2,L3,L4,L5
5		To implement a Decision Tree Algorithm for classification task	3	L1,L2,L3,L4,L5
6		To implement K-Means Clustering algorithm for unsupervised learning task.	2	L1,L2,L3,L4,L5
7		To implement a Hierarchical Clustering algorithm for unsupervised learning task.	3	L1,L2,L3,L4,L5
8		To demonstrate Association Mining, Classification and Clustering Algorithms using Weka Open Source tool and asses the performances	3	L1,L2,L3,L4,L5
9		Detailed case study of any one BI tool	2	L1,L2,L3,L4
10	Group Activity/ Case study	Business Intelligence Mini Project: A BI report must be prepared outlining the following steps: a) Problem definition, identifying which data retrieval task is needed b) Identify and use a standard data retrieval dataset available for the problem. Some links for data retrieval datasets are: WEKA site, UCI Machine Learning Repository, KDD site, KDD Cup etc. c) Implement the data retrieval algorithm of choice d) Interpret and visualize the results Provide clearly the BI decision that is to be taken as a result of mining.	08	L1,L2,L3,L4,L5
Total Hours			30	

Books and References:

Sr. No.	Title	Authors	Publisher	Edition	Year
1.	Data Mining Concepts and Techniques	Jiawei Han, Micheline Kamber	Morgan Kaufmann	3rd	2012
2.	Data Mining for Business Intelligence: Concepts, Techniques, and Applications in Microsoft Office Excel with XLMiner	G. Shmueli, N.R. Patel, P.C. Bruce	Wiley	1st	2008
3.	Introduction to Data Mining	P. N. Tan, M. Steinbach, Vipin Kumar	Pearson Education	2nd	2006

Online Resources:

Sr. No.	Website Name	URL	Modules covered
1.	https://data-flair.training	https://data-flair.training/blogs/data-mining-tutorial/	M1,M2
2.	https://hanj.cs.illinois.edu	https://hanj.cs.illinois.edu/bk3/bk3_slidesindex.htm	M3,M4,M5
3.	https://data-flair.training	https://data-flair.training/blogs/business-intelligence/	M6
4.	http://people.sabanciuniv.edu	http://people.sabanciuniv.edu/berrin/cs512/lectures/WEKA/WEKA%20Explorer%20Tutorial-REFERENCE.pdf	M3,M4,M5
5.	GIAN IIT Kanpur- https://www.iitg.ac.in/cet/gian.html	https://www.youtube.com/watch?v=wnk_MB586Zw	M4

Semester –VI

Choice Based Credit Grading Scheme with Holistic and Multidisciplinary Education (CBCGS-HME 2023)
Proposed TCET Autonomy Scheme (w.e.f. A.Y. 2024-25)

B.E. (Information Technology)								T.E. (SEM: VI)		
Course Name: Software Engineering								Course Code: PCC- IT 602		
Teaching Scheme (Program Specific)					Examination Scheme (Academic)					
Modes of Teaching / Learning / Weightage					Modes of Continuous Assessment / Evaluation					
Hours Per Week					Theory (100)			Practical/Ora l/ Presentation (25)	Term Work (25)	Total
					40	60				
Theor y	Tutoria l	Practica l	Contac t Hours	Credi ts	ISE	IE	ESE	OR	TW	150
3	--	2	5	4	20	20	60	25	25	
IA: In-Semester Assessment - Paper Duration – 1 Hour										
ESE: End Semester Examination - Paper Duration – 2 Hours										
The weightage of marks for continuous evaluation of Term work/Report: Formative (40%), Timely completion of practical (40%) and Attendance / Learning Attitude (20%)										
Prerequisite: Object Oriented Paradigms.										

Course Objective: To equip students with the knowledge of software engineering principles, processes, and methodologies to analyze, design, develop, and manage reliable software systems while addressing real-world challenges such as risk management, quality assurance, and sustainability using modern tools and practices.

Course Outcomes: Upon completion of the course student will be able to:

Sr. No.	Course Outcomes	Cognitive levels of attainment as per Bloom's Taxonomy	PO Mapping	PSO Mapping
1	Understand and explain the fundamentals of software engineering, the software process frameworks, and umbrella activities to manage and improve software development..	L1, L2	1,11	1
2	Analyze and compare traditional and agile software development models, including their applicability to various project scenarios.	L1, L2, L4	1,2,3,5	1,2
3	Identify and formulate functional and non-functional requirements for software systems, and perform cost estimation using various models.	L1, L2, L3	1,2,3,5,10	1,2
4	Design software systems using Design Principles, concepts, and techniques for components of design model.	L1, L2, L3, L6	3,5,6,9	1,3
5	Evaluate and mitigate software project risks and apply configuration management practices to maintain project integrity.	L1, L2, L3, L4, L5	2,4,6,7,10	2,3
6	Apply software testing techniques and assess software quality using SQA processes and McCall's quality factors.	L1, L2, L3, L4,	2,3,5,6,9	1,3

Detailed Syllabus:

Module No.	Topics	Hrs.	Cognitive levels of attainment as per Bloom's Taxonomy
1	The Software Process Software, Software engineering, Software application Domain, The Changing Nature of Software, Software Development Myths, Process Frameworks, Software Umbrella activities, Process Patterns, Process Assessment and Improvement, Personal Software Process, Team Software Process.	05	L1, L2, L3
2	Traditional & Agile Software Development Traditional Development: Software process Models: Waterfall, Incremental, RAD Model, Prototyping, Spiral and Specialized Models, Component based & Concurrent Development Model. Agile Development: Agile Manifesto, Agile Principles, Agile Models: Scrum, Extreme Programming, Feature Driven Development.	09	L1, L2, L3, L4
3	Requirements Analysis with Cost Estimation Software Requirements: Functional and non-functional requirements, user requirements, system requirements, interface specification, the software requirements specification document. Requirements engineering process: Feasibility studies, requirements elicitation and analysis, requirements validation, requirements management. Project Estimation: LOC based, FP based and Use case-based estimation, Empirical Estimation Models, COCOMO-II Model Analysis Model: Introduction of Analysis elements, Scenario based, Flow based, behavior and class-based elements.	09	L1, L2, L3, L4, L5
4	Design Engineering Design Engineering & Design Model: Design process, Design principles, Design concepts, and the Design Model, Data Design, Architecture Design, User Interface Design, Component level Design.	06	L1, L2, L3, L4, L6
5	Risk Management & Software Configuration Management Risk Management: Reactive versus Proactive Risk Strategies, Software Risks, Risk Identification, Assessing Overall Project Risk, Risk Components and Drivers, Risk Projection, developing a Risk Table, Assessing Risk Impact, Risk Refinement, Risk Mitigation, Monitoring, and Management, The RMMM Plan. Software Configuration Management: An SCM Scenario, Elements of a Configuration Management System, The SCM Process	07	L1, L2, L3, L4
6	Software Testing with Quality Assurance	09	L1, L2, L3, L4,

	Software Testing: Need for Testing, Testing Tactics, Black Box Testing, Equivalence partitioning, Boundary Value analysis, White Box Testing, Basis Path testing strategic approach of Testing, Test Strategies for Conventional Software. Software Quality Assurance: Elements of Software Quality Assurance , SQA Processes, SQA activities, McCall's Quality Factor.		L6
	Total	45	
	Hr.		

List of Experiments:

Expt No.	Type of Experiment	Experiment topic	Cognitive levels of attainment as per Bloom's Taxonomy	PO	PSO
1	Basic Experiment	Topic Finalization, Problems Definition	L2, L3 1, 2, 3, 9 1, 3	1, 2, 3, 9	1, 3
2		Literature survey on various software modeling to develop the project and select the best model for your project.	L1, L2, L4	1, 2, 5, 11	1
3	Design Experiment	Technical article on software development methodology: Selection of software development methodology for development of your project. Write detailed 2 pages' article about that methodology by stating: methodology name, description, in which situation this model is used and why it is used, pros & cons of this methodology. Write detailed article about that methodology by stating: methodology name, description, in which situation this model is used and why it is used, pros & cons of this methodology. Article should be of 0% plagiarism.	L2, L3, L6	1, 2, 9, 11	1
4		Write Software Requirements Specification (SRS) document for your Project	L3, L4	2, 3, 5, 9	1, 2
5		Use case and Gantt Chart development	L3, L5	2, 3, 9, 10	1
6		Draw Data Flow Diagram and Estimate the cost of your project	L3, L5	2, 3, 5, 10	1, 2
7		Use case and Gantt Chart development	L3, L5	2, 3, 9, 10	1

8		Draw Data Flow Diagram and Estimate the cost of your project	L3, L5	2, 3, 5, 10	1, 2
9		GUI Design & implementation of mini project.	L3, L6	3, 5, 8, 10	2,3
10		Develop test cases for testing mini projects.	L3, L4	3, 5, 8, 10	1,3
11	Group Activity/ Case study	Case study on software configuration management.	L2, L4, L5	1, 5, 6, 7, 11	1
Total Hours			30		

Books and References:

Sr. No.	Title	Authors	Publisher	Edition	Year
	Software Engineering : A Practitioner's Approach	Roger S Pressman	McGraw-Hill	9th Edition	July 2023
	Software Engineering	Ian Sommerville	Pearson Education	10th Edition	May 2017

Online Resources:

Sr. No.	Website Name	URL	Modules covered
1	https://nptel.ac.in	https://nptel.ac.in/courses/106101061/ https://nptel.ac.in/courses/106105087/	M1,M2
2	https://nptel.ac.in	https://nptel.ac.in/courses/106108103/	M3
3	https://www.guru99.com	https://www.guru99.com/software-configuration-management-tutorial.html	M4
4	https://nptel.ac.in	https://nptel.ac.in/courses/110107081/	M5,M6



T.E. Semester –VI

Choice Based Credit Grading Scheme with Holistic and Multidisciplinary Education (CBCGS-HME 2023)
Proposed TCET Autonomy Scheme (w.e.f. A.Y. 2024-25)

B.E. (Information Technology)					T.E. (SEM: VI)				
Course Name: Internet of Things					Course Code: PEC-IT 6011				
Teaching Scheme (Program Specific)					Examination Scheme (Formative/ Summative)				
Modes of Teaching / Learning / Weightage					Modes of Continuous Assessment / Evaluation				
Hours Per Week					Theory (100)		Practical/Or al (25)	Term Work (25)	Total
Theory	Tutorial	Practical	Contact Hours	Credits	ISE	IE	ESE	PR/OR	TW
3	-	-	3	3	20	20	60	-	25
125									
ISE: In-Semester Examination - Paper Duration – 1 Hour IE: Innovative Examination ESE: End Semester Examination - Paper Duration - 2 Hours Total weightage of marks for continuous evaluation of Term work/Report: Formative (40%), Timely Completion of Practical (40%) and Attendance /Learning Attitude (20%).									
Prerequisite: IOT Lab, Sensor Lab, Wireless Network									

Course Objective: The course intends to deliver the fundamentals of IOT concepts used for smart city development, IoT technologies, applications, protocols, and analytics of data in IOT. Also make real life application with the help of different design platforms used for an embedded systems application like Arduino and raspberry-pi.

Course Outcomes: Upon completion of the course student will be able to:

S.No.	Course Outcomes	Cognitive levels of attainment as per Bloom's Taxonomy
1	Apply the concepts of MPMC & IOT	L1, L2,L3
2	Identify & Understand the IOE Enabling technology & RFID Technology	L1, L2,L3
3	Apply Knowledge on RFID Case Study & different applications	L1, L2,L3
4	Analysis and evaluate protocols used in IOT	L1, L2,L3,L4
5	Design and develop smart city in IOT	L1, L2,L3,L4, L5,L6
6	Analysis and evaluate the data received through sensors in IOT	L1, L2,L3,L4,L5

Detailed Syllabus:

Module No.	Topics	Hrs.	Cognitive levels of attainment as per Bloom's Taxonomy
0	Prerequisite		L1, L2
	Introduction to Arduino, Raspberry Pi. Basics of Arduino programming, Extended Arduino libraries. Sensors, Sensor Types and Interfacing: Temperature, Pressure, Humidity sensors & Sensor family.		
1	Introduction to IoT	06	L1, L2, L3
	Definition and evolution of IoT, Key components: sensors, actuators, networks, IoT architecture: layers and protocols, Applications in various engineering fields, Future trends and challenges		
2	IoT Communication Protocols	06	L1, L2, L3
	Overview of communication protocols, MQTT, CoAP, HTTP, and LoRaWAN Data transmission methods: wired vs. wireless Security protocols and best practices		
3	IoT Hardware and Sensors	09	L1, L2, L3, L4
	Types of sensors: analog vs. digital Microcontrollers (Arduino, Raspberry Pi) Designing and prototyping IoT devices Hands-on project: Building a basic IoT device		
4	IoT Data Management and Analytics	09	L1, L2, L3, L4, L5
	Data collection and storage methods, Introduction to big data in IoT, Data analytics techniques, Visualization tools for IoT data, Apache, Hadoop, Using Hadoop MapReduce for Batch Data Analysis, Using Apache Storm for Real-time Data Analysis, Agriculture & Health Monitoring Case Study.		
5	IoT Security and Privacy	08	L1, L2, L3, L4, L5
	Overview of IoT security issues, Authentication and authorization, Risk management strategies, Case studies on IoT security breaches		
6	Future Trends and Innovations in IoT	07	L1, L2, L3, L4, L5
	Emerging technologies (AI, Edge Computing), IoT in Smart Cities and Industries, Regulatory and ethical considerations Tools for IOT: Chef, Chef Case studies, Puppet, Puppet Case Study		
	Total Hrs	45	

Books and References:

Sr. No.	Title	Authors	Publisher	Edition	Year
1.	Internet of Things connecting objects to the web	Hakima Chaouchi	Wiley	1st	2010
2.	Internet of Things (A Hands-on Approach)	Arshdeep Bhaga and Vijay Madisetti.	--	---	2014
3.	The Internet of Things	Samuel Greengard	MIT Press	2nd	2015
4.	RFID and the Internet of Things	Herve chabanne	Wiley	1st	2013
5.	Fundamentals of Sensor Network Programming: Applications and Technology	S. Sitharama Iyengar, Nandan Parameshwaran, Vir V. Phoha, N. Balakrishnan, Chuka D. Okoye	John Wiley & Sons	1st	2010
6.	Building the internet of things with ipv6 and mipv6, The Evolving World of M2M Communications	Daniel Minoli	John Wiley & Sons	1st	2013
7.	6LoWPAN: The Wireless Embedded Internet	Zach Shelby, Carsten Bormann	Wiley	1st	2009
8.	Interconnecting Smart Objects with IP: The Next Internet	Jean-Philippe Vasseur, Adam Dunkels, Morgan Kuffmann	Elsevier	1st	2010
9.	Designing the Internet of Things	Adrian McEwen (Author), Hakim Cassimally	John Wiley & Sons	1st	2013
10.	Internet of Things: Converging Technologies for Smart Environments and Integrated Ecosystems	Dr. Ovidiu Vermesan, Dr. Peter Friess	River Publishers	1st	2013
11.	Internet of Things (A Hands-on- Approach)	Vijay Madisetti , Arshdeep Bahga	John Wiley & Sons	1st	2014
12.	ARM System on chip Architecture	Steve Furber	Pearson	2nd	2012
13.	Getting Started with Arduino: The Open Source Electronics Prototyping Platform (Make)	Massimo Banzi	O'Reilly Media	-	-
14.	RaspberryPiCookbok	SimonMonk	O'Reilly Media	-	-

Online Recourses:

S. No.	Website Name	URL	Modules covered
1.	https://www.nptel.ac.in	https://nptel.ac.in/courses/106105166/	M1,M2,M3 , M4,M5,M6
2.	https://www.tutorialspoint.com	https://www.tutorialspoint.com/internet_of_things/inter-net_of_things_pdf	M1,M2,M3 , M6
4	http://www.infocobuild.com	http://www.infocobuild.com/education/audio-video-courses/electronics/MicroprocessorsMicrocontrollers-IIT-Kharagpur/lecture-34.html	M5, M6
3.	http://www.listingtec.com	http://www.listingtec.com/nptel-iot-assignment-8-answers-introduction-to-internet-of-things/	M1,M4,M5 , M6

T.E. Semester –VI

Choice Based Credit Grading Scheme with Holistic and Multidisciplinary Education (CBCGS-HME 2023)
Proposed TCET Autonomy Scheme (w.e.f. A.Y. 2024-25)

B.E (Information Technology)								T.E.(SEM : VI)		
Course Name: Project Management								Course Code : PEC- IT 6012		
Teaching Scheme (Program Specific)					Examination Scheme (Formative/ Summative)					
Modes of Teaching / Learning / Weightage					Modes of Continuous Assessment / Evaluation					
Hours Per Week					Theory (100)			Practical/Or al (25)	Term Work (25)	Total
Theor y	Tutoria l	Practica l	Contac t Hours	Credit s	ISE	IE	ESE	OR	TW	125
3	-	-	3	3	20	20	60	-	25	
<p style="text-align: center;">ISE: In-Semester Examination - Paper Duration – 1 Hour IE: Innovative Examination ESE: End Semester Examination - Paper Duration - 2 Hours The weightage of marks for continuous evaluation of Term work/Report: Formative (40%), Timely completion of practical (40%) and Attendance / Learning Attitude (20%)</p>										
<p style="text-align: center;">Prerequisite: Project based learning</p>										

Course Objective: The objective of the course is to familiarize the students with the use of a structured methodology/approach for each and every unique project undertaken, including utilizing project management concepts, tools and techniques and appraise the students with the project management life cycle and make them knowledgeable about the various phases from project initiation through closure.

Course Outcomes: Upon completion of the course students will be able to:

Sr. No.	Course Outcomes	Cognitive levels of attainment as per Bloom's Taxonomy
1	Apply selection criteria and select an appropriate project from different options	L1, L2, L3, L4
2	Write work break down structure for a project and develop a schedule based on it	L1, L2, L3, L4
3	Identify opportunities and threats to the project and decide an approach to deal with them strategically	L1, L2, L3, L4
4	Use Earned value technique and determine & predict status of the project	L1, L2, L3, L4

5	Compare and contrast various project execution, Monitoring and Controlling Projects, Project Contracting, Project Leadership and Ethics and Closing the Project	L1, L2, L3, L4
6	Capture lessons learned during project phases and document them for future reference	L1, L2,

Detailed Syllabus:

Module No.	Topics	Hrs.	Cognitive levels of attainment as per Bloom's Taxonomy
1	Project Management Foundation	6	L1, L2, L3, L4
	Definition of a project, Project Vs Operations, Necessity of project management, Triple constraints, Project life cycles (typical & atypical) Project phases and stage gate process. Role of project manager, Negotiations and resolving conflicts, Project management in various organization structures, PM knowledge areas as per Project Management Institute (PMI)		
2	Initiating Projects	6	L1, L2, L3, L4
	How to get a project started, Selecting project strategically, Project selection models (Numeric /Scoring Models and Non-numeric models), Project portfolio process, Project sponsor and creating charter; Project proposal. Effective project team, Stages of team development & growth (forming, storming, norming & performing), team dynamics		
3	Project Planning and Scheduling	8	L1, L2, L3, L4
	Work Breakdown structure (WBS) and linear responsibility chart, Interface Co-ordination and concurrent engineering, Project cost estimation and budgeting, Top down and bottoms up budgeting, Networking and Scheduling techniques. PERT, CPM, GANTT chart, Introduction to Project Management Information System (PMIS)		
4	Planning Projects	8	L1, L2, L3, L4
	Crashing project time, Resource loading and levelling, Goldratt's critical chain, Project Stakeholders and Communication plan Risk Management in projects: Risk management planning, Risk identification and risk register, Qualitative and quantitative risk assessment, Probability and impact matrix. Risk response strategies for positive and negative risks		

5	Executing Projects, Monitoring and Controlling Projects & Project Contracting	10	L1, L2, L3, L4
	5.1 Executing Projects: Planning monitoring and controlling cycle, Information needs and reporting, engaging with all stakeholders of the projects, Team management, communication and project meetings 5.2 Monitoring and Controlling Projects: Earned Value Management techniques for measuring value of work completed; Using milestones for measurement; change requests and scope creep, Project audit. 5.3 Project Contracting : Project procurement management, contracting and outsourcing,		
6	Project Leadership and Ethics & Closing the Project	7	L1, L2
	6.1 Project Leadership and Ethics: Introduction to project leadership, ethics in projects, Multicultural and virtual projects 6.2 Closing the Project: Customer acceptance; Reasons of project termination, Various types of project terminations (Extinction, Addition, Integration, Starvation), Process of project termination, completing a final report; doing a lessons learned analysis; acknowledging successes and failures; Project management templates and other resources; Managing without authority; Areas of further study		
	Total Hours	45	

Text /Reference Books:

Sr. No.	Title	Authors	Publisher	Edition	Year
1	Project Management Foundation:	Project Management: A managerial approach, Jack Meredith & Samuel Mantel	Wiley India	Seventh Edition	2009
2	Initiating Projects & Project Planning and Scheduling	A Guide to the Project Management Body of Knowledge (PMBOK® Guide)	Project Management Institute PA, USA	--	--

3	Planning Projects	Project Management, Gido Clements	Cengage Learning	--	--
4	Executing Projects, Monitoring and Controlling Projects & Project Contracting	Project Management, Gopalan Wiley India	Wiley India	--	--
5	Project Leadership and Ethics & Closing the Project	Project Management, Dennis Lock.	Gower Publishing England	Ninth Edition	--

Online References:

Sr. No.	Website Name	URL	Modules Covered
1	Website Name URL Modules Covered 1	http://www.opentextbooks.org.hk http://www.opentextbooks.org.hk/system/files/export/15/	M1 –M6
2	https://www.nesacenter.org	https://www.nesacenter.org https://www.nesacenter.org/uploaded/conferences/SEC/2	M1-M3, M6
3	http://www.edo.ca	http://www.edo.ca http://www.edo.ca/downloads/project-management.pdf	M1,M4

Semester –VI
Choice Based Credit Grading Scheme with Holistic and Multidisciplinary Education (CBCGS-HME 2023)
Proposed TCET Autonomy Scheme (w.e.f. A.Y. 2024-25)

B.E. (Information Technology)					T.E. (SEM: VI)					
Course Name: Artificial Intelligence					Course Code: PEC- IT 6013					
Teaching Scheme (Program Specific)					Examination Scheme (Formative/ Summative)					
Modes of Teaching / Learning / Weightage					Modes of Continuous Assessment / Evaluation					
Hours Per Week					Theory (100)		Practical/Oral (25)	Term Work (25)	Total	
Theory	Tutorial	Practical	Contact Hours	Credits	ISE	IE	ESE	Oral	TW	
3	-	-	3	3	20	20	60	-	25	125
<p style="text-align: center;">ISE: In-Semester Examination - Paper Duration – 1 Hour IE: Innovative Examination ESE: End Semester Examination - Paper Duration - 2 Hours</p> <p style="text-align: center;">The weightage of marks for continuous evaluation of Term work/Report: Formative (40%), Timely completion of project (40%) and Attendance / Learning Attitude (20%)</p>										
<p>Prerequisite: Programming Fundamentals, Mathematics, Data Structures and Algorithms, Basics of Logic and Reasoning (AND, OR, NOT, IMPLIES)</p> <p>RBT : Revised Bloom's Taxonomy</p>										

Course Objective:

To introduce the fundamental concepts, techniques, and applications of Artificial Intelligence for solving complex problems. It emphasizes the design and implementation of intelligent systems using AI methodologies such as search strategies, reasoning, planning, learning, and uncertainty handling.

Course Outcomes: Upon completion of the course students will be able to:

Sr. No.	Course Outcomes	Cognitive Levels of Attainment as per Bloom's Taxonomy	PO Mapping	PSO Mapping
1	Understand the foundational concepts of AI, intelligent agents, and their environments, including the PEAS framework.	L1,L2	1, 2, 5	1
2	Apply uninformed and adversarial search techniques to solve problems and implement strategies like Minimax and Alpha-Beta Pruning.	L1,L2,L3	1,2,3	2
3	Utilize heuristic-based informed search methods, including A* and Backtracking, for solving complex problems.	L2,L3,L4	1,3,5	2,3
4	Develop reasoning systems using propositional and predicate logic and implement basic logic programming with PROLOG.	L1,L2,L3	1,4,5	3

5	Demonstrate knowledge of planning techniques and learning strategies, such as decision trees and inductive learning, for intelligent systems.	L2,L3,L4,L5	1,2,4,6	2,3
6	Apply and design expert systems for knowledge-based tasks.	L1,L2,L3,L4,L5,L6	2,4,5,6	3

Detailed Syllabus:

Module No.	Topics	Hrs.	RBT Levels
	Prerequisites Programming Fundamentals, Mathematics, Data Structures and Algorithms, Basics of Logic and Reasoning(AND,OR,NOT,IMPLIES)	-	
1	Introduction Introduction: Introduction to AI, AI Problems and AI techniques, Solving problems by searching, Problem Formulation, Applications of AI Intelligent Agents: Structure of Intelligent agents, Types of Agents, Agent Environments PEAS representation for an Agent.	5	L1,L2
2	Uninformed Search Techniques Uninformed Search Techniques: DFS, BFS, Uniform cost search, Depth Limited Search, Iterative Deepening, Bidirectional search, Comparing Different Techniques. Adversarial Search: Game Playing, Min-Max Search, Alpha Beta Pruning.	8	L1,L2,L3
3	Informed Search Techniques Informed Search Methods: Heuristic functions, Hill Climbing, Simulated Annealing, Best First Search, A*, Crypto- Arithmetic Problem, Backtracking for CSP, Performance Evaluation.	8	L2,L3,L4
4	Knowledge and Reasoning Knowledge and Reasoning: A Knowledge Based Agent, WUMPUS WORLD Environment, Propositional Logic, First Order Predicate Logic, Forward and Backward Chaining, Resolution. , Introduction to PROLOG.	8	L1,L2,L3
5	Planning, knowledge and Reasoning Planning: Introduction to Planning, Planning with State Space Search Learning: Learning from Observation, General Model of Learning, Agents, Inductive Learning, Learning Decision Trees, Rote Learning Uncertain Knowledge and Reasoning: Uncertainty, Knowledge in an Uncertain Domain, Conditional Probability, Joint Probability, Bayes theorem, Belief Networks	8	L2,L3,L4,L5
6	Expert System and Applications	8	L1,L2,L3,L4,L5,L6

	Expert Systems: Representing and using Domain Knowledge, Expert System-shell, Explanation, Knowledge Acquisition, Applications: Building a Chatbot using Intelligent Agents, Maze Solver using DFS and BFS, Tic-Tac-Toe Game Agent, Recommendation System using Decision Trees, Medical Diagnosis Expert System		
Total Hrs.		45	

Capstone Project Hours Distribution:

Sr. No.	Work to be done	No. of Hours	Cognitive levels of attainment as per Bloom's Taxonomy	Program Outcome	PEO Achieved
1	Study Research papers, articles-Finding Relevant Projects	4	L1,L2	1,2,3,6,7,8	1,2
2	Project Title finalization and development of Modules	2	L1,L2	1,2,3,6,7,8	1,2
3	Design methodology and tools for implementation	4	L1,L2	1,2,3,6,7,9,12	1,2
4	Implementation of Project phase 1	4	L1,L2,L3	1,2,3,6,7,9,12	1,2
5	Result Phase I	2	L1,L2,L3,L4	1,2,3,5,6,7,8,9,11,12	1,2
6	Implementation of Project Phase 2	4	L1,L2,L3	1,2,3,6,7,9,12	1,2
7	Result Phase II	2	L1,L2,L3,L4	1,2,3,5,6,7,8,9,11	1,2
8	Testing	2	L1,L2,L3,L4	1,2,3,5,6,7,8,9,11	1,2
9	Result validation	2	L1,L2,L3,L4,L5	1,2,3,5,6,7,8,9,11,12	1,2,3
10	Report Writing	4	L1,L2	1,2, 6,7,9,10 12	1,2,3
Total Hours		30			

Books and References:

Sr. No	Title	Authors	Publisher	Edition	Year
1	Artificial Intelligence: A Modern Approach	Stuart Russell and Peter Norvig	Pearson	2nd Edition	2021
2	Artificial Intelligence	Elaine Rich, Kevin Knight, Shivshankar B Nair	Tata McGraw	3rd Edition	2011
3	Artificial Intelligence	Elaine Rich, Kevin Knight	Tata McGraw Hill	2nd Edition	1991

4	Artificial Intelligence: A Modern Approach,	Stuart Russell and Peter Norvig	PHI	3rd Edition	2009
5	AI-Structures and Strategies for Complex Problem Solving., 4/e	George Luger	Pearson Education.	4th edition	2002

Online Resources:

S. No.	Website Name	URL	Modules Covered
1.	NPTEL	https://nptel.ac.in/courses/106102220	M1
2.	NPTEL	https://nptel.ac.in/courses/106102220	M2
3.	NPTEL	https://nptel.ac.in/courses/106102220	M3
4.	NPTEL	https://nptel.ac.in/courses/106102220	M4
5.	NPTEL	https://nptel.ac.in/courses/106102220	M5
6.	NPTEL	https://nptel.ac.in/courses/106102220	M6

T.E. Semester –VI

Choice Based Credit Grading Scheme with Holistic and Multidisciplinary Education (CBCGS-HME 2023)
Proposed TCET Autonomy Scheme (w.e.f. A.Y. 2024-25)

B.E (Information Technology)					T.E.(SEM : VI)				
Course Name: Ethical hacking and Digital Forensics					Course Code : PEC- IT 6014				
Teaching Scheme (Program Specific)					Examination Scheme (Formative/ Summative)				
Modes of Teaching / Learning / Weightage					Modes of Continuous Assessment / Evaluation				
Hours Per Week					Theory (100)	Practical/O ral (25)	Term Work (25)	Total	
Theory	Tutorial	Practical	Contact Hours	Credits	ISE	IE	ESE	OR	TW
3	-	-	3	3	20	20	60	-	25
125									
ISE: In-Semester Examination - Paper Duration – 1 Hour IE: Innovative Examination ESE: End Semester Examination - Paper Duration - 2 Hours The weightage of marks for continuous evaluation of Term work/Report: Formative (40%), Timely completion of practical (40%) and Attendance / Learning Attitude (20%)									
Prerequisite: Cryptography and Security, Computer Networks									

Course Objective:

The course intends to deliver the fundamentals of current cyber security issues, knowledge about ethical hacking Methodology, various tool of ethical hacking, underlying principles and techniques associated with the digital forensic practices and cybercrime, importance of evidence handling and storage for various devices, investigation of attacks and apply digital forensic knowledge to use computer forensic tools, investigate attacks and report writing.

Course Outcomes: Upon completion of the course students will be able to:

SN	Course Outcomes	Cognitive levels of attainment as per Bloom's Taxonomy
1	Define the concept of ethical hacking and its associated applications in Information Communication Technology (ICT) world.	L1, L2
2	Explore ,apply and analysis the various ethical hacking tools using kali linux	L1,L2,L3,L4
3	Underline the need of digital forensic and role of digital evidences.	L1, L2
4	Explain the methodology of incident response and various security issues in ICT world, and identify digital forensic tools for data collection.	L1, L2,L3
5	Recognize the importance of digital forensic duplication and various tools for analysis to achieve adequate perspectives of digital forensic investigation in various applications /devices like Windows/Unix system.	L1, L2, L3,L4
6	List the method to generate legal evidence and supporting investigation reports and will also be able to use various digital forensic tools.	L1, L2, L3,L4

Detailed Syllabus:

Module No.	Topics	Hrs .	Cognitive levels of attainment as per Bloom's Taxonomy
1	Introduction to Cyber Crime and Ethical Hacking Introduction of Cybercrime: Types of cybercrime, categories cybercrime, Computers' roles in crimes, Prevention from Cybercrime, Hackers, Crackers, Phreakers. Ethical Hacking :Difference between Hacking and Ethical hacking : Steps of Ethical Hacking, Need of ethical hackers , advantage and limitation of hacking, Skill of ethical hackers	5	L1, L2
2	Ethical Hacking tools with kali Linux Installation of kali linux and configuration, Information gathering tools – Nmap , Zeen Map , Stealth Scan, Searchsploit, DNS Tools, Hping3 Vulnerability Analyses Tools- Cisco Tools, Cisco Auditing Tool, BED , Website Penetration testing tool- Vega usage, ZapProxy, Database tool – Sqlmap, exploring to Sql Injection, Social engineering tool-SET, Sniffing & Spoofing	10	L1,L2,L3,L4
3	Introduction to Digital Forensics and Digital Evidences Digital Forensic, Rules for Digital Forensic The Need for Digital Forensics, Types of Digital Forensics, Ethics in Digital Forensics Digital Evidences: Types and characteristics and challenges for Evidence Handling.	5	L1, L2
4	Computer Security Incident Response Methodology Introduction to Computer Security Incident - Goals of Incident response, Incident Response Methodology, Formulating Response Strategy. IR Process – Initial Response, Investigation, Remediation, Tracking of Significant, Investigative Information, Reporting Pre-Incident Preparation, Incident Detection and Characterization. Live Data Collection: Live Data Collection on Microsoft Windows Systems, Live Data Collection on Unix-Based Systems	8	L1, L2,L3
5	Forensic Duplication and Disk Analysis, and Investigation Forensic Duplication: Forensic Image Formats, Duplication, Live System Duplication, Forensic Duplication tools. Disk and File System Analysis: Media Analysis Concepts, File System Abstraction Model Partitioning and Disk Layouts: Partition Identification and Recovery, Redundant Array of Inexpensive Disks Special Containers : Virtual Machine Disk Images , Forensic Containers Hashing, Carving :Foremost Forensic Imaging : Deleted Data , File Slack , dd , dcfldd , dc3dd Data Analysis: Analysis, Methodology Investigating Windows systems, Investigating UNIX systems ,Investigating Applications, Web Browsers, Email, Malware Handling: Static and Dynamic Analysis	8	L1, L2, L3,L4

6	Forensic Investigation Report and Forensic Tools	9	L1, L2, L3.L4
	Investigative Report, Guidelines for Writing a Report, sample for writing a forensic report. Computer Forensic Tools: need and types of computer forensic tools, task performed by computer forensic tools. Study of open source Tools like SFIT, Autopsy etc. to acquire, search, analyze and store digital evidence		
	Total Hrs.	45	

Books and References:

Sr. No.	Title	Authors	Publisher	Edition	Year
	Digital Forensic : The fascinating world of Digital Evidences	Nilakshi Jain, Dhananjay Kalbande	Wiley publication	1 st edition	2017
	Incident Response and computer forensics	Jason Luttgens, Matthew Pepe, Kevin Mandia	Tata McGraw Hill,	3rd Edition	2014
	Network Security Assessment	Chris McNab	O'Reily	2nd edition	2013
	Digital Forensics for Network, Internet, and Cloud Computing A forensic evidence guide for moving targets and data	Clint P Garrison	Syngress Publishing, Inc.	1st edition	2010
	Scene of the Cybercrime: Computer Forensics Handbook	Debra Littlejohn Shinder Michael Cross	Syngress Publishing	2nd edition	2008

Online References

Sr. No.	Website Name	URL	Modules Covered
1	https://www.itu.int	https://www.itu.int/en/ITU-D/Cybersecurity/Documents/Introduction%20to%20the%20Concept%20of%20IT%20Security.pdf	M1
2	https://onlinecourses.nptel.ac.in https://www.tutorialspoint.com	https://onlinecourses.nptel.ac.in/noc19_cs68/previe w https://www.tutorialspoint.com/kali_linux/index.htm	M2
2	https://searchsecurity.techtarget.com	https://searchsecurity.techtarget.com/definition/incident-response	M3
3	https://www.educba.com	https://www.educba.com/32-most-important-cyber-security-tools/	M4,M5
4	https://digital-forensics.sans.org	https://digital-forensics.sans.org/blog/2010/08/25/intro-report-writing-digital-forensics/	M6

T.E. Semester –VI

Choice Based Credit Grading Scheme with Holistic and Multidisciplinary Education (CBCGS-HME 2023)
TCET Autonomy scheme with effect from 2024-25

T.E. (Information Technology)					T.E. (SEM: VI)					
Course Name: Analysis of Algorithms					Course Code: PEC-IT 6015					
Teaching Scheme (Program Specific)					Examination Scheme (Formative/ Summative)					
Modes of Teaching / Learning / Weightage					Modes of Continuous Assessment / Evaluation					
Hours Per Week					Theory (100)		Practical/Oral (25)	Term Work (25)	Total	
Theory	Tutorial	Practical	Contact Hours	Credits	ISE	IE	ESE	Oral	TW	
3	-	-	3	3	20	20	60	-	25	125
ISE: In-Semester Examination - Paper Duration – 1 Hour IE: Innovative Examination ESE: End Semester Examination - Paper Duration - 2 Hours The weightage of marks for continuous evaluation of Term work/Report: Formative (40%), Timely completion of project (40%) and Attendance / Learning Attitude (20%)										
Prerequisite: Data Structure and Algorithms RBT : Revised Bloom's Taxonomy										

Course Objective: This course introduces the foundational concepts of algorithm analysis, focusing on designing efficient solutions to computational problems. It emphasizes techniques like recursion, advanced data structures, greedy methods, backtracking, dynamic programming, and string matching, enabling students to tackle real-world optimization and pattern recognition challenges effectively.

Course Outcomes: Upon completion of the course students will be able to:

Sr. No.	Course Outcomes	Cognitive levels of attainment as per Bloom's Taxonomy	PO Mapping (Write only Numbers/s)	PSO Mapping (Write only Numbers/s)
1	Understand the concepts of advanced data structures and apply methods to solve recurrence problems.	L1,L2,L3	1,2,11	1,2
2	Choose appropriate advanced data structure for a given problem and Calculate its complexity.	L1,L2,L3	1,2,3,4,11	1,2
3	Analyze the greedy programming technique and solve real-world optimization problems.	L1,L2,L3,L4	1,3,5,6,11	1,2
4	Evaluate & analyse the back tracking algorithm and understand maximum flow network algorithms.	L1,L2,L3,L4	1,2,3,4,10,11	1,2
5	Analyze the dynamic programming technique to solve the problems	L1,L2,L3,L4	1,2,3,4,10,11	1,2

6	Evaluate and implement appropriate string pattern-matching algorithms to solve pattern-based problems.	L1,L2,L3,L4,L5,L6	1,2,3,5,10,11	1,2
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Detailed Syllabus:

Module No.	Topics	Hrs.	RBT Levels
	Prerequisites	-	
	Knowledge of any Programming Language, Data Structures and Analysis		
1	Analysis of Algorithms and Recurrences	6	L1, L2, L3,L4,L5,L6
	Analysis of Algorithms Definition of Algorithm, Properties of Algorithm, Importance of analysis of algorithms, Asymptotic Notations. Recurrences: Introduction to recurrence relations; The substitution method, Recursive tree method, Masters method.		
2	Advanced Tree Data Structures	8	L1,L2,L3
	Introduction. Binary Search Tree, AVL tree, Red-Black Trees, B/B+ tree, 2-3 tree operations, Tries Data Structures, time complexity analysis of all problems.		
3	Greedy algorithms	8	L1,L2,L3,L4
	Introduction. General Characteristics of greedy algorithms, Problem solving using Greedy Algorithm, Fractional Knapsack problem, Job sequencing with deadlines, Optimal Merge Pattern, Huffman algorithm, Minimum Spanning Trees (Kruskal's algorithm, Prim's algorithm), Analysis of All problems		
4	Backtracking and Maximum flow	9	L1,L2,L3,L4
	Backtracking: General method, Key Characteristics of Backtracking, N-Queen problem, sum of subsets problem, graph coloring, Hamiltonian cycles Introduction to flow networks, Augmenting Paths Residual Network, the Ford Fulkerson method.		
5	Dynamic Programming	9	L1,L2,L3,L4
	Introduction to Dynamic programming. Comparison with Greedy algorithm, divide & conquer algorithm and dynamic programming , Single source shortest path- Bellman Ford Algorithm, All pair shortest path- Floyd Warshall Algorithm, 0/1 knapsack, Travelling salesman problem, Longest common subsequence(LCS), Analysis of All problems		
6	String Matching Algorithms	5	

	Introduction. The naïve string matching algorithm, Rabin Karp algorithm, Knuth-Morris-Pratt algorithm (KMP), Analysis of All problems		L1,L2,L3,L4,L5, L6
Total Hrs.		45	

Capstone Project Hours Distribution:

Sr. No.	Work to be done	No. of Hours	Cognitive levels of attainment as per Bloom's Taxonomy	Program Outcome	PEO Achieved
1	Study Research papers, articles- Mini project title identification	4	L1,L2	1,2,3,6,7,8	1,2
2	Project Title finalization and development of Modules	2	L1,L2	1,2,3,6,7,8	1,2
3	Design methodology and tools for implementation	4	L1,L2	1,2,3,6,7,9,12	1,2
4	Implementation of Modules phase 1	4	L1,L2,L3	1,2,3,6,7,9,12	1,2
5	Result Phase I	2	L1,L2,L3,L4	1,2,3,5,6,7,8,9,11,12	1,2
6	Implementation of Modules Phase 2	4	L1,L2,L3	1,2,3,6,7,9,12	1,2
7	Result Phase II	2	L1,L2,L3,L4	1,2,3,5,6,7,8,9,11	1,2
8	Testing	2	L1,L2,L3,L4	1,2,3,5,6,7,8,9,11	1,2
9	Result validation	2	L1,L2,L3,L4,L5	1,2,3,5,6,7,8,9,11,12	1,2,3
10	Report Writing	4	L1,L2	1,2, 6,7,9,10 12	1,2,3
Total Hours		30			

Books and References:

Sr. No	Title	Authors	Publisher	Edition	Year
1	Introduction to the Design and Analysis of Algorithms	Anany Levitin	Pearson	3rd Edition	2021
2	Introduction to ALGORITHMS	Cormen, Leiserson, Rivest, Stein	PHI	3rd Edition	2011
3	Algorithms: Design and Analysis	Harsh Bhasin	Oxford Publication	3rd Edition	2016
4	Fundamentals of Computer Algorithms	Horowitz, Sahani, Rajsekaran	Universities Press	2nd	2005

5	C and Data structures	Deshpande, Kakde	Dream Tech	3rd	2017
6	Data Structures and Algorithms in C++	Goodritch, Tamassia, Mount	Wiley	1st	2011

Online Resources:

S. No.	Website Name	URL	Module s Covered
1.	NPTEL	https://archive.nptel.ac.in/courses/106/102/106102064/	M1
2.	NPTEL	https://archive.nptel.ac.in/courses/106/102/106102064/3	M2
3.	NPTEL	https://onlinecourses.nptel.ac.in/noc23_cs63/preview	M3
4.	NPTEL	https://archive.nptel.ac.in/courses/106/106/106106127/5	M4
5.	NPTEL	https://archive.nptel.ac.in/courses/106/106/106106127/4	M5
6.	NPTEL	https://archive.nptel.ac.in/courses/106/106/106106127/	M6



T.E/T. T Semester –VI

Choice Based Credit Grading Scheme with Holistic and Multidisciplinary Education (CBCGS-HME 2023) Proposed TCET Autonomy Syllabus (w.e.f. A.Y. 2023-2024)

B.E/B. Tech (All Branches)								T.E/T. T: SEM VI		
Course Name: Basics of Social Network Analysis								Course Code: OEC-6011		
Teaching Scheme (Program Specific)					Examination Scheme (Formative / Summative)					
Modes of Teaching / Learning / Weightage					Modes of Continuous Assessment / Evaluation					
Hours Per Week					Theory (100)			Practica l/ Oral (25)	Ter m Wor k (25)	Total
Theor y	Tutoria l	Practica l	Contac t Hours	Credit s	ISE	IE	ESE	PR	TW	125
3	-	-	3	3	20	20	60	-	25	
ISE: In - semester Examination –Paper Duration – 1 Hour IE: Innovative Examination ESE: End Semester Examination – Paper Duration – 2 Hours The weightage of marks for continuous evaluation taken with Term work/Report: Formative (40%), Timely completion of practical (40%) and Attendance/Learning Attitude (20%)										
Prerequisite: Basics of Computer networks, graphs, algorithms										

Course Objective:

This course provides an overview of the technology of social networks and how an individual can influence others on a network.

Course Outcomes: Upon completion of the course students will be able to:

Sr. No.	Course Outcomes	Cognitive levels of attainment as per Bloom's Taxonomy
1.	Understand the basic concepts of social networks	L1, L2, L3
2	Understand the fundamental concepts in social network mining	L1, L2, L3
3	Understand the modelling and visualization of network	L1, L2, L3
4	Understand the concepts of social network graph analysis	L1, L2, L3, L4
5	Perform visualization and exploration using Gephi software.	L1, L2, L3, L4
6	Understand the dynamic social networks	L1, L2

Detailed Syllabus:

Module No.	Topics	Hrs.	Cognitive levels of attainment as per Bloom's Taxonomy
1	Introduction	9	L1, L2, L3
	Introduction to Semantic Web, the Social Web - Social Network analysis, Development of Social Network Analysis – the concepts and measures in network analysis, Blogs and online communities - Web-based networks - Applications of Social Network Analysis. Advantages and disadvantages in social networks.		
2	Social Network Mining	7	L1, L2, L3, L4
	Introduction to social network mining. Social network extraction from big data, Various social network mining tasks with real-world examples. Community detection and Shingling algorithm, Social Networks as Graphs. Random graph models, ranking algorithms, Graph and Matrices, Basic measures for individuals and networks,		
3	Modelling and visualization of network	7	L1, L2, L3, L4, L5
	Mechanisms: Homophily, Opportunity, and Balance, edges , nodes Analyze a social network by data wrangling and visualizing a network		
4	Social Network Graph Analysis	7	L1, L2, L3, L4, L5
	Graph kernels, Graph classification, mining and outlier detection, centrality measures , network level measures, partitioning of graphs, components and bridges, Cliques		
5	Gephi	9	L1, L2, L3, L4, L5
	Download and Install Gephi, load network data, manipulate the color, structures and shapes, get Network-Level Measures, centrality measures,.		
6	Dynamic Social Networks	6	L1, L2
	Social learning on networks, Information and Biological networks, Various L1, L2 applications of Social Network mining in real world applications, Social Connects: Affiliation and identity		
	Total Hours	45	

Reference Books:

Sr. No.	Title	Authors	Publisher	Year
1	Social Network Data Analytics	Charu C Aggarwal	Springer	2011
2	Network Graph Analysis and Visualization with Gephi	Ken Cherven	Packt	2013
3	Social network analysis: A Handbook	Scott, J.	Sage	2007
4	Social Network Analysis,	Knoke	Sage	2008

Online References:

Sr. No.	Website Name	URL	Modules Covered
1	towardsdatascience.com	https://towardsdatascience.com/how-to-get-started-with-social-network-analysis-6d527685d374	M6
2	iopscience.iop.org	https://iopscience.iop.org/article/10.1088/1742-6596/1235/1/012111/pdf	M1-M5

T.E/T. T Semester –VI

Choice Based Credit Grading Scheme with Holistic and Multidisciplinary Education (CBCGS-HME 2023) Proposed TCET Autonomy Syllabus (w.e.f. A.Y. 2023-2024)

B.E/B. Tech (All Branches)								T.E. Open Elective SEM:VI				
Course Name: Basics of Robotics Process Automation								Course Code : OEC-6012				
Teaching Scheme (Program Specific)					Examination Scheme (Formative/ Summative)							
Modes of Teaching / Learning / Weightage					Modes of Continuous Assessment / Evaluation							
Hours Per Week					Theory (100)			Oral (25)		Term Work (25)		Total
Theor y	Tutoria l	Practica l	Contac t Hours	Credit s	IS E	IE	ES E	OR		TW		125
3	-	-	5	4	20	20	60	-		25		
IA : Internal Assessment consist of ISE (In-semester Examination) and IE (Innovative Examination) Duration of ISE : 1 Hour												
ESE : - End Semester Examination Paper Duration - 2 Hours												
Prerequisite: Programming Languages, Software process.												

Course Objective: The course intends to deliver the fundamentals concepts of robotic process automation and the use of various tool for process automation in detail. It also focus on the development of bots and its deployment.

Course Outcomes: Upon completion of the course, student will be ale to:

S.No .	Course Outcomes	Cognitive levels of attainment as per Bloom's Taxonomy
1	Understand and analyze business functionalities in Robotics Process Automation	L1, L2,L4
2	Analyze various tool software bots development	L1,L2,L3
3	Understand and apply variable and data manipulation using tool	L1,L2,L4
4	Implementing recorder and scraping utility for robotic process automation	L2,L3,L5
5	Perform exception handling and error reporting for RPA	L2,L3
6	Understand the steps involve for publishing the bots for automation	L2,L3, L5

Module No.	Topics	Hrs.	Cognitive levels of attainment as per Bloom's Taxonomy
1	Introduction Robotic process automation need, benefits, component of RPA, databases , API Programming interface, Artificial Intelligence , Cognitive Automations , Agile , Scrum, Kanban and waterfall. Natural language	07	L1, L2,L4

	processing and RPA		
2	Workflow , Conditional , Looping Statements Introduction, Installation and activation, Interfaces, Different types of workflows, Creating-a-basic-workflow, Debugging, Managing packages, Reusing Library, Source control, Activities guide, Workflow, Control Flow, Sequences, Flowcharts, State Machines, Control Flows, The-assign- activity, The-delay-activity, The-do-while-activity, The-if-activity, The- switch-activity, The-while-activity, The-for-each-activity, The-break-Activity	09	L1,L2,L3
3	Variable , Datatable and Recording for RPA Managing-variables, Naming-best-practices, The-variables-panel, Generic- value-variables, Text-variables, True-or-false-variables, Number-variables, Array-variables, Date-and-time-variables, Data-table-variables, Managing-arguments, Using-arguments, Data Manipulations, Data table , Excel Automation,	09	L1,L2,L4
4	Recording and Scraping Recording Introduction, Recording Types- Automatic Recording, Manual Recording Scraping : Elements, Output-or-screen-scraping-methods, Examples-of- using-output-or-screen-scraping-methods, About-web-scraping, Example-of-using-web-scraping, data scraping	09	L2,L3,L5
5	Exception Handling , Debugging and Logging Exception Handling Unavailability of element, Handling runtime exceptions, Logging and taking screenshot, Debugging techniques, Collecting crash dumps, Error reporting.	08	L2,L3
6	Deploy and Marinating Bots publishing using utility Publishing workflow, Writing editing publish package to .jsonfile. Overview of Orchestration Server- Queues, assets, process, developing a process. Using an Orchestration server to control bots. Publish and managing update.	06	L2,L3, L5
	Total Hr.	45	

Books and References:

S. No.	Title	Authors	Publisher	Edition	Year
1.	Learning Robotic Process Automation Create software robots and automate business process with the leading RPA tool	Alok Mani Tripathi	Packt	1st	2018
2.	Robotic Process Automation Projects: Build real- world RPA solutions using UiPath and Automation Anywhere	Nandan Mullakara , Arun Kumar Asokan	Packt	1st	2020
3.	The Robotic Process Automation Handbook: A Guide to Implementing RPA Systems 1st ed. Edition	Tom Taulli	Apress	1st	2020

Online Resources:

S. No.	Website Name	URL	Modules covered
1.	https://www.tutorialspoint.com	https://www.javatpoint.com/rpa	M1
2.	https://www.tutorialspoint.com	https://www.tutorialspoint.com/uiopath/uiopath_robotic_process_automation_working.htm	M2
3.	https://www.uipath.com	https://www.uipath.com/developers/video-tutorials/excel-and-datatables-automation	M3
4.	https://www.tutorialspoint.com	https://www.tutorialspoint.com/uiopath/uiopath_studio_data_scraping_and_screen_scraping.htm	M4
5.	https://www.tutorialspoint.com	https://www.tutorialspoint.com/uiopath/uiopath_studio_automation_projects_and_debugging.htm	M5
6.	https://docs.uipath.com	https://docs.uipath.com/orchestrator/docs/publishing-a-project-from-studio-to-orchestrator	M6

T.E/T.T Semester –VI

**Choice Based Credit Grading Scheme with Holistic and Multidisciplinary Education
 (CBCGS-HME 2023) Proposed TCET Autonomy Syllabus (w.e.f. A.Y. 2023-2024)**

B.E/B. Tech (All Branches)								T.E/T. T: SEM VI		
Course Name: Fundamentals of Communication Engineering								Course Code: OEC-6013		
Teaching Scheme (Program Specific)					Examination Scheme (Formative / Summative)					
Modes of Teaching / Learning / Weightage					Modes of Continuous Assessment / Evaluation					
Hours Per Week					Theory (100)			Practical/ Oral (25)	Term Work (25)	Total
Theor y	Tutori al	Practic al	Contact Hours	Credit s	ISE	I E	ES E	P R	TW	125
3	-	-	3	3	20	20	60	-	25	
<p>ISE: In - semester Examination –Paper Duration – 1 Hour IE: Innovative Examination ESE: End Semester Examination – Paper Duration – 2 Hours The weightage of marks for continuous evaluation taken with Term work/Report: Formative (40%), Timely completion of practical (40%) and Attendance/Learning Attitude (20%)</p>										
Prerequisite: Basic Mathematics										

Course Objectives: The course intends to give an overview of communication engineering and will be able to equip students to comprehend, design, and apply communication systems in a diverse array of domains, laying a strong foundation for their future endeavors in the field of communication engineering and technology. Students would be able to acquire a solid foundation in the fundamental theories and principles underlying analog and digital communications, computer networks, optical communications, mobile communications, and sensor networks.

Course Outcomes: Upon completion of the course students will be able to:

Sr. No.	Course Outcomes	Cognitive levels of attainment as per Bloom's Taxonomy Levels
1	Explain the fundamental principles of analog communication systems, modulation techniques, and noise and its impact on analog communication.	L1,L2,L3
2	Describe sampling, digital baseband, passband transmission, different modulation techniques, noise, and Shannon's Information Theory.	L1,L2,L3
3	Draw and explain computer network layered architecture layers including protocols and their services and describe the functions of physical layer and various hardware components such as physical media, networking components required in data transmission and multiplexing	L1,L2,L3

	techniques	
4	Explain the fundamentals, advantages, and advances in optical communication systems and explore concepts like WDM, Fiber to the X (FTTX), and RF over Fiber for Optical Networks.	L1,L2,L3
5	Describe the operation of sensor networks with respect to architecture, routing protocols, and applications.	L1,L2,L3
6	Describe the cellular design concepts and 2G, 3G, 4G and 5G architectures and radio interfaces.	L1,L2,L3

Detailed Syllabus:

Module No.	Topics	Hrs.	Cognitive levels of attainment as per Bloom's Taxonomy
1	Analog Communications Overview of communication systems, Types of communication systems, need for analog communication, Basics of amplitude, frequency, and phase modulation, Advantages and disadvantages of AM, FM, and PM, sources of noise in communication, Calculating SNR and its importance, Real-world applications of analog communication, and Future trends in analog communication.	08	L1,L2,L3
2	Digital Communication Advantages of digital communication over analog, Sampling and quantization, Baseband and passband transmission, Pulse Amplitude Modulation (PAM), Nyquist and Shannon criteria, Digital Modulation Techniques, AWGN channel and its modeling Multipath fading channels, Shannon's Information Theory Channel capacity and the capacity theorem, Application of digital communication in wireless, optical communication.	08	L1,L2,L3
3	Computer Communication Networks Computer Network Applications, Network Hardware, Network Software, Reference Models, overview of OSI and TCP/IP, layer Functions, sockets and ports, types of networks (LAN,MAN,WAN), networks topologies, multiplexing and multiple access techniques.	08	L1,L2,L3
4	Optical Fiber Communication & Networks Ray theory, Numerical Aperture, Types and classification of optical fibers, Fiber materials, Attenuation, and dispersion, OTDR, Optical Components (Fiber joints and splices, Couplers, Isolators and Circulators, Multiplexers, Detectors, Switches), Link power budget and rise time budget, WDM, Fiber to the X, Radio-over-Fiber.	08	L1,L2,L3

5	Wireless Sensor Networks	06	L1,L2,L3
	Definition and characteristics of WSNs, Applications and significance, Sensor Node Architecture and Components, Sensor node structure and components, Sensor types and their applications, Communication Protocols in WSNs, Wireless communication principles, MAC (Medium Access Control) protocols, Routing protocols: Overview and types Data Aggregation and Fusion, and Energy consumption analysis in WSNs.		
6	Mobile Communication	07	L1,L2,L3
	Introduction to wireless communication: basic terms used in wireless communication. Features of all conventional multiple access techniques: OFDM-OFDMA. The Cellular Concept System Design Fundamentals. 2G, 3G, 4G, and 5G system architecture and radio specifications.		
		45	

Books and References:

S. No.	Title	Authors	Publisher	Edition	Year
1	Electronics Communication Systems	Wayne Tomasi	Pearson education.	5th Edition	2009
2	Digital Communication Systems	Haykin Simon I John	Wiley and Sons, New Delhi	4th Edition,	2014
3	Fiber Optic Communication Systems	G. Agarwal	John Wiley and Sons	3rd	2010
4	Computer Networks	A. S. Tanenbaum	Prentice Hall	5th Edition	2013
5	Adhoc & Sensor Networks Theory and Applications	Cordeiro, Agrawal	Cambridge University Press India Pvt. Ltd	Second Edition	2010
6	Wireless Communications	Andreas F. Molisch	Wiley-IEEE Press	Second	2012

Online References:

S. No.	Website Name	URL	Modules Covered
1	NPTEL	https://onlinecoursesarchive.nptel.ac.in/noc17_ec11	M1
2	NPTEL	https://nptel.ac.in/courses/117/105/117105144/	M2
3	NPTEL	https://swayam.gov.in/nd1_noc19_ee67/preview	M3
4	NPTEL	https://nptel.ac.in/courses/106105183	M3
5	NPTEL	https://nptel.ac.in/courses/106/105/106105160/	M1, M2, M4
6	NPTEL	http://nptel.ac.in/courses/117104099/	M6

T.E/T. T Semester –VI
Choice Based Credit Grading Scheme with Holistic and Multidisciplinary Education
(CBCGS-HME 2023) Proposed TCET Autonomy Scheme (w.e.f. A.Y. 2023-24)

B.E/B. Tech (All Branches)					T.E/T. T: SEM VI				
Course Name : Introduction to Eco-Design of Sustainable Electronic Products					Course Code: OEC-6014				
Teaching Scheme (Program Specific)					Examination Scheme (Formative / Summative)				
Modes of Teaching / Learning / Weightage					Modes of Continuous Assessment / Evaluation				
Hours Per Week					Theory (100)		Practical/ Oral (25)	Term Work (25)	Total
Theory	Tutorial	Practical	Contact Hours	Credits	ISE	IE	ESE	PR	TW
3	-	-	3	3	20	20	60	-	25
ISE: In - semester Examination –Paper Duration – 1 Hour IE: Innovative Examination ESE: End Semester Examination – Paper Duration – 2 Hours The weightage of marks for continuous evaluation taken with Term work/Report: Formative (40%), Timely completion of practical (40%) and Attendance/Learning Attitude (20%)									
Prerequisite: Basic Physics and Environmental Science									

Course Objective: To acquire the basic knowledge of sustainable product design by applying eco-design principles in product development and integrating renewable energy sources into electronic products to compliance with environmental regulations.

Course Outcomes: Students will be able to -

SN	Course Outcomes	Cognitive Levels as per Bloom's Taxonomy
1	Recognize the significance of sustainable design in reducing electronic waste	L1,L2,L3
2	Analyze the life cycle of electronic products for environmental impact	L1,L2,L3,L4
3	Evaluate environmental implications of material choices by implementing sustainable material sourcing strategies.	L1,L2,L3
4	Evaluate energy consumption patterns in electronic devices	L1,L2,L3, L4
5	Implement effective end-of-life strategies for electronic products	L1,L2,L3, L4
6	Implement regulatory compliance in product development by adhering to global standards for sustainable electronics design	L1,L2,L3, L4

Detailed Syllabus:

Module No.	Topics		Hrs.	Cognitive Levels as per Bloom's Taxonomy
01	Introduction to Sustainability in Electronics		08	L1,L2,L3
	1.1	Definition of sustainability in electronics, Environmental impacts of electronic waste, Importance of sustainable design practices, Overview of electronics industry and their relevant regulations, Case studies on successful eco-friendly electronic products		
02	Eco-Design Principles and Life Cycle Assessment		08	L1,L2,L3,L4
	2.1	Fundamentals of eco-design, Application of eco-design principles in product development, Life cycle assessment methodologies, Evaluation of product life cycle for environmental impact, Eco-design in electronics industry.		
03	Materials Selection and Sustainable Sourcing		07	L1,L2,L3
	3.1	Importance of energy efficiency in electronics, Strategies for improving energy efficiency in product design, Integration of renewable energy sources in electronic products, Analysis of energy consumption patterns in electronic devices		
04	Energy Efficiency and Renewable Energy Integration		07	L1,L2,L3,L4
	4.1	Importance of energy efficiency in electronics, Strategies for improving energy efficiency in product design, Integration of renewable energy sources in electronic products, Analysis of energy consumption patterns in electronic devices		
05	End-of-Life Management and Circular Economy		07	L1,L2,L3,L4
	5.1	Practices for managing end-of-life electronic products, Introduction to the circular economy in the electronics industry, Recycling and refurbishing electronic products, Case studies on successful implementation of circular economy principles		
06	Regulatory Compliance and Global Standards		08	L1,L2,L3,L4
	6.1	Overview of global regulations for sustainable electronic products, Compliance requirements for eco-friendly product design, Standards for reducing electronic waste and pollution, Responsibilities of manufacturers in adhering to environmental regulations		

Books and References:

SN	Title	Authors	Publisher	Edition	Year
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1	Principles of Environmental Engineering and Science	Davis M.L. and Masten S.J.	McGraw-Hill Education	Fourth Edition	2020
2	Product Design and Development	Ulrich K.T. and Eppinger S.D.	McGraw-Hill Education	Sixth Edition	2016
3	Design + Environment: A Global Guide to Designing Greener Goods	Helen Lewis, John Gertsakis	Greenleaf Publishing Ltd.	First Edition	2017

Online References:

S. No.	Website Name	URL	Modules Covered
1.	Ecochain	https://ecochain.com/blog/guide-to-sustainable-product-design/	M1-M3
2.	Life Cycle Assessment	https://learnandconnect.pollutec.com/en/life-cycle-assessment-lca-an-essential-tool-for-eco-design	M2
3.	Ecodesign for Sustainable Products Regulation	https://commission.europa.eu/energy-climate-change-environment/standards-tools-and-labels/products-labelling-rules-and-requirements/sustainable-products/ecodesign-sustainable-products-regulation_en	M6
4.	Neuronicworks	https://neuronicworks.com/blog/environmentally-sustainable-design/	M1-M6

T.E/T. T Semester –VI
Choice Based Credit Grading Scheme with Holistic and Multidisciplinary Education
(CBCGS-HME 2023) Proposed TCET Autonomy Scheme (w.e.f. A.Y. 2023-24)

B.E/B. Tech (All Branches)								T.E/T. T: SEM VI		
Course Name: Fundamentals of Development Engineering								Course Code: OEC-6015		
Teaching Scheme (Program Specific)					Examination Scheme (Formative / Summative)					
Modes of Teaching / Learning / Weightage					Modes of Continuous Assessment / Evaluation					
Hours Per Week					Theory (100)			Practical/ Oral (25)	Term Work (25)	Total
Theory	Tutorial	Practical	Contact Hours	Credits	ISE	IE	ESE	PR	TW	125
3	-	-	3	3	20	20	60	-	25	
<p style="text-align: center;">ISE: In - semester Examination –Paper Duration – 1 Hour IE: Innovative Examination ESE: End Semester Examination – Paper Duration – 2 Hours The weightage of marks for continuous evaluation taken with Term work/Report: Formative (40%), Timely completion of practical (40%) and Attendance/Learning Attitude (20%)</p>										
Prerequisite:										

Course Objectives:

Understand Rural Development Concepts and Historical Roots, Examine Post-Independence Rural Development Initiatives, Explore Rural Development in Five Year Plans, Analyze Impact Post-73rd Amendment Scenario, Comprehend Urbanization and Rural-Urban Interface, Grasp Urban Governance and Local Planning Principles

Course Outcomes:

SN	Course Outcome	Cognitive levels as per bloom's Taxonomy
1	Understand rural development and its historical roots in India, including Sarvodaya Movement and Panchayati Raj.	L1, L2, L3
2	Discuss the recommendations of the Balwant Rai Mehta Committee, emphasize people's participation, and analyze the linkage with Ashok Mehta Committee for rural development.	L1, L2, L3

3	Grasp the role of Five Year Plans, planning processes, and the importance of integrated approaches, special component plans, and micro-eco zones in rural development.	L1, L2, L3
4	Assess environmental impacts and implications of the 73rd Constitutional Amendment Act for decentralized rural governance.	L1, L2, L3
5	Analyze urbanization trends, causes, and challenges in managing the rural-urban interface in India.	L1, L2, L3
6	Acquire knowledge about urban governance structures, decentralized planning, smart cities, and sustainable urban development strategies.	L1, L2, L3

Detailed Syllabus

Module No.	Topic s	Hrs.	Cognitive levels as per bloom's Taxonomy
1	Introduction to Rural Development	06	L1, L2, L3
	Introduction to Rural Development Meaning, nature and scope of development; Nature of rural society in India; Hierarchy of settlements; Social, economic and ecological constraints for rural development. Roots of Rural Development in India Rural reconstruction and Sarvodaya programme before independence; Impact of voluntary effort and Sarvodaya Movement on rural development; Constitutional direction, directive principles; Panchayati Raj - beginning of planning and community development; National extension services.		
2	Post-Independence rural Development	09	L1, L2, L3
	Post-Independence rural Development Balwant Rai Mehta Committee - three tier system of rural local Government; Need and scope for people's participation and Panchayati Raj; Ashok Mehta Committee - linkage between Panchayati Raj, participation and rural development.		
3	Rural Development Initiatives in Five Year Plans	10	L1, L2, L3
	Rural Development Initiatives in Five Year Plans Five Year Plans and Rural Development; Planning process at National, State, Regional and District levels; Planning, development, implementing and monitoring organizations and agencies; Urban and rural interface - integrated approach and local plans; Development initiatives and their convergence; Special component plan and sub-plan for the weaker section; Micro-eco zones; Data base for local planning; Need for decentralized planning; Sustainable rural development		
4	Environmental Impact Assessment	06	L1, L2, L3
	Post 73rd Amendment Scenario 73rd Constitution Amendment Act, including - XI schedule, devolution of powers, functions and finance; Panchayati Raj institutions - organizational linkages; Recent changes in rural local planning; Gram Sabha - revitalized Panchayati Raj; Institutionalization; resource		L1, L2, L3

	mapping, resource mobilization including social mobilization; Information Technology and rural planning; Need for further amendments.		
5	Urbanization and Rural-Urban Interface	08	L1, L2, L3
	5.1. Definition and concept, Trends and patterns of urbanization in India, Causes and consequences of urbanization, Challenges posed by rapid urbanization, Rural- Urban Interface, Planning and Policies for Urban Development		
6	Urban Governance and Local Planning	06	L1, L2, L3
	Urban Governance and Local Government, Decentralized Planning in Urban Areas, Smart Cities and Sustainable Urban Development, Urban-Rural Linkages and Convergence, Exploring ways to bridge the urban-rural divide, Urban and rural development convergence models		
Total Hours		45	

Books and References:

SN	Title	Authors	Publisher	Edition	Year
1	ITPI, Village Planning and Rural Development,	ITPI,	New Delhi	-	-
2	GoI, Constitution (73rd GoI, New Delhi Amendment) Act,	GoI, New Delhi	GoI, New Delhi	-	-
3	Planning Commission, Manual of Integrated District Planning, 2006,	Planning Commission New Delhi Planning Commission	New Delhi	-	-
4	The Urban Complex, Doubleday	Weaver, R.C.,			
5	Planning Commission, Five Year Plans,	NITI Ayog			

T.E/T. T Semester –VI
Choice Based Credit Grading Scheme with Holistic and Multidisciplinary Education
(CBCGS-HME 2023) Proposed TCET Autonomy Scheme (w.e.f. A.Y. 2023-24)

B.E/B. Tech (All Branches)					T.E/T. T: SEM VI				
Course Name: : Introduction to Industry 4.0					Course Code: OEC-6016				
Teaching Scheme (Program Specific)					Examination Scheme (Formative / Summative)				
Modes of Teaching / Learning / Weightage					Modes of Continuous Assessment / Evaluation				
Hours Per Week					Theory (100)		Practical / Oral (25)	Term Work (25)	Total
Theory	Tutorial	Practical	Contact Hours	Credits	ISE	IE	ESE	PR	TW
3	-	-	3	3	20	20	60	-	25
ISE: In - semester Examination –Paper Duration – 1 Hour IE: Innovative Examination ESE: End Semester Examination – Paper Duration – 2 Hours The weightage of marks for continuous evaluation taken with Term work/Report: Formative (40%), Timely completion of practical (40%) and Attendance/Learning Attitude (20%)									
Prerequisite: Sensor/ transducer, field transmitters, converters, final control element, Computer based control system architecture, Basics of Internet of Things (IoT)									

Course Objective:

The objective of the course is to introduce to the students about the Industry 4.0 is to drive manufacturing forward: to be faster, more efficient and customer-centric while pushing beyond automation and optimization to discover new business opportunities and models.

Course Outcomes: Upon completion of the course students will be able to:

SN	Course Outcomes	Cognitive levels of attainment as per Bloom's Taxonomy
1	Understand the drivers and enablers of Industry 4.0	L1, L2
2	Appreciate the smartness in Smart Factories, Smart cities, smart products and smart services	L1, L2, L3, L4
3	Outline the various systems used in a manufacturing plant and their role in an Industry 4.0 world	L1, L2, L3, L4
4	Understand the opportunities, challenges brought about by Industry 4.0 and how organizations and individuals should prepare to reap the benefits	L1, L2, L3, L4
5	Publish and distribute Android Application	L1, L2, L3, L4
6	Understand and identify the various Business issues in Industry 4.0	L1, L2, L3, L4

Detailed Syllabus:

Module No	Topics	Hrs	Cognitive levels as per bloom's Taxonomy
1	Module 1: Introduction to Industry 4.0 1.1 The Various Industrial Revolutions 1.2 Digitalization and the Networked Economy 1.3 Drivers, Enablers, Compelling Forces and Challenges for Industry 4.0 1.4 The Journey so far: Developments in USA, Europe, China and other countries 1.5 Comparison of Industry 4.0 Factory and Today's Factory 1.6 Trends of Industrial Big Data and Predictive Analytics for Smart Business Transformation	8	L1, L2
2	Module 2: Road to Industry 4.0 2.1 Internet of Things (IoT) & Industrial Internet of Things (IIoT) & Internet of Services 2.2 Smart Manufacturing 2.3 Smart Devices and Products 2.4 Smart Logistics 2.5 Smart Cities 2.6 Predictive Analytics	6	L1, L2, L3, L4
3	Module 3: Related Disciplines, System, Technologies for enabling Industry 4.0 3.1 Cyber physical Systems 3.2 Robotic Automation and Collaborative Robots 3.3 Support System for Industry 4.0 3.4 Mobile Computing 3.5 Related Disciplines 3.6 Cyber Security	8	L1, L2, L3, L4
4	Module 4: Role of data, information, knowledge and collaboration in future organizations 4.1 Resource-based view of a firm 4.2 Data as a new resource for organizations 4.3 Harnessing and sharing knowledge in organizations 4.4 Cloud Computing Basics 4.5 Cloud Computing and Industry 4.0	8	L1, L2, L3, L4
5	Module 5: Other Applications and Case Studies 5.1 IIoT case studies 5.2 Case studies from students	4	L1, L2, L3, L4
6	Module 6: Business issues in Industry 4.0 6.1 Opportunities and Challenges 6.2 Future of Works and Skills for Workers in the Industry 4.0 Era 6.3 Strategies for competing in an Industry 4.0 world	4	L1, L2, L3, L4

Books and References:

Sr No	Title	Authors	Publisher	Edition	Year
1	Industry 4.0: The Industrial Internet of Things	Alasdair Gilchrist	Apress	----- -	2016
2	Additive Manufacturing Technologies Rapid Prototyping to Direct Digital Manufacturing	Lan Gibson, et.al	Springer	----- -	2010
3	Industrial Internet of Things: Cyber manufacturing Systems	Sabina Jeschke, et.al	Springer	----- -	-----
4	Designing the Internet of Things	A. McEwen et. al	Wiley	1st edition	2013
5	Healthcare 4.0 Next Generation Processes with the Latest Technologies	J. Chanchaichujit et.al	Palgrave Pivot		2019
6	Industrial Automation: Hands	F. Lamb	McGraw-Hill Education	1st edition	2013
7	The Industrial Internet of Things: Reference Architecture – IIC	----- -	-----	Volume G1	----- -
8	Industrial Internet of Things: Security Framework –IIC	----- -	-----	Volume G4	----- -

Online References:

Sr. No.	Website Name	URL	Modules Covered
1	https://nptel.ac.in/	https://onlinecourses.nptel.ac.in/noc20_cs69/preview	M1,M2,M3, M4,M5,M6

T.E/T. T Semester –VI
Choice Based Credit Grading Scheme with Holistic and Multidisciplinary Education (CBCGS-HME 2023)

Proposed TCET Autonomy Syllabus (w.e.f. A.Y. 2023-2024)

B.E/B. Tech (All Branches)								T.E/T. T: SEM VI		
Course Name: Introduction to Artificial Intelligence and Data Science								Course Code: OEC-6017		
Teaching Scheme (Program Specific)					Examination Scheme (Formative / Summative)					
Modes of Teaching / Learning / Weightage					Modes of Continuous Assessment / Evaluation					
Hours Per Week					Theory (100)			Practical / Oral (25)	Term Work (25)	Total
Theory	Tutorial	Practical	Contact Hours	Credits	ISE	IE	ESE	PR	TW	125
3	-	-	3	3	20	20	60	-	25	
ISE: In - semester Examination –Paper Duration – 1 Hour IE: Innovative Examination ESE: End Semester Examination – Paper Duration – 2 Hours The weightage of marks for continuous evaluation taken with Term work/Report: Formative (40%), Timely completion of practical (40%) and Attendance/Learning Attitude (20%)										
Prerequisite: Basic linear algebra, basic probability and statistics										

Course Objective:

This course aims to Equip students with foundational knowledge, skills, and ethical awareness in Artificial Intelligence and Data Science, enabling them to analyse data, develop models, and understand AI's societal impact.

Course Outcomes: Upon completion of the course students will be able to

Sr. No.	Course Outcomes	Cognitive levels of attainment as per Bloom's Taxonomy
1	Understand the concept of Data Science and its related terminologies	L1, L2
2	Understand and apply EDA using Python programming	L1, L2, L3, L4
3	Analyze and apply Feature Selection Techniques using Python programming	L1, L2, L3, L4
4	Understand, Apply and Demonstrate different tools for Data Visualization	L1, L2, L3, L4
5	Understand and Apply various AI search algorithms (uninformed, informed), local and adversarial search algorithms to real-world	L1, L2, L3, L4

	problems.	
6	Analyze different case studies on Applications of Data Science to solve real - world problems	L1, L2, L3, L4

Detailed Syllabus:

Module No.	Topics	Hrs.	Cognitive levels of attainment as per Bloom's Taxonomy
1	Introduction to Artificial Intelligence and Data Science Introduction: Data Science History, Increasing attention to Data Science, Data Science and Related Terminologies, Types of Analytics, Applications of Data Science, Data Science Process Models, Intelligence and it's type, Categorization of Artificial Intelligent based System, Agents & Environments	7	L1, L2
2	Exploratory Data Analysis Introduction, Steps in Data Pre-processing, Understanding Data, Looking at the Data, Dealing with Missing Values, Standardizing Data, Steps involved in EDA using Python Programming	8	L1, L2, L3, L4
3	Data Modelling: Feature Selection, Engineering, and Data Pipelines Feature Selection, Dimensionality Reduction, Independent and Dependent Variables, Relationship between Variables: Correlation, Multi-collinearity, Factor Analysis, Treatment of Outliers	8	L1, L2, L3, L4
4	Data Visualization Importance of Data Visualization, Looking at Data, Visualization of Data- Histogram, Countplot, Boxplot, Data Visualization for Machine Learning, Data Visualization Techniques	8	L1, L2, L3, L4
5	Problem Solving in AI Problem Solving Agent, Formulating Problems, Example Problems, Uninformed Search Methods, Informed Search Method, Local Search Methods, Genetic algorithms	8	L1, L2, L3, L4
6	Applying Domain Expertise to Solve Real-World Problems Using Data Science The role of sustainable agriculture in ensuring food security, Global and local food systems, Challenges and opportunities in feeding a growing population	6	L1, L2, L3, L4
	Total Hours	45	

Books and Reference:

S.N	Title	Authors	Publisher	Edition	Year
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1	Introduction to Data Science	B.Uma Maheshwari, R.Sujatha	Wiley	First Edition	2021
2	Data Science for Dummies	Lillian Pierson	Wiley	Second Edition	2019
3	Python for Data Science	Dr. Mohd Abdul Hameed	Wiley	First Edition	2021
4	A First Course in Artificial Intelligence	Deepak Khemani	McGraw Hill Education	First Editio n	2013
5	Artificial Intelligence and Intelligent Systems	N. P. Padhy	Oxford	First Editio n	2005

Online Resources:

S. No.	Website Name	UR L	Modules Covered
1	www.edureka.co	https://www.edureka.co/blog/what-is-data-science/	M1-M6
2	www.w3schools.in	https://www.w3schools.in/python-data-science/	M1-M3, M5
3	nptel.ac.in	https://onlinecourses.nptel.ac.in/noc20_cs81/previe w	M1-M4, M6
4	www.tutorialspoint.com	https://www.tutorialspoint.com/artificial_intelligen ce/artificial_intelligent_systems.htm	M1, M2, M6

T.E/T. T Semester –VI
Choice Based Credit Grading Scheme with Holistic and Multidisciplinary Education
(CBCGS- HME 2023) Proposed Syllabus under Autonomy Scheme w.e.f. A.Y. 2023-2024)

B.E/B. Tech (All Branches)								T.E/T. T: SEM VI		
Course Name: Introduction to IoT Applications								Course Code: OEC-6018		
Teaching Scheme (Program Specific)					Examination Scheme (Formative / Summative)					
Modes of Teaching / Learning / Weightage					Modes of Continuous Assessment / Evaluation					
Hours Per Week					Theory (100)			Practical / Oral (25)	Term Work (25)	Total
Theory	Tutorial	Practical	Contact Hours	Credits	ISE	IE	ESE	PR	TW	125
3	-	-	3	3	20	20	60	-	25	
ISE: In - semester Examination –Paper Duration – 1 Hour IE: Innovative Examination ESE: End Semester Examination – Paper Duration – 2 Hours The weightage of marks for continuous evaluation taken with Term work/Report: Formative (40%), Timely completion of practical (40%) and Attendance/Learning Attitude (20%)										
Prerequisite: Basic Computer skills, programming knowledge, electronics and circuits, mathematics and statistics, databases.										

Course Objective:

To make students understand, concepts of IoT (Internet of Things), covering fundamentals and architecture of various hardware components, communication protocols, and its impact on industries and societal domains, along with emerging IoT technologies and trends.

Course Outcomes: Upon completion of the course students will be able to:

Sr. No.	Course Outcomes	Cognitive level of attainment as per Bloom's Taxonomy
1	Key IoT concepts and describe the architecture and components of IoT systems, including sensors, microcontrollers, and communication modules.	L1, L2
2	Apply data acquisition, preprocessing, storage, and real-time analytics techniques to IoT data.	L1, L2, L3
3	Recognize security threats and vulnerabilities in IoT and implement security measures.	L1, L2, L3
4	Understand ethical considerations and privacy concerns in IoT application design.	L1, L2, L3, L4
5	Analyze real-world IoT applications in domains like smart homes, healthcare, and	L1, L2, L3, L4

	industry.	
6	Recognize emerging IoT technologies and trends in quantum computing, sustainability, and 5G.	L1, L2, L3

Detailed Syllabus:

ModuleNo.	Topics	Hrs.	Cognitive levels of attainment as per Bloom's Taxonomy
1	Introduction to IoT Defining IoT- Introduction to IoT, Historical evolution of IoT, Key components and architecture, IoT use cases and impact IoT Ecosystem - IoT stakeholders and roles, Protocols and communication in IoT, Challenges and opportunities in the IoT ecosystem	6	L1, L2, L3
2	IoT Hardware and Sensors IoT Hardware Components - Microcontrollers and development boards Sensors and actuators, Communication modules Data Acquisition and Processing - Data types and formats, Data acquisition methods, Data processing at the edge and in the cloud	6	L1, L2, L3, L4
3	Data Handling and Analysis Data Storage and Management - Data storage options, Databases for IoT, Data security and privacy considerations, Real-time Data Analytics and Visualization, Real-time data analytics tools Data visualization techniques, Real-world applications of data analytics in IoT	7	L1, L2, L3
4	IoT Security and Privacy IoT Security Threats - Common security threats and vulnerabilities in IoT, Security protocols and encryption, Access control and authentication in IoT Ethical Considerations and Data Privacy - Ethical considerations in IoT design, Regulatory frameworks (e.g., GDPR), Best practices for ensuring data privacy in IoT Applications	8	L1, L2, L3
5	IoT Applications domain Smart Homes and Cities- IoT in smart homes, Smart city applications Case studies in smart living environments. IoT in Healthcare and Industry - IoT applications in healthcare, Industrial IoT (IIoT) and Industry 4.0, Real-world examples of IoT in healthcare and industry	9	L1, L2, L3, L4
6	Future Trends and Emerging Technologies		

Emerging IoT Technologies - Quantum computing and its potential impact on IoT, Edge computing advancements, IoT's role in 5G networks Environmental Sustainability and IoT - IoT's contribution to environmental monitoring and sustainability, Green IoT solutions Ethical and ecological implications of IoT	9	L1, L2, L4
Total Hours	45	

Books and References:

SN	Title	Authors	Publisher	Edition	Year
1	Internet of Things: Principles and Paradigms	Rajkumar Buyya, Amir Vahid Dastjerdi, and Arkady Zaslavsky	Morgan Kaufmann	1st	2016
2	Getting Started with Arduino	Massimo Banzi	Maker Media, Inc.	3rd	2014
3	Designing Data-Intensive Applications	Martin Kleppmann	O'Reilly Media	1st	2017
4.	Big Data: A Revolution That Will Transform How We Live, Work, and Think	Viktor Mayer-Schönberger and Kenneth Cukier	Eamon Dolan/Houghton Mifflin Harcourt	1st	2013
5.	IoT Security: Practical Guide Book	Daniele Catteddu and Lorenzo Pupillo	CreateSpace Independent Publishing	1st	2017
6.	Security Engineering: A Guide to Building Dependable Distributed Systems	Ross J. Anderson	Wiley	2nd	2008
7.	Smart Homes for Dummies	Danny Briere and Pat Hurley	Wiley	2nd	2011
8.	Quantum Computing for Everyone	Chris Bernhardt	The MIT Press,	1st	2019
9.	5G for the Connected World	Devaki Chandramouli, Rainer Liebhart, and Juho Pirskanen	Wiley	1st	2019

Online References:

Sr. No.	Website Name	URL	Modules Covered
1	IoT For All.	https://www.iotforall.com/	M1,M2,M3,M4,M5, M6
2.	IoT Tech News	https://www.iottechnews.com/	M4,M5,M6
3.	IoT Analytics	https://iot-analytics.com/	M1,M2,M3,M4,M5, M6

T.E/T. T Semester –VI

Choice Based Credit Grading Scheme with Holistic Multidisciplinary Education (CBCGS- HME 2023)

Proposed TCET Autonomy Scheme (w.e.f. A.Y. 2024-25)

B.E/B. Tech (All Branches)					T.E/T. T: SEM VI				
Course Name: Introduction to Blockchain					Course Code: OEC-6019				
Teaching Scheme (Program Specific)					Examination Scheme (Formative / Summative)				
Modes of Teaching / Learning / Weightage					Modes of Continuous Assessment / Evaluation				
Hours Per Week					Theory (100)		Practical / Oral (25)	Term Work (25)	Total
Theory	Tutorial	Practical	Contact Hours	Credits	ISE	IE	ESE	PR	TW
3	-	-	3	3	20	20	60	-	25
ISE: In - semester Examination –Paper Duration – 1 Hour IE: Innovative Examination ESE: End Semester Examination – Paper Duration – 2 Hours The weightage of marks for continuous evaluation taken with Term work/Report: Formative (40%), Timely completion of practical (40%) and Attendance/Learning Attitude (20%)									
Prerequisite: Substantial programming experience, software engineering									

Course Objective: The course intends to deliver understanding of fundamentals of blockchain, list the concepts and blockchain technologies that can be used in application development

Course Outcomes: Upon completion of the course students will be able to:

Sr. No.	Course Outcomes
1	Understand the components of blockchain and cryptocurrencies
2	Describe the concepts, technology and applications of Blockchain to be applied in the application
3	Distinguish and apply different consensus algorithm as per the requirement of application
4	Get acquainted with different crypto currencies and their characteristics
5	Apply blockchain technology thinking to improve on existing products in IT
6	Design, build, and deploy a distributed application

Module No.	Topics	Hrs	Cognitive level of attainment as per Bloom's Taxonomy
1	Basics of Blockchain	7	L1,L2
	Distributed Database, Two General Problem, Byzantine General problem and Fault Tolerance Introduction, Advantage over conventional distributed database, Blockchain Network, Mining Mechanism, Distributed Consensus, Merkle Patricia Tree, Gas Limit, Transactions and Fee, Anonymity, Reward, Chain Policy, Life of Blockchain application, Soft & Hard Fork, Private and Public blockchain.		
2	Distributed Ledger Technology	8	L1,L2
	Cryptography: Hash function, Digital Signature - ECDSA, Memory Hard Algorithm, Zero Knowledge Proof, Digital Trust, Asset, Transactions, Distributed Ledger Technology, Types of network Components of blockchain or DLT, Ledger Blocks, Blockchain and Cryptography, Private keys, public keys, Hashing, Digital Signature		
3	Distributed Consensus	8	L1,L2,L3,L4
	Nakamoto consensus, Proof of Work, Proof of Stake, Proof of Burn, Difficulty Level, Sybil Attack, Energy utilization and alternate		
4	Cryptocurrency	7	L1,L2,L3,L4
	Currency, Double Spending, Cryptocurrency, P2P Payment Gateway, Wallet, Mining, public blockchain and private blockchain, Other Cryptocurrencies		
5	Ethereum and Hyperledger Fabric	9	L1,L2,L3,L4,L5, L6
	Ethereum network, EVM, Transaction fee, Mist, Ether, gas, Solidity, Smart contracts, Truffle, Web3, Design and issue Cryptocurrency, Mining. Introduction to Hyperledger, What is Hyperledger, Why Hyperledger, Where can Hyperledger be used, Hyperledger Architecture, Membership, Blockchain, Transaction, Chain code, Hyperledger Fabric, Features of Hyperledger		
6	Applications of Blockchain	6	L1,L2,L3,L4,L5, L6
	Blockchain in Finance: Cryptocurrencies, Smart Contracts for financial services, Supply Chain Management with Blockchain, Identity Management and Blockchain, Healthcare applications and Electronic Health Records (EHR).		
Total Hours		45	

Book References:

Sr. No	Title	Authors	Publisher	Edition	Year
1.	Bitcoin and cryptocurrency technologies: a comprehensive introduction.	Arvind Narayanan, Joseph Bonneau, Edward Felten, Andrew Miller, and Steven Goldfeder	Princeton University Press, 2016.	Second	2016
2.	Mastering Bitcoin	Andreas Antonopoulos	O'REILLY	First	2014
3.	Mastering Blockchain	Imran Bashir	Packt Publishing	First	2017

Online References:

Sr. No.	Website Name	URL	Modules Covered
1.	https://www.coursera.org	https://www.coursera.org/learn/blockchainprofessionals	M1,M2,M3
2.	https://www.coursera.org	https://www.coursera.org/learn/smarter-contracts	M1.M2,M3
3.	https://www.coursera.org	https://www.coursera.org/learn/blockchainfoundations-and-use-cases	M1.M2,M3
4.	https://www.dappuniversity.com	https://www.dappuniversity.com/articles/theultimate-ethereum-dapp-tutorial	M4,M5
5.	https://www.hyperledger.org	https://www.hyperledger.org/use/fabric	M6
6.	https://www.tutorialspoint.com	https://www.tutorialspoint.com/blockchain/index.htm	M4,M5,M6
7.	https://www.guru99.com	https://www.guru99.com/blockchain-tutorial.html	M1,M2,M5,M6
8.	https://www.javatpoint.com/	https://www.javatpoint.com/blockchain-tutorial	M1,M2,M5,M6
9.	https://ghostvolt.com	https://ghostvolt.com/articles/blockchain_intro.html	M1,M2,M3,M4,M6
10.	https://hackr.io/	https://hackr.io/blog/blockchain-programmingbeginners-guide	M4,M5,M6

T.E/T. T Semester-VI

Choice Based Credit Grading Scheme with Holistic and Multidisciplinary Education (CBCGS-HME 2023) Proposed TCET Autonomy Scheme (w.e.f. A.Y. 2023-24)

B.E/B. Tech (All Branches)					T.E/T. T: SEM VI				
Course Name: Basics of Cyber Security and Laws					Course Code: OEC-6020				
Teaching Scheme (Program Specific)					Examination Scheme (Formative / Summative)				
Modes of Teaching / Learning / Weightage					Modes of Continuous Assessment / Evaluation				
Hours Per Week					Theory (100)		Practical / Oral (25)	Term Work (25)	Total
Theory	Tutorial	Practical	Contact Hours	Credits	ISE	IE	ESE	PR	TW
3	-	-	3	3	20	20	60	-	25
ISE: In - semester Examination –Paper Duration – 1 Hour IE: Innovative Examination ESE: End Semester Examination – Paper Duration – 2 Hours The weightage of marks for continuous evaluation taken with Term work/Report: Formative (40%), Timely completion of practical (40%) and Attendance/Learning Attitude (20%)									
Prerequisite: Cryptography and Network Security									

Course Objective: The course intends to deliver the fundamental knowledge to understand concepts of cyber law, intellectual property, cybercrimes, trademarks, domain theft, tools used in cyber security and analyze security policies, protocols applied in Indian IT Act 2008, security standards compliances.

Course Outcomes: Upon completion of the course students will be able to:

S.No	Course Outcomes	Cognitive levels of attainment as per Bloom's Taxonomy
1	Understand the concept of cybercrime and its effect on outside world	L1
2	Interpret and apply IT law in various legal issues , Analyse security challenges and issues	L1, L2, L3, L4
3	Understand and analyse various attack using tools like wire shark , key logger etc.	L1
4	Distinguish different aspects of cyber law	L1, L2, L3, L4
5	Study India IT Act and analyse different case studies	L1, L2, L3, L4
6	Apply Information Security Standards compliance during software design and Development	L1, L2, L3, L4

Detailed Syllabus:

Module No	Topics	Hrs	Cognitive levels of attainment as per Bloom's Taxonomy
1	Introduction to Cybercrime	07	L1
	Introduction to Cybercrime: Cybercrime definition and origins of the world, Cybercrime and information security, Classifications of cybercrime, Cybercrime and the Indian ITA 2000, A global Perspective on cybercrimes		
2	Symmetric and Asymmetric Cryptography	09	L1, L2, L3, L4
	Introduction to symmetric cryptography, Substitution cipher, transposition cipher, stream and block cipher, and arithmetic modes for block ciphers, Introduction to asymmetric cryptography Primes, factorization, Fermat's little theorem, Euler's theorem, and extended Euclidean algorithm, RSA, attacks on RSA, Diffie Hellman key exchange, Message integrity, message authentication, MAC, hash function, H MAC		
3	Cyber offenses & Cybercrime	10	L1
	Cyber offenses & Cybercrime: How criminal plan the attacks, Social Engg, Cyber stalking, Cyber café and Cybercrimes, Bot nets, Attack vector, Cloud computing, Proliferation of Mobile and Wireless Devices, Trends in Mobility, Credit Card Frauds in Mobile and Wireless Computing Era, Security Challenges Posed by Mobile Devices, Registry Settings for Mobile Devices, Authentication Service Security, Attacks on Mobile/Cell Phones, Mobile Devices: Security Implications for Organizations, Organizational Measures for Handling Mobile, Devices-Related Security Issues, Organizational Security Policies and Measures in Mobile Computing Era, Laptops		
4	Tools and Methods Used in Cyber line	08	L1, L2, L3, L4
	Phishing, Password Cracking, Key loggers and Spywares, Virus and Worms, Steganography, DoS and DDoS Attacks, SQL Injection, Buffer Over Flow, Attacks on Wireless Networks, Phishing, Identity Theft (ID Theft)		
5	The Concept of Cyberspace	09	L1, L2, L3, L4
	E-Commerce, The Contract Aspects in Cyber Law, The Security Aspect of Cyber Law, The Intellectual Property Aspect in Cyber Law, The Evidence Aspect in Cyber Law, The Criminal Aspect in Cyber Law, Global Trends in Cyber Law, Legal Framework for Electronic Data Interchange Law Relating to Electronic Banking, The Need for an Indian Cyber Law		
	Indian IT Act.		

6	Cyber Crime and Criminal Justice: Penalties, Adjudication and Appeals Under the IT Act, 2000, IT Act. 2008 and its Amendments	07	L1, L2, L3, L4
	Total Hours	45	

Books and References:

Sr. No.	Title	Authors	Publisher	Edition	Year
1	Cyber Security	Nina Godbole, Sunit Belapure	Wiley India ,New Delhi	2 nd	2011
2	The Indian Cyber Law	Suresh T. Vishwanathan	Bharat Law House, New Delhi	2 nd	2015
3	Cyber Law & Cyber Crimes	Advocate Prashant Mali	Snow White Publications, Mumbai	2 nd	2015
4	Information Systems Security	Nina Godbole	Wiley India, New Delhi	2 nd	2014
5	Cyber Security & Global Information Assurance	Kenneth J. Knapp	Information Science Publishing	1 st	2009

Online Resource

S.No.	Website Name	URL	Modules covered
1.	http://www.cyberalegalservices.com	http://www.cyberalegalservices.com/detail-casestudies.php	M1
2.	https://www.tutorialspoint.com	https://www.tutorialspoint.com/information_security_cyber_law/offences_and_penalties	M2
3.	https://www.educba.com	https://www.educba.com/32-most-important-cyber-security-tools/	M3
4.	https://www.itu.int	https://www.itu.int/en/ITU-D/Cybersecurity/Documents/Introduction%20to%20the%20Concept%20of%20IT%20Security.pdf	M4
5.	https://www.tutorialspoint.com	https://www.tutorialspoint.com/information_security_cyber_law/information_technology_act.htm	M5
6.	https://www.cimcor.com	https://www.cimcor.com	M6

T.E/T. T Semester –VI
Choice Based Credit Grading Scheme with Holistic and Multidisciplinary Education
(CBCGS-HME 2023) Proposed TCET Autonomy Scheme (w.e.f. A.Y. 2023-24)

B.E/B. Tech (All Branches)					T.E/T. T: SEM VI				
Course Name: Introduction to Robotics					Course Code: OEC-6021				
Teaching Scheme (Program Specific)					Examination Scheme (Formative / Summative)				
Modes of Teaching / Learning / Weightage					Modes of Continuous Assessment / Evaluation				
Hours Per Week					Theory (100)		Practical / Oral (25)	Term Work (25)	Total
Theory	Tutorial	Practical	Contact Hours	Credits	ISE	IE	ESE	PR	TW
3	-	-	3	3	20	20	60	-	25
ISE: In - semester Examination –Paper Duration – 1 Hour IE: Innovative Examination ESE: End Semester Examination – Paper Duration – 2 Hours The weightage of marks for continuous evaluation taken with Term work/Report: Formative (40%), Timely completion of practical (40%) and Attendance/Learning Attitude (20%)									
Prerequisite: Sensors and Actuators, Design of Machine Elements & Mechanical System.									

Course Objectives:

Course intends to provide the student with the significance of robotic system with robotic elements/peripherals, their selection and interface with manufacturing equipment's. To familiarize the students with the basics of robot kinematics.

Course Outcomes:

SN	Course Outcomes	Cognitive levels as per bloom's Taxonomy
1	Acquire the skills in understanding robot basic knowledge	L1, L2
2	Develop skills in understanding various robot subsystems and wheeled Mobile Robot Vehicles	L1, L2, L3
3	Develop skills in understanding various sensors, robot peripherals and their use.	L1, L2, L3
4	Develop skills in robot Kinematics for robot control.	L1, L2, L3, L4
5	Select robot for industrial task and identify areas in which robot can be deployed in industry	L1, L2, L3
6	Develop skills in machine vision	L1, L2, L3, L4

Detailed Syllabus

Module No.	Topics	Hrs.	Cognitive levels as per bloom's Taxonomy
1	Introduction and Fundamentals of Robotics	7	L1, L2
	Automation & robotics, Robotic System & Anatomy Classification, Future Prospects Robotic Application in Manufacturing: Material transfer, Machine loading & unloading, Processing operations, Assembly & Inspectors		
2	Robot Subsystems and Wheeled Mobile Robot Vehicles	7	L1, L2, L3
	Motion, Recognition, Control Industrial Robot Anatomy, 4 Common Configurations, Robot Motions, Joint Notation Scheme, Work Volume, Drive Systems, Speed, Load Carrying Capacity, Precision of Movement (Resolution, Accuracy, Repeatability, Compliance). Motion Control Programming, Wheeled Mobile Robot Vehicles: Wheeled Mobile Robots: Differential Drive, Car (Ackermann) Drive, Synchronous Drive, Omnidirectional Drive		
3	Robotics System & Components	7	L1, L2, L3
	Control Loops, Basic Control System Concepts & Models, Control System Analysis, Robot Activation & Feedback Components, Position & Velocity Sensors, Actuators, Power Transmission Systems, Homogeneous Coordinates, DH parameters		
4	Robot Kinematics	10	L1, L2, L3, L4
	Coordinate Frames, Rotations, Homogeneous Coordinates, Arm Equation of Planer Robot, Four axis SCARA Robot, TCV, forward kinematics, Inverse Kinematics of Planer Robot, Four Axis SCARA Robot.		
5	Trajectory Planning & Robot Dynamics	8	L1, L2, L3
	Manipulator Path Control- Linear, Quadratic and Cubic Interpolation, Work Space Analysis, Robot Dynamics –Langrangian Dynamics of one and two link robot arm Robot languages; Programming in suitable languages Characteristics of robot		
6	Robot Vision-Based Control	6	L1, L2, L3, L4
	Introduction, Low level & High level vision, Sensing & Digitizing, Template Matching, Image processing & analysis, Segmentation, Edge detection, Object description & recognition, Interpretation, Noises in Image, Applications		

Books and References:

S N	Title	Authors	Publisher	Edition	Year
1	Introduction to Robotics	S. K. Saha	McGraw Hill	1st Edition	2008
2	Industrial Robotics	Groover and Simmers	SIE	1st Edition	2015
3	Introduction to Robotics Mechanics and Control	John Craig	Pearson	-	2008
4	Industrial Robotics Technology Programming and Applications	MP Groover, M. Weiss, R. N. Nagel, N. G. Odrey	SIE	2nd Edition	2017
5	Wheeled Mobile Robotics From Fundamentals Towards Autonomous Systems	Gregor Klančar, Andrej Zdešar, Sašo Blažič, Igor Škrjanc	Elesvier ButterworthHeinemann	-	2017

Online References:

Sr.No	Website Name	URL	Modules Covered
1	http://nptel.ac.in	https://nptel.ac.in/courses/112105249	M1, M2, M3, M4
2	http://nptel.ac.in	https://nptel.ac.in/courses/107106090	M5, M6

T.E/T. T Semester –VI
Choice Based Credit Grading Scheme with Holistic and Multidisciplinary Education
(CBCGS-HME 2023) Proposed TCET Autonomy Scheme (w.e.f. A.Y. 2023-24)

B.E/B. Tech (All Branches)								T.E/T. T: SEM VI		
Course Name: English for Competitive Examinations								Course Code: OEC-6022		
Teaching Scheme (Program Specific)					Examination Scheme (Formative / Summative)					
Modes of Teaching / Learning / Weightage					Modes of Continuous Assessment / Evaluation					
Hours Per Week					Theory (100)			Practical / Oral (25)	Term Work (25)	Total
Theor y	Tutoria l	Practica l	Contact Hours	Credits	ISE	IE	ESE	PR	TW	125
3	-	-	3	3	20	20	60	-	25	
ISE: In - semester Examination –Paper Duration – 1 Hour IE: Innovative Examination ESE: End Semester Examination – Paper Duration – 2 Hours The weightage of marks for continuous evaluation taken with Term work/Report: Formative (40%), Timely completion of practical (40%) and Attendance/Learning Attitude (20%)										
Prerequisite: Basic knowledge of English language, Grammar and Vocabulary										

Course Objective: The course will be able to develop understanding of English from competitive examination perspective. Course Outcomes: **Upon completion of the course students will be able to:**

Sr. No.	Course Outcomes	Cognitive Levels of Attainment as per Revised Bloom's Taxonomy
1	Understanding vocabulary, intensive and extensive comprehension	L1, L2, L3
2	To gain competence in grammatical rules and different types of sentence construction	L1, L2, L3
3	To Develop writing skills required for competitive examination	L1, L2, L3
4	Accomplishing communicative skills	L1, L2, L3
5	To enhance competitive oriented critical reasoning and logic	L1, L2, L3
6	To increase the awareness about current affairs and general awareness	L1, L2, L3

Detailed Syllabus

Module No.	Topics	Hrs.	Cognitive Levels of Attainment as per Revised Bloom's Taxonomy
1	Vocabulary Building and Comprehension	05	L1, L2, L3
	1.1 Vocabulary Expansion, Word roots, prefixes, and suffixes, Synonyms and antonyms, Idioms and phrasal verbs 1.2 Reading Comprehension 1.3 Strategies for effective reading 1.4 Practice with diverse text types 1.5 Inference and critical analysis		
2	Grammar and Sentence Structure	05	L1, L2, L3
	2.1 Parts of Speech: Nouns, pronouns, verbs, adjectives, adverbs, etc. Sentence construction and analysis 2.2 Tenses and Verb Forms: Present, past, and future tenses Conditional sentences 2.3 Sentence Structure 2.4 Types of sentences (simple, compound, complex) 2.5 Subject-verb agreement 2.6 Question Tag 2.7 Degrees of Comparison 2.8 Reported Speech 2.9 Change the Voice		
3	Writing Skills	06	L1, L2, L3
	3.1 Essay Writing 3.2 Types of essays (descriptive, argumentative, narrative) 3.3 Planning and structuring essays 3.4 Letter and Email Writing 3.5 Formal and informal correspondence 3.6 Business communication		
4	Communication Skills	04	L1, L2, L3
	4.1 Speaking Skills: Public speaking and presentation skills 4.2 Pronunciation and intonation 4.3 Listening Skills: Active listening techniques 4.4 Understanding various accents		
5	Critical Reasoning and Logic	04	L1, L2, L3
	5.1 Logical Reasoning: Deductive and inductive reasoning, Analyzing arguments 5.2 Critical Thinking 5.3 Identifying fallacies		

	5.4 Problem-solving through critical thinking		
6	Current Affairs and General Awareness	06	L1, L2, L3
	6.1 Reading News Articles		
	6.2 Understanding news articles and editorials		
	6.3 Extracting important information		
	6.4 Discussion and Debates		
	6.5 Participating in group discussions		
	6.6 Structured debates on current topics		

Books and References:

Sr • No	Name of the Book	Name of the Author	Publisher	Edition	Year of Publication
1	Practical English Usage	Michael Swan	OUP	4th Edition	1995
2	Remedial English Grammar	F.T. Wood	Macmillan	2014 Edition	2007
3	On Writing Well	William Zinsser	Harper Resource Book	25 th Anniversary Edition	2001
4	Study Writing	Liz Hamp- Lyons and Ben Heasley	Cambridge University Press	2nd Edition	2006
5	Communication Skills	Sanjay Kumar and PushpLata	OUP	1st Edition	2011
6	Exercises in Spoken English Parts. I-III	CIEFL	University Press	1997 Edition	1997
7	The Briefest English Grammar	Ruth Colman	UNSW Press	1 st Edition	2004
8	English Grammar in Use	Raymond Murphy	Cambridge University	5 th Edition	2019

T.E. Semester –VI

B.E. (Information Technology)					SEM: VI		
Course Name: Research Based Learning					Course Code: HME -RBL601		
Teaching Scheme (Program Specific)					Examination Scheme (Formative/ Summative)		
Modes of Teaching / Learning / Weightage					Assessment/Evaluation Scheme		
Hours Per Week					Presentation	Report	Term Work
Theory	Tutorial	Practical	Contact Hours	Credits	AC	AC	TW
-	-	2	2	1	15	10	25
AC: Activity The weightage of marks for continuous evaluation of Term work: Formative (40%), Timely completion of practical (40%), and Attendance / Learning Attitude (20%).							
Mid Semester Assessment for Term work will be on continuous basis							
Prerequisite: Domain knowledge							

Course Objectives: To develop the skills necessary for conducting effective research, performing critical analysis, and producing high-quality research papers with the aid of modern AI tools.

Course Outcomes: Upon completion of the course students will be able to:

S.N.	Course Outcome	Cognitive level attainment as per revised Bloom Taxonomy
1	Formulate research questions and identify problems using structured qualitative and quantitative methods.	L1, L2, L3
2	Conduct literature reviews and perform exploratory data analysis to support research objectives.	L1, L2, L3, L4
3	Apply AI-driven tools for drafting, grammar checking, and enhancing research paper quality.	L1, L2, L3, L4
4	Design and develop methodology/ prototype/simulation and visualize research findings using tools.	L1, L2, L3, L4
5	Structure and refine research paper through effective proofreading, editing, and citation management.	L1, L2, L3, L4, L5
6	Prepare professional presentations and refine research paper based on peer-review feedback for publication.	L1, L2, L3, L4, L5, L6

Detailed Syllabus:

Module No.	Topics	Hours	Cognitive level attainment as per revised Bloom Taxonomy
1	Fundamentals of research and problem identification Importance of research in engineering and its impact. Identifying research gaps and formulating research questions, and problem Identification. Structuring research: Qualitative vs. Quantitative methods. Designing experiments, surveys, or simulations. Ethical considerations in research.	3	L1, L2, L3
2	Literature Review and Data analysis Conducting literature review of at least 5 good quality research papers using tools like Google Scholar, Semantic Scholar, and ResearchGate. Data collection and analysis Exploratory data analysis (EDA).	3	L1, L2, L3, L4
3	AI tools for research paper writing Introduction to AI-powered tools for literature review (e.g., Afforai, Connected Papers, Litmaps). Introduction to AI tools for data collection and analysis (e.g., ChatGPT, Excel/Google Sheets automation, MS Office copilot). AI-driven tools for analysis and visualization (e.g., Tableau, Python libraries, Excel AI). Using AI tools for drafting and grammar checking (e.g., Grammarly, QuillBot). AI tools for improving content quality (e.g., ChatGPT for paraphrasing, Jasper for creative edits).	3	L1, L2, L3, L4
4	Design methodology/prototype/algorithm/ Design and Simulation/ Data Visualization Perform EDA on sample datasets. Designing prototype, testing, analyzing and visualize data related to the research problem. Visualize findings using tools like Matplotlib, Seaborn, or Tableau.	3	L1, L2, L3, L4
5	Drafting Research paper and proof reading Structure of a research paper: Abstract, Introduction, Literature Review, Methodology, Results, Discussion, Conclusion, and References. Technical paper writing tips for clarity, coherence, and impact. Refining the paper: Proofreading, editing, and formatting, plagiarism check. Citation management tools (e.g., Zotero, EndNote, Mendeley).	3	L1, L2, L3, L4, L5
6	Presentation & publication Preparing presentations for conferences or seminars.	3	L1, L2, L3, L4, L5

	AI tools for presentation design (e.g., Canva, Beautiful.ai). Select the relevant journal or conference for submission. Understanding the peer-review process, refining paper based on editor/reviewers comments and resubmission of paper.		,L6
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Books and References:

Sr. No.	Title	Authors	Publisher	Edition	Year
1.	Research Methodology: A Step-by-Step Guide for Beginners	Ranjit Kumar	Sage Publications	5th	2022
2.	Writing Research Papers: A Complete Guide	James D. Lester, Jim D. Lester Jr.	Pearson	16th	2021
3.	Introduction to Research Methods: A Practical Guide	Catherine Dawson	Routledge	5th	2019
4.	Data Visualization: A Handbook for Data-Driven Design	Andy Kirk	SAGE Publications	3rd	2024
5.	AI-Powered Research: The Future of Scientific Exploration	John W. Shepherd	AI Publications	1st	2023
6.	Zotero: A Beginner's Guide to Citation Management	Julian Littman	Wiley	1st	2020
7.	Effective Data Storytelling	Brent Dykes	Wiley	1st	2020

Mooc's Courses Link:

Sr.No	Website Name	Course Link	Modules covered	No.of weeks
1.	NPTEL	https://onlinecourses.nptel.ac.in/noc23_ge36/preview	M1 – M6	8

T.E. Semester –VI

Choice Based Credit Grading Scheme with Holistic and Multidisciplinary Education (CBCGS-HME 2023) Proposed TCET Autonomy Scheme (w.e.f. A.Y. 2024-25)

B.E. (Information Technology)					SEM: VI					
Course Name: Professional Skill V (Full Stack Development II - Basic)					Course Code: HME-IT-PS601					
Teaching Scheme (Program Specific)					Examination Scheme (Formative/ Summative)					
Modes of Teaching / Learning / Weightage					Modes of Continuous Assessment / Evaluation					
Hours Per Week					Theory (100)			PR	TW	Total
Theor y	Tutoria l	Practical	Conta ct Hours	Credit s	ISE	IE	ESE			25
-	-	2	2	1	-	-	-	15	10	
PR,TW will be part of theory evaluation										
The weightage of marks for continuous evaluation of Term work/ Report: Formative (40%), Timely completion of practical (40%) and Attendance/Learning Attitude (20%)										
Prerequisite: HTML, CSS, JavaScript, Basic knowledge of operating systems (especially UNIX/Linux for technical support course, networking fundamentals, computer programming and software development concepts										

Course Objective: The objective of this course is to equip students with essential skills in web security, modern web development, software design and modeling, business process modeling, technical support and troubleshooting, and deployment and infrastructure management, through a combination of theory and practical exercises.

Course Outcomes: Upon completion of the course students will be able to:

Sr. No.	Course Outcomes	Cognitive levels of attainment as per Bloom's Taxonomy
1	Understand the web security fundamentals, including OWASP's top vulnerabilities, OPEN ID and OAuth workflows, public key encryption, and best practices for configuration management	L1,L2
2	Understand modern web development, 12 Factor App principles, Angular component reuse, object-oriented concepts, and practical Aspect-Oriented Programming (AOP) examples	L2,L3
3	Gain expertise in software design basics, object-oriented programming (OOP) fundamentals, creating and interpreting ER diagrams, and using UML (Activity, Class, Sequence diagrams) through practical modeling exercises.	L1,L2,L3
4	Learn business process modeling basics, BPMN notations, modeling processes with BPMN, integrating BPMN with software development life-cycle, and real-world case studies	L1,L3
5	Develop essential OS skills (UNIX), scripting basics, software troubleshooting techniques, network fundamentals and troubleshooting, and practical exercises using Postman and other tools	L1,L2,L3
6	Explore deployment and infrastructure management, install and configure Point of Sale (PoS) systems, manage penny drops and related transactions, provision and configure Storage Area Networks (SAN), and engage in practical deployment scenarios and hands-on exercises	L1,L2,L3

Detailed Syllabus:

Module No.	Topics	Hrs.	Cognitive levels of attainment as per Bloom's Taxonomy
1	Fundamentals of Web Security	3	L1,L2
	Introduction to Web Security, OWASP Top 10 Vulnerabilities, OPEN ID and OAuth Workflows, Overview of Public Key Encryption, Best Practices for Configuration Management		
2	Modern Web Development Practices	5	L2,L3
	Introduction to Modern Web Development, Principles of 12 Factor Applications, Angular Component Reuse and Object-Oriented Concepts, Introduction to Aspect-Oriented Programming (AOP), Practical Implementation Examples		
3	Software Design and Modeling	6	L1,L2,L3
	Basics of Software Design, Fundamentals of Object-Oriented Programming (OOP), Creating and Interpreting ER Diagrams, Introduction to UML (Activity Diagrams, Class Diagrams, Sequence Diagrams), Practical Modeling Exercises		
4	Business Process Modeling	5	L1,L3
	Introduction to Business Process Modeling, Overview of BPMN Notations, Modeling Business Processes using BPMN, Integration of BPMN with Software Development Life-cycle, Case Studies and Real-world Examples		
5	Technical Support and Troubleshooting	5	L1,L2,L3
	Essential OS Skills (UNIX), Basics of Scripting, Introduction to Software Troubleshooting, Understanding Networks and Network Troubleshooting, Practical Exercises with Postman and other tools		
6	Deployment and Infrastructure Management	6	L1,L2,L3
	Introduction to Deployment and Infrastructure Management, Installation and Configuration of Point of Sale (PoS) Systems, Handling Penny Drops and Related Transactions, Provisioning and Configuring Storage Area Networks (SAN), Practical Deployment Scenarios and Hands-on Exercises		
	Total Hours	30	

Books and References:

Sr. No.	Title	Authors	Publisher	Edition	Year
1	Web Application Security: A Beginner's Guide	Bryan Sullivan and Vincent Liu	McGraw-Hill Education	-	2018
2	The Web Application Hacker's Handbook: Finding and Exploiting Security Flaws	Dafydd Stuttard and Marcus Pinto	Wiley	Second	2011

3	Business Process Model and Notation: BPMN	Stephen A. White	Pearson	-	2013
4	The Practice of System and Network Administration	Thomas A. Limoncelli, Christina J. Hogan, and Strata R. Chalup	Addison-Wesley Professional	Third	2016

T.E. Semester –VI

Choice-Based Credit Grading Scheme with Holistic and Multidisciplinary Education (CBCGS-HME 2023)

Proposed TCET Autonomy Scheme (w.e.f. A.Y. 2024-25)

B.E. (Information Technology)					S.E. SEM : VI			
Course Name: Professional Skills-V (Generic Track: Cloud Analyst-II)					Course Code : HME – COMP-PS601			
Teaching Scheme (Program Specific)					Examination Scheme (Academic)			
Modes of Teaching / Learning / Weightage					Modes of Continuous Assessment / Evaluation			
Theo ry	Tutorial	Practical	Contact Hours	Credits	Presentation	Report	TW	25
					AC	AC		
-	-	2	2	1	15	10	25	
The weightage of marks for continuous evaluation of Term work/Report: Formative (40%), Timely completion of practical (40%) and Attendance / Learning Attitude (20%)								
Prerequisite: Computer Basics, Procedural Programming Languages, Infrastructure Security, Cloud Infrastructure								

Course Objective: To comprehend cloud concepts involves grasping the fundamental principles of on-demand resource provisioning, scalability, and virtualization, while understanding the cloud environment entails familiarity with the infrastructure, services, and deployment models. Utilizing cloud services involves efficiently leveraging platforms, software, and infrastructure provided by cloud service providers to meet diverse computing needs.

Course Outcomes: Upon completion of the course students will be able to:

Sr. No.	Course Outcomes	Cognitive levels of attainment as per Bloom's Taxonomy	PO Mapping (Write only Number/s)	PSO Mapping (Write only Number/s)
1	Configure, test and deploy secure and cost-effective cloud infrastructure	L1-L6	1-6, 8-12	1,2,3,4
2	Provide secure and easy access to the cloud services	L1-L6	1-6, 8-12	1,2,3,4
3	Automate cloud infrastructure deployment and management	L1-L6	1-6, 8-12	1,2,3,4
4	Use cloud monitoring and deployment tools	L1-L6	1-6, 8-12	1,2,3,4
5	Deploy and utilize machine learning model on cloud computing environment	L1-L6	1-6, 8-12	1,2,3,4
6	Compliance of cloud infrastructure with the various standards	L1-L6	1-6, 8-12	1,2,3,4

Suggested List of Experiments:

Sr. No.	Practical/Experiment topic	Hrs.	Cognitive levels of attainment as per Bloom's Taxonomy
1.	Design and deploy the cloud-based application with scalability feature.	2	L1,L2.L3,L4
2.	Create Virtual Private Cloud for the cloud-based application.	2	L1,L2.L3,L4
3.	Create security groups for the cloud instances.	2	L1,L2.L3,L4,L5, L6
4.	Deploy load balancer for the application deployed on to distribute the load among multiple instances.	2	L1,L2.L3,L4,L5, L6
5.	Create and modify the firewall rules of Virtual Private Cloud.	2	L1,L2.L3,L4,L5, L6
6.	Design the secure network architecture for the cloud-based application.	2	L1,L2.L3
7.	Use serverless computing models to provide the services of application hosted on cloud computing environment.	2	L1,L2.L3,L4,L5, L6
8.	Create API and access the cloud services using the API.	2	L1,L2.L3,L4,L5, L6
9.	Automate the Deployment of Networks in cloud computing environment with Terraform.	2	L1,L2.L3,L4,L5, L6
10.	Explore and configure parameters and tools to monitor and manage cloud services.	2	L1,L2.L3
11.	Implement the application which uses the cloud services to create machine learning model.	2	L1,L2.L3,L4,L5, L6
12.	Implement the application which uses the Natural Language API service of cloud computing.	2	L1,L2.L3,L4,L5, L6
13.	Implement the application which uses the audio to text API service of cloud computing.	2	L1,L2.L3,L4,L5, L6
14.	Case study on various standards developed for the efficient use and high security of cloud computing.	2	L1,L2.L3
15.	Mini Project	2	L1,L2.L3,L4,L5, L6
Total Hours.		30	

Online References:

Sr. No.	Website Name	URL	Practical's
1	www.aws.amazon.com	https://aws.amazon.com/getting-started/handson/?nc2=h_ql_le_gs_t&getting-started-all.sort-by=item.additionalFields.content-latest-publish-date&getting-started-all.sort-order=desc&awsf.getting-started-category=*all&awsf.getting-started-content-type=*all	1-15

T.E. Semester –VI

Choice Based Credit Grading Scheme with Holistic and Multidisciplinary Education (CBCGS-HME 2023) Proposed TCET Autonomy Scheme (w.e.f. A.Y. 2024-25)

B.E (Information Technology)								SEM: VI		
Course Name: Industry Practice-IV (Full Stack Development II-Advanced)								Course Code: HME-IT-IP601		
Teaching Scheme (Program Specific)					Examination Scheme (Formative/ Summative)					
Modes of Teaching / Learning / Weightage					Modes of Continuous Assessment / Evaluation					
Hours Per Week					Theory (100)			PR	TW	Total
Theor y	Tutoria l	Practical	Conta ct Hours	Credit s	ISE	IE	ESE			25
-	-	2	2	1	-	-	-	15	10	
The weightage of marks for continuous evaluation of Term work/ Report: Formative (40%), Timely completion of practical (40%) and Attendance/Learning Attitude (20%)										
Prerequisite: HTML, CSS, JavaScript, Object oriented concepts, networking fundamentals, computer programming and software development concepts										

List of Practical/ Experiments:

Practica l Number	Type of Experiment	Practical/ Experiment Topic	Hr s.	Cognitive levels of attainment as per Bloom's Taxonomy
1	Basic Experiments	Install OpenProject and learn the key concepts.	2	L1,L2
2		Create a dashboard that displays key project metrics such as task progress, team workload, and project timeline. Use the OpenProject API to fetch project data and visualize it using charts and graphs.	2	L1,L2
3	Design/Develop Experiments	Develop front-end components for different use cases using Angular.	2	L2,L3
4		Perform test automation using Cypress.	2	L2,L3
5		Deploy Keycloak as an Identity Management Server.	2	L2,L3
6		Implement authentication and authorization on the server-side.	2	L1,L2,L3
7		Implement authentication and authorization on the front-end.	2	L1,L3
8		Package a Java application using Maven and Gradle.	2	L1,L3
9		Write automated tests for APIs and UIs using tools like Postman and Selenium.	2	L1,L3
10		Use shell scripts to troubleshoot issues in a production environment.	2	L1,L2,L3

11	Case studies	Analyze a project that successfully used OpenProject for time tracking and reporting. Evaluate how it improved project management and productivity.	2	L1,L2,L3
12		Review a company's test automation strategy for APIs and UIs using tools like Postman and Selenium. Discuss how it reduced manual testing effort and improved software reliability.	2	L1,L2,L3
13	Mini Project	Develop a web-based task management system that allows users to create, assign, and track tasks, similar to popular project management tools.	6	L1,L2,L3,L4
Total Hours			30	

Books and References:

Sr. No.	Title	Authors	Publisher	Edition	Year
1	Web Application Security: A Beginner's Guide	Bryan Sullivan and Vincent Liu	McGraw-Hill Education	-	2018
2	The Web Application Hacker's Handbook: Finding and Exploiting Security Flaws	Dafydd Stuttard and Marcus Pinto	Wiley	Second	2011
3	Business Process Model and Notation: BPMN	Stephen A. White	Pearson	-	2013
4	The Practice of System and Network Administration	Thomas A. Limoncelli, Christina J. Hogan, and Strata R. Chalup	Addison-Wesley Professional	Third	2016

T.E. Semester –VI

Choice Based Credit Grading Scheme with Holistic and Multidisciplinary Education (CBCGS-HME 2023)

Proposed TCET Autonomy Syllabus (w.e.f. A.Y. 2023-2024)

B.E. (Information Technology)					T.E. SEM: VI		
Course Name: Industry Practices-IV (Employability Skills) (Object Oriented Programming and Linear Data structures & Algorithms)					Course Code: HME-ITIP601		
Teaching scheme (Holistic and Multidisciplinary Education-HME)					Examination Scheme (Academic)		
Modes of Teaching / Learning / Weightage					Assessment/Evaluation Scheme		
Theory	Tutorial	Practical	Contact Hours	Credits	Presentation AC	Report AC	Term Work
-	-	2	2	1	15	10	25
Prerequisite: Data Structures, JavaScript							

Note:- IP Syllabus is designed looking into the current market scenario & industry trends. In future contents may be revised based on industry requirements.

Course Objective: The course intends to provide the knowledge of object-oriented programming concepts and apply them in problem solving. The course intends to develop skills to apply appropriate data structures in problem solving.

Course Outcomes: Upon completion of the course students will be able to:

Sr. No.	Course Outcomes	Cognitive levels of attainment as per Bloom's Taxonomy	PO Mapping (Write only Number/s)	PSO Mapping (Write only Number/s)
1	Understand the basics of object-oriented programming concepts	L1, L2	1,2,5	1,2
2	Apply the concept of encapsulation using JavaScript	L1, L2, L3	1,2,3,5,9,10,12	1,2,3
3	Apply the concept of inheritance using JavaScript	L1, L2, L3	1,2,3,5,9,10,12	1,2,3
4	Experiment with arrays and strings using JavaScript	L1, L2, L3	1,2,3,5,9,10,12	1,2,3
5	Examine the use cases of tuples and maps using JavaScript	L1, L2, L3, L4	1,2,3,5,8,9,10,12	1,2,3,4
6	Experiment with linked list using JavaScript and compare arrays with arrays	L1, L2, L3, L4	1,2,3,5,9,10,12	1,2,3,4

Detailed Syllabus:

Module No.	Topics	Hrs.	Self Study	Cognitive levels of attainment as per Bloom's Taxonomy
1	OOPS Basics Introduction to Object-Oriented Programming (OOP), Classes and Objects in JavaScript, Constructors and Prototypes, Method Chaining and Fluent Interfaces, Static Methods and Properties, Understanding "this" Keyword, Object Creation Patterns (Factory, Constructor, Prototype), ES6 Class Syntax, Using Classes and OOP in Modern JavaScript Frameworks	4	2	L1, L2
2	Encapsulation Understanding Encapsulation in Object-Oriented Programming (OOP), Data Hiding and Access Control, Private and Public Members in JavaScript, Encapsulating Data with Getters and Setters, Benefits and Importance of Encapsulation, Implementing Encapsulation in JavaScript Classes, Using Closures for Private Members, Weak Encapsulation Techniques, Encapsulation in Module Systems (CommonJS, ES6 Modules), Encapsulation in Prototypal Inheritance	5	2	L1, L2, L3
3	Inheritance, Friend Prototypal Inheritance in JavaScript, Creating and Extending Objects with Prototype Chains, Constructor Functions and the "new" Keyword, The Prototype Object and Prototype Methods, Overriding and Inheriting Methods, "super" Keyword and Calling Parent Methods, Classical Inheritance vs. Prototypal Inheritance, Constructor Stealing and Object Composition, Mixins and Multiple Inheritance, Implementing Inheritance with ES6 Classes	5	2	L1, L2, L3
4	Array, String Creating and Initializing Arrays, Accessing Array Elements, Modifying Array Elements, Array Length and Manipulation, Array Iteration and Looping, Array Methods, Array Searching and Filtering, Array Mapping and Transformation, Array Sorting and Reversing, Multi-dimensional Arrays, String Basics in JavaScript, String Manipulation, String Methods and Properties, Regular Expressions and String Matching, Template Literals and String Interpolation, Converting Strings to Arrays and Vice Versa, Unicode and Character Encoding in JavaScript	5	2	L1, L2, L3
5	Tuple, Map Introduction to Searching Techniques, Linear Search, Binary Search, Interpolation Search, Exponential Search, Jump Search, Fibonacci Search, Ternary Search, Hashing and Hash-based Search, String Searching: Brute Force, String Searching: Knuth-Morris-Pratt (KMP) Algorithm, String Searching: Rabin-Karp Algorithm, String Searching: Boyer-Moore Algorithm, Searching in Sorted and Rotated Arrays, Searching in 2D Arrays, Searching in Trees: Depth-First Search (DFS) and Breadth-First Search (BFS)	5	2	L1, L2, L3, L4
6	Sorting Techniques Introduction to Tuples in JavaScript, Creating and Initializing Tuples, Accessing Tuple Elements, Modifying Tuple Elements, Deconstructing Tuples, Working with Tuple Methods, Tuple vs. Array: Differences and Use Cases, Introduction to Maps in JavaScript, Creating and	6	5	L1, L2, L3, L4

	Initializing Maps, Adding and Retrieving Values from Maps, Modifying and Deleting Map Entries, Iterating over Maps, Map Methods and Properties, Map Keys and Values, Map Size and Checking for Existence, Map Use Cases and Benefits, Maps vs. Objects: Differences and Use Cases, Map Performance and Efficiency			
	Total	30	15	
	Hours			

Text /Reference Books:

Sr. No.	Title	Authors	Publisher	Edition	Year
1	Mastering JavaScript Object-Oriented Programming	Andrea Chiarelli	Packt Publishing Ltd.	First Edition	2016
2	JavaScript: Object-Oriented Programming	Ved Antani, Gaston C. Hillar, Stoyan Stefanov, Kumar Chetan Sharma	Packt Publishing Ltd.	First Edition	2016
3	JavaScript Data Structures and Algorithms: An Introduction to Understanding and Implementing Core Data Structure and Algorithm Fundamentals	Sammie Bae	Springer India	Second Edition	2021
4	Data Structures and Algorithms with JavaScript: Bringing Classic Computing Approaches to the Web	Michael Mcmillan	O'Reilly	First Edition	2014

Online References:

Sr. No.	Website Name	URL	Modules Covered
1	https://www.educative.io	https://www.educative.io/courses/learn-object-oriented-programming-in-javascript	M1-M3
2	https://www.udacity.com	https://www.udacity.com/course/object-oriented-javascript--ud711	M1-M3
3	https://www.freecodecamp.org	https://www.freecodecamp.org/learn/javascript-algorithms-and-data-structures/	M4, M6
4	https://www.freecodecamp.org	https://www.freecodecamp.org/news/tag/data-structures/	M4-M6

Syllabus for Advance Web Development

A.Y. (2023-24)

T.E. Semester –VI

B.E. (Information Technology)							T.E. SEM: VI		
Course Name: Web X.O							Course Code: MDL60116		
Teaching Scheme (Program Specific)					Examination Scheme (Formative/ Summative)				
Modes of Teaching / Learning / Weightage					Modes of Continuous Assessment / Evaluation				
Hours Per Week					Theory (100)		ctical/Oral (25)	Term Work (25)	Total
Theory	Tutorial	Practical	Contact Hours	Credits	ISE	ESE	OR	TW	125
3	-	@4	7	5	40	60	25	--	
@Capstone Project									
ISE: In- Semester Examination(In campus online in form of MCQs) - Paper Duration – 1 Hour ESE: End Semester Examination (Subjective in offline mode) - Paper Duration - 2 Hours.									
Prerequisite: HTML , CSS , Java script									

Course Objective:

This course provides a comprehensive overview of advanced web technologies, starting with an introduction to Web X.0 and the evolution of web analytics into Web Analytics 2.0, emphasizing clickstream analysis and experimentation. It explores Web 3.0 concepts and the Semantic Web, including key technologies such as RDF, RDFS, and SPARQL. Students will also gain hands-on experience with Type Script, learning its architecture, types, and programming constructs. Additionally, the course covers open-source web development frameworks, including Django, Drupal, and Joomla, equipping learners with the skills to install, configure, and use these platforms effectively.

Sr.No	Course Outcomes
.	Students will be able to:
1	describe the current state of web analytics and industry trends, and evaluate strategies for selecting effective web analytics tools, demonstrating their understanding at a comprehension and evaluation level.
2	analyze clickstream data and identify key metrics for measuring success, as well as apply testing and experimentation techniques to improve web performance, reflecting their ability to operate at an analysis and application level.
3	explain the components of the Semantic Web and assess the challenges it faces, including the use of technologies like RDF, RDFS, SKOS, and SPARQL, showcasing their analytical skills at an understanding and evaluation level.
4	construct TypeScript applications by setting up the environment, utilizing types, and implementing decision-making constructs, functions, and classes, demonstrating their skills at an application level.
5	differentiate between various knowledge representation languages such as OWL and RIF, and apply these concepts to create semantic web applications, showcasing their understanding at an analysis and application level.
6	install and configure web development frameworks like Django and Drupal, and compare Joomla and WordPress in terms of architecture and features.

Detailed Syllabus:

Module No.	Topics	No of Hours
1	Introduction to Web X.0	
	State of the Analytics Union, State of the Industry, Rethinking Web Analytics: Meet Web Analytics 2.0, Optimal Strategy for Choosing Your Web Analytics Soul Mate	6
2	Web Analytics 2.0	
	The Awesome World of Clickstream Analysis: Metrics. The Key to Glory: Measuring Success. Failing Faster: Unleashing the Power of Testing and Experimentation	6
3	Web 3.0	
	Web 3.0 and Semantic Web: Challenges, Components, Semantic Web Stack: RDF, RDF Schema (RDFS), Simple Knowledge Organization System (SKOS), SPARQL as RDF query language, N-Triples as a format for storing and transmitting data, Turtle (Terse RDF Triple Language),	8
4	Type Script	
	Overview, Type Script Internal Architecture, Type Script Environment Setup, Type Script Types, variables and operators, Decision Making and loops, Type Script Functions, Type Script Classes and Objects, Type Script Modules	8
5	Semantic Web	
	Web Ontology Language (OWL) a family of knowledge representation languages, Rule Interchange Format (RIF), a framework of web rule language dialects supporting rule interchange on the Web	7
6	Open Source Frameworks for web development	
	Django: Install Django, Django Create App, Django Create Project Drupal: Drupal – Installation, Drupal – Architecture Joomla: <u>Joomla Vs WordPress</u> , <u>Joomla - Architecture</u>	8

List of Practical's

Sn o	Title
1	Study and analysis of web development evolution
2	Write a program find the biggest of three number using type script
3	Write a program for simple Inheritance in type script
4	Write a program for Array in Angular JS
5	Write a program for Filter in Angular JS
6	Write a program to implement decision making using PHP
7	Develop interactive web page using PHP

8	Develop a simple web page using Python
9	Design a web application for demonstration of online shopping
10	Capstone Project

Sr. No	Title	Authors	Publisher	Edition	Year
1	Web Analytics 2.0: The Art of Online Accountability	Avinash Kaushik	O'Reilly Media	1st	2021
2	Advanced Web Analytics: How to Integrate Data, Technology, and Marketing	Brian Clifton	Wiley	2 nd	2021
3	Django for APIs: Build web APIs with Python and Django	William S. Vincent	Leanpub	1st	2022
4	Pro Drupal 9 Development	John VanDyk et al.	Apress	1st	2022

Online Resources:

Sr. No.	Website Name	URL	Modules covered
1.	https://www.geeksforgeeks.org	https://www.geeksforgeeks.org/web-1-0-web-2-0-and-web-3-0-with-their-difference/	M1
2	https://www.coursera.org	https://www.coursera.org/learn/teaching-learning-tools?msockid=0f398285cee461271b7896bacf7f60e9	M2
3	https://www.geeksforgeeks.org	https://www.geeksforgeeks.org/web-3-0-and-its-features/	M3
4	https://www.geeksforgeeks.org	https://www.geeksforgeeks.org/typescript-any-type/?ref=header_ind	M4
5	https://www.geeksforgeeks.org	https://www.geeksforgeeks.org/introduction-to-semantic-ui/?ref=header_ind	M5
6	https://docs.djangoproject.com/	https://docs.djangoproject.com/en/5.1/topics/install/	M6

Syllabus for Blockchain Specialization –
A.Y. (2023-24)
T.E. Semester –VI

B.E. (Information Technology)					T.E. SEM: VI				
Course Name: Blockchain and Ethereum					Course Code: MDL-6013				
Teaching Scheme (Program Specific)					Examination Scheme (Formative/ Summative)				
Modes of Teaching / Learning / Weightage					Modes of Continuous Assessment / Evaluation				
Hours Per Week					Theory (100)		Practical/Oral (25)	Term Work (25)	Total
Theory	Tutorial	Practical	Contact Hours	Credits	ISE	ESE	OR	TW	
3	-	@4	5	5	40	60	25	-	125
@ Capstone project/Case studies									
ISE: In- Semester Examination(In campus online in form of MCQs) - Paper Duration – 1 Hour									
ESE: End Semester Examination (Subjective in offline mode) - Paper Duration - 2 Hours									
Prerequisite: Substantial programming experience, software engineering									

Course Objective: This course intends to deliver fundamentals of digitization, cryptographic concepts, Bitcoin Blockchain and scripts, Alternative coins and Blockchain applications

Course outcome:

Sr no	Course outcome
1.	Understand the fundamentals of digitization and blockchain technology
0.	Analyze cryptographic concepts for secure communication
0.	Understand the Bitcoin blockchain and scripting mechanisms
0.	Explore the characteristics and applications of alternative coins
0.	Examine blockchain applications across diverse domains
0.	Apply blockchain concepts to design and implement basic solutions

Detailed Syllabus:

Module No.	Topics	No of Hours
1	Introduction	6
	Contents: Landscape of digitalization, introduction to cryptographic concepts,	
2	Public key cryptosystems	6
	Contents: Hashing, public key cryptosystems, private vs public blockchain and use cases, Hash Puzzles, Introduction to Bitcoin Blockchain	
3	Bitcoin Blockchain and scripts	6
	Contents: Bitcoin Blockchain and scripts, Use cases of Bitcoin Blockchain scripting language in micropayment, escrow etc Downside of Bitcoin – mining	
4	Alternative coins	6
	Contents: Ethereum and Smart contracts , Ethereum continued, IOTA	
5	Permissioned Blockchain	7
	Contents: The real need for mining – consensus – Byzantine Generals Problem, and Consensus as a distributed coordination ,problem – Coming to private or permissioned blockchains – Introduction to Hyperledger, Hyperledger, Corda	
6	Blockchain applications	5

	Contents: Uses of Blockchain in E-Governance, Land Registration, Medical Information Systems, and others	
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Total Hours:- 36 (12 Weeks)

Capstone Project hours:

Work to be done	Hrs.
Identification and Study of blockchain application for designing blockchain scripts	4
Project Title Identification	2
Modelling or prototype design	4
Graphics Design	4
Implementation (Smart contract)	8
Testing of Mini Project	4
Preparation of Report	4
Total Hours	30

Books and References:

Sr. No	Title	Authors	Publisher	Edition	Year
1	Blockchain Revolution	Don Tapscott, Alex Tapscott	Penguin Random House	1st	2016
2	Blockchain and Digital Transformation of Supply Chains	Wolfgang Kersten, Thorsten Blecker	epubli	1st	2020
3	Cryptography and Network Security: Principles and Practice	William Stallings	Pearson Education	7th	2016

Online Resources:

Sr. No.	Website Name	URL	Modules covered	No of hours
1.	https://www.coursera.org	https://onlinecourses.nptel.ac.in/noc20_cs01/previous	M1,	7
2	https://www.coursera.org	https://onlinecourses.nptel.ac.in/noc20_cs01/previous	M2,	5
3	https://www.coursera.org	https://onlinecourses.nptel.ac.in/noc20_cs01/previous	M3	6
4	https://www.coursera.org	https://onlinecourses.nptel.ac.in/noc20_cs01/previous	,M4	6
5	https://www.coursera.org	https://onlinecourses.nptel.ac.in/noc20_cs01/previous	,M5,	6
6	https://www.coursera.org	https://onlinecourses.nptel.ac.in/noc20_cs01/previous	M6	6