

T.T. Semester –VI B. TECH Internet of Things (IOT)
Choice Based Credit Grading Scheme with Holistic and Multidisciplinary Education (CBCGS- HME 2020)
Syllabus under Autonomy Scheme

B. TECH Internet of Things (IOT)					T.T. SEM: VI					
Course Name: Cloud Computing					Course Code: PCC- IOT601					
Teaching Scheme (Program Specific)					Examination Scheme (Formative/ Summative)					
Modes of Teaching / Learning / Weightage					Modes of Continuous Assessment / Evaluation					
Hours Per Week-Theory (100)					IA	ESE	Practical /Oral (25)	Term Work (25)	Total	
Theory	Tutorial	Practical	Contact Hours	Credits	ISE	IE	-	PR/OR	TW	
3	-	2	5	4	20	20	60	-	25	125
ISE: In-Semester Examination - Paper Duration – 1 Hours IE: Innovative Examination ESE: End Semester Examination - Paper Duration - 2 Hours The weightage of marks for continuous evaluation of Term work/ Report: Formative (40%), and Attendance/Learning Attitude (20%)										
Prerequisite: Computer Basics, DBMS										

Course Objective: The course intends to deliver the fundamentals of cloud computing, its services, architecture, and infrastructure, with the knowledge of virtualization, and the security issues in the cloud, and how to overcome them.

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 cloud computing, its types and applications.	L1, L2
2	Identify and apply suitable cloud services.	L1, L2, L3
3	Apply suitable virtualization concept.	L1, L2, L3
4	Identify the architecture, infrastructure of cloud computing	L1, L2, L3
5	Address the core issues of cloud computing such as security, privacy and interoperability	L1, L2, L3
6	Perform various case studies of cloud computing.	L1, L2, L3, L4

Detailed Syllabus:

Module No.	Topics	Hrs.	Cognitive levels of attainment as per Bloom's Taxonomy
1	Introduction to Cloud Computing	6	L1, L2
	Introduction: Distributed computing, Cloud Computing, Layers and Types of Clouds, Cloud Infrastructure Management, Challenges and Applications. Virtualization: Virtualization of Computing, Storage and Resources. Cloud Services: Introduction to Cloud Services IaaS, PaaS and SaaS		
2	Cloud Services	9	L1, L2, L3
	Services (SaaS,IaaS,Paas): Evolution of SaaS, Challenges of SaaS Paradigm, SaaS Integration Services, SaaS Integration of Products and Platforms. Infrastructure As a Services (IaaS): Introduction, Background & Related Work, Virtual Machines Provisioning and Manageability, Virtual Machine Migration Services, VM Provisioning and Migration in Action. Platform As a service (PaaS): Integration of Private and Public Cloud, Technologies and Tools for Cloud Computing, Resource Provisioning services		
3	Abstraction and Virtualization	9	L1, L2, L3
	Abstraction and Virtualization: Introduction to Virtualization Technologies, Load Balancing and Virtualization, Understanding Hypervisors, Understanding Machine Imaging, Porting Applications, Virtual Machines Provisioning and Manageability Virtual Machine Migration Services, Virtual Machine Provisioning and Migration in Action, Provisioning in the Cloud Context, Virtualization of CPU, Memory, I/O Devices.		
4	Cloud Infrastructure	8	L1, L2, L3
	Cloud Infrastructure and Cloud Resource Management: Architectural Design of Compute and Storage Clouds, Layered Cloud Architecture Development, Design Challenges, Inter Cloud Resource Management, Resource Provisioning and Platform Deployment, Global Exchange of Cloud Resources. Administrating the Clouds, Cloud Management Products, Emerging Cloud Management Standards		
5	Security in cloud	7	L1, L2, L3
	Security: Security Overview, Cloud Security Challenges and Risks, Software-as-a Service Security, Cloud computing security architecture: Architectural Considerations, General Issues Securing the Cloud, Securing Data, Data Security, Application Security, Virtual Machine Security, Identity and Presence, Identity Management and Access Control, Autonomic Security Establishing Trusted Cloud, computing, Secure Execution Environments and Communications, Autonomic Security Storage Area Networks, Disaster Recovery in Clouds.		
6	Case Studies	6	L1, L2, L3, L4
	Cloud Based Case-Studies: Overview of Cloud services, Designing Solutions for the Cloud, Implement & Integrate Solutions, Emerging Markets and the Cloud, Tools for Building Private Cloud: IaaS using Eucalyptus, PaaS on IaaS - AppScale		
Total Hours		45	

Books and References:

SN	Title	Authors	Publisher	Edition	Year
1	Cloud Computing: Principles and Paradigms	Rajkumar Buyya, James Broberg, Andrzej M Goscinski	Wiley publication.		
2	Cloud Computing: A Practical Approach	Toby Velte, Anthony Velte	McGraw-Hill Osborne Media		

3	Cloud Application Architectures: Building Applications and Infrastructure in the Cloud	George Reese	O'Reilly Publication.		
4	Cloud Computing Explained: Implementation Handbook for Enterprises	John Rhoton	Recursive Press		

Online References:

S. No.	Website Name	URL	Modules Covered
1	www.simplilearn.com	https://www.simplilearn.com/tutorials/cloud-computing-tutorial	M1-M6
2	www.javatpoint.com	https://www.javatpoint.com/cloud-computing-tutorial	M1-M6
3	www.w3schools.in	https://www.w3schools.in/cloud-computing/tutorials/	M1-M6

Practical Number	Type of Experiment	Practical/ Experiment Topic	Hrs.	Cognitive levels of attainment as per Bloom's Taxonomy
1	Basic Experiments	Exploring AWS Console and configure CLI.	2	L1, L2, L3
2		Explore Amazon EC2	2	L1, L2, L3
3	Design Experiments	Implement Management in AWS <ul style="list-style-type: none"> ● Create new users who can login to AWS console ● Create role for an application to access S3 ● Create policies for new user to have either admin or limited privileges. 	2	L1, L2, L3
4		implement the storage in AWS.	2	L1, L2, L3
5		implement the load balancer in AWS.	2	L1, L2, L3
6		Implement the networking concept in AWS.	2	L1, L2, L3
7		Practical for cloud security in AWS	2	L1, L2, L3
8		understanding the migration in cloud	4	L1, L2, L3
9		case study	4	L1, L2, L3, L4
10	Mini/Minor Projects/ Seminar/ Case Studies	Mini projects for Innovative exams.	8	L1, L2, L3, L4
		Total Hours	30	

B.Tech. Semester VI
Choice Based Credit Grading Scheme with Holistic Student Development (CBCGS- H 2020) Proposed Syllabus under
Autonomy Scheme

B.Tech (Internet of Things)					B. Tech. (SEM: VI)					
Course Name: Core course VI (Wireless Sensor Networks)					Course Code: PCCIOT602					
Teaching Scheme (Program Specific)					Examination Scheme (Formative/ Summative)					
Modes of Teaching / Learning / Weightage					Modes of Continuous Assessment / Evaluation					
Hours Per Week Theory (100)					IA	ESE	Practical/Oral (25)	Term Work (25)	Total	
Theory	Tutorial	Practical	Contact Hours	Credits	ISA	IE	-	PR/OR		
3	-	2@	5	4	20	20	60	25	25	150
@-Professional Elective Courses Lab will be conducted in the form Capstone Project										
IA: In Semester Assessment- Paper Duration 1 Hours										
ESE: End Semester Evaluation- 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: Computer Networks, Mobile Communication Systems										

Course Objective: Course aims to make students understand the concepts of wireless sensor and adhoc networks, the major challenges and designing issues, various MAC and routing protocols in wireless sensor and adhoc networks and heterogeneous network architecture including MANET, WLAN, Cellular 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
1	Understand and describe the concept of wireless sensor networks, Adhoc networks, and their applications.	L1, L2
2	Describe and evaluate the performance of various routing protocols in wireless sensor and adhoc networks.	L1, L2, L3
3	Explain the broadcasting and Geocasting routing techniques in MANETES	L1, L2, L3, L4, L5
4	Describe and examine the performance of Multicasting protocols.	L1, L2, L3
5	Understand and describe the various design issues and challenges in Wireless Sensor Networks.	L1, L2, L3, L4
6	Understand and explain the heterogeneous network architecture comprised of MANETs, WLANs and Cellular Networks.	L1, L2, L3, L4, L5

Detailed Syllabus:

Module No	Topics	Hrs	Cognitive levels of attainment as per Bloom's Taxonomy
1	Introduction to MANET and Wireless Sensor Networks	08	L1, L2
	Introduction to WSN and MANET. WPAN: Bluetooth, ZigBee, UWB WLAN: Architecture, PHY and MAC layer, 802.11a, 802.11b, 802.11n. Application of sensor Network, Sensing and Communication Range, Energy and Clustering of sensors		
2	Routing in Ad hoc Networks	10	L1, L2, L3
	Topologies - Based Routing Protocols: DSDV, WRP, OLSR, DSR, AODV, TORA, ZRP. Position-Based Routing: Location Services: DREAM, Quorum based, Grid based Forwarding Strategies: Greedy packet forwarding, Expected zone routing, Relative Distance Micro-Discovery Ad Hoc Routing. Other Routing Protocols: Signal Stability Routing Protocol, Power Aware Routing, Associativity-Based Routing, QoS Routing.		
3	Broadcasting and Geo-casting in MANET	08	L1, L2, L3, L4, L5
	Introduction, The Broadcast Storm, Broadcasting: Ad Hoc Broadcast Protocol, Lightweight and Efficient Network-Wide Broadcast Geo-casting: Location-Based Multicast, Voronoi Diagram Based Geo-casting, Flooding-Based Geogrid, Route Creation Oriented		
4	Multi-casting in MANET	08	L1, L2, L3
	Tree-Based Approaches: Multicast Ad Hoc On-Demand Distance Vector Protocol, Location Guided Tree Construction Algorithm for Small Group Multicast, Multicast Zone Routing. Mesh-Based Approaches: On-Demand Multicast Routing Protocol, Stateless Approaches: Differential Destination Multicast, Hybrid Approaches: Ad Hoc Multicast Routing Protocol		
5	Design Issues & Challenges in Wireless Sensor Networks	06	L1, L2, L3, L4
	Introduction, Design Issues & Challenges: Energy, Self-Management, Hardware, Operating System, Middleware, QoS, Medium Access Schemes, Network and transport layer. Fundamentals of Network Security.		
6	Integrating MANETs, WLANs and Cellular Networks	05	L1, L2, L3, L4, L5
	Introduction, Ingredients of a Heterogeneous Architecture, Protocol Stack, Comparison of the Integrated Architectures.		
Total Hours		45	

Books and References:

Sr. No.	Title	Authors	Publisher	Edition	Year
1	Ad Hoc & Sensor Networks Theory and Applications	Cordeiro, Agrawal	Cambridge University Press India Pvt. Ltd	Second Edition	2010
2	Ad Hoc Wireless Networks Architecture and Protocols	C.Siva Ram Murthy and B.S.Manoj	Pearson	Second Edition	2016
3	Ad Hoc & Sensor Networks	Houda Labiod	Wiley	First Edition	2010
4	Wireless Communication and Networking	Vijay Garg	Elsevier Inc.	First Edition	2004
5	Embedded Systems: An Integrated Approach	Lyla Das	Pearson Publication	First Edition	2013
6	Wireless and Mobile Networks, Concepts and Protocols	Manvi, Kakkasageri	Wiley	Second Edition	2014

Online References:

Sr. No.	Website Name	URL	Modules Covered
1	NPTEL	https://nptel.ac.in/courses/106/105/106105160/	M1, M2, M4
2	NPTEL	https://ict.iitk.ac.in/courses/wireless-ad-hoc-and-sensor-networks/	M1. M2
4	Swayam	https://onlinecourses.swayam2.ac.in/ugc19_cs10/preview	M4, M5, M6

Suggested List of Practicals/ Experiments:

Practical Number	Type of Experiment	Practical/ Experiment Topic	Hrs.	Cognitive Levels as per Bloom's Taxonomy
1	Basic Experiments	Simulation Of Bluetooth Frequency Hopping	2	L1,L2,L3
2		Simulation Of Bluetooth Voice Transmission	2	L1,L2,L3
3		To create different topologies for wired network using NS2	2	L1,L2,L3
4		To create a network topology with five nodes and assign node one and two as source nodes and node four as destination nodes for wireless networks using NS2.	2	L1,L2,L3
5		Design a random scenario of 5 nodes with node 2 as source, 4 as sink and make node 3 as mobile node near to node 5.	2	L1,L2,L3
6	Design Experiments	Design the random scenario of 10 nodes with node 1, 2 and node 3 as source nodes and node 5, 6 and node 9 as sink.	2	L1,L2,L3
7		Design a network for the given design parameters	2	L1,L2,L3
8		Vary power parameters to define node existence time.	2	L1,L2,L3
9	Advanced	To understand the effect of shadowing to the pathloss formula.	2	L1,L2,L3,L4

10	Experiments	To understand the cellular frequency reuse concept fulfilling the finding of the co-channel cells for a particular cell .	2	L1,L2,L3,L4
11		Finding the cell cluster within a certain geographic area .	2	L1,L2,L3
12-13	Mini/Minor Projects/ Seminar/ Case Studies	Case study	4	L1,L2,L3,L4
14-15	Group Presentation	Tutorial-1 (Group presentations on topics beyond syllabus Tutorial-2	4	L1,L2,L3

T.T. Semester – VI
Choice Based Credit Grading Scheme with Holistic and Multidisciplinary Education
(CBCGS- HME 2020) Syllabus under Autonomy Scheme

B.TECH. Internet of Things (IOT)					T.T. SEM: VI						
Course Name: Machine Learning					Course Code: PCC-IOT603						
Teaching Scheme (Program Specific)					Examination scheme						
Modes of Teaching / Learning / Weightage					Modes of Continuous Assessment / Evaluation						
Hours Per Week- Theory (100)					IA		ESE	Practical/ Oral (25)	Term Work (25)	Total	
Theory	Tutorial	Practical	Contact Hours	Credits	ISA	IE	-	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 (20%)											
Prerequisite: Data Structures, Basic Probability and Statistics, Algorithms											

Course Objective: To impart fundamental knowledge about Machine learning basics and its algorithms for understanding the development of various applications.

Course Outcomes: Students will be able to:

SN	Course Outcomes	Cognitive levels of attainment as per Bloom's Taxonomy
1	Understand basic concepts of Machine Learning	L1, L2
2	Solve Regression problems	L1, L2, L3
3	Solve classification problems	L1, L2, L3
4	Evaluate model performance and select model	L1, L2, L3, L4
5	Solve Clustering and reinforcement learning problems.	L1, L2, L3
6	Apply Dimensionality reduction techniques.	L1, L2, L3

Detailed Syllabus:

Module No.	Topics	Hrs.	Cognitive levels of attainment as per Bloom's Taxonomy
1	Introduction to Machine Learning	5	L1, L2
	Introduction to Machine Learning, Types of Machine Learning, Issues in Machine Learning, Application of Machine Learning, Steps in developing a Machine Learning Application.		
2	Learning with Regression	6	L1, L2, L3
	Linear Regression, Cost function, Regularization, Polynomial Regression, Decision Tree Regressor, Metric for evaluating regressors		

3	Learning with Classification and Trees	12	L1, L2, L3
	Logistic Regression Naïve Bayes kNN Support Vector Machine Multiclass classification Decision Trees, Entropy, Information gain, Gini Index Bias Variance tradeoff Ensembles: Bagging (Random Forest), Boosting (XGBoost)		
4	Model Evaluation and Selection	6	L1, L2, L3, L4
	Metrics for Evaluating Classifier Performance, Cross Validation, Model Selection Using Statistical Tests of Significance		
5	Clustering and Reinforcement Learning	10	L1, L2, L3
	kMeans, Hierarchical, Density based Anomaly detection Terminology, Monte Carlo, Temporal Difference, SARSA, Q-learning		
6	Dimensionality Reduction	6	L1, L2, L3
	Principal Component Analysis, Single value decomposition, Linear Discriminant Analysis		

Books and Reference:

SN	Title	Authors	Publisher	Edition	Year
1	Machine Learning In Action	Peter Harrington	DreamTech Press	1 st	2012
2	Introduction to Machine Learning	Ethem Alpaydın	MIT Press	4 th	2020
3	Machine Learning	Tom M. Mitchell	McGraw Hill	Indian	1997
4	Machine Learning An Algorithmic Perspective	Stephen Marsland	CRC Press	2 nd	2011
5	Machine Learning — A Probabilistic Perspective	Kevin P. Murphy	MIT Press	1 st	2012
6	Pattern Recognition and Machine Learning	Christopher M. Bishop	Springer	1 st	2006
7	Elements of Statistical Learning	Trevor Hastie, Robert Tibshirani, Jerome Friedman	Springer	2 nd	2017

Online Resources:

S. No.	Website Name	URL	Modules Covered
1	www.analyticvidhya.com	https://www.analyticsvidhya.com/%20machine%20learning/	M1-M6
2	www.towardsdatascience.com	https://towardsdatascience.com/machine-learning/home	M1-M6
3	www.coursera.org	https://www.coursera.org/learn/machine-learning/home/welcome	M1-M6

Suggested list of Practical/ Experiments:

Practical Number	Type of Experiment	Practical/ Experiment Topic	Hrs.	Cognitive Level s as per Blooms Taxonomy
1	Basic Experiments		2	L1, L2
2		Implement Linear Regression on the case identified.	2	L1, L2, L3
3		Implement Logistic Regression on the case identified.	2	L1, L2, L3
4		Implement Naïve Bayes on the case identified.	2	L1, L2, L3
5		Implement k Nearest neighbor on the case identified.	2	L1, L2, L3
6		Implement Support Vector Machine on the case identified.	2	L1, L2, L3
7	Design Experiments	Implement Decision Tree algorithm on the case identified.	2	L1, L2, L3, L4
8		Implement Ensemble on the case identified.	2	L1, L2, L3, L4
9		Implement clustering algorithm on the case identified.	2	L1, L2, L3, L4
10	Advanced Experiments	Implement Principle Component Analysis on the case identified.	2	L1, L2, L3, L4
11-12	Mini/Minor Projects/ Seminar/ Case Studies	Case Study based on any Machine Learning technique	6	L1, L2, L3, L4, L5
13-15	Group Presentation	To design a model for classification / prediction/ clustering onto above features and tune the model	4	L1, L2, L3, L4, L5

T.T. Semester –VI B. TECH Internet of Things (IOT)
Choice Based Credit Grading Scheme with Holistic and Multidisciplinary Education (CBCGS- HME 2020)
Syllabus under Autonomy Scheme

B. TECH Internet of Things (IOT)					T.T. SEM: VI					
Course Name: Mobile Application Development					Course Code: PEC-IOT6011					
Teaching Scheme (Program Specific)					Examination Scheme (Formative/ Summative)					
Modes of Teaching / Learning / Weightage					Modes of Continuous Assessment / Evaluation					
Hours Per Week-Theory (100)					IA		ESE	Practical /Oral (25)	Term Work (25)	Total
Theory	Tutorial	Practical	Contact Hours	Credits	ISE	IE	-	PR/OR	TW	125
3	-	2	5	4	20	20	60	-	25	
ISE: In-Semester Examination - Paper Duration – 1 Hours IE: Innovative Examination ESE: End Semester Examination - Paper Duration - 2 Hours The weightage of marks for continuous evaluation of Term work/ Report: Formative (40%), and Attendance/Learning Attitude (20%)										
Prerequisite: Basic Knowledge of OOPS concept and Core java										

Course Objective: The course intends to deliver the fundamentals of android, its services, architecture, and infrastructure, with the knowledge of Database connectivity, and the graphics.

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 Android architecture, activities and their life cycle.	L1, L2
2	Apply the knowledge to design user interface using Android UI And Component.	L1, L2, L3
3	Manage system database, remote database operations using web services and Firebase.	L1, L2, L3
4	Identify the architecture, infrastructure of cloud computing	L1, L2, L3
5	Apply knowledge of map, location services, Graphics, android system and background services.	L1, L2, L3
6	Publish and distribute Android Application.	L1, L2, L3, L4

Detailed Syllabus:

Module No.	Topics	Hrs.	Cognitive levels of attainment as per Bloom's Taxonomy
1	Android OS	6	L1, L2
	Introduction to Android, Android System with Architecture, Android Architecture, Development with Android – Platforms, Tools, Versions, Setup Android Environment, Say Hello to Android Application, Building Blocks of Android Application, Work with Activity, Activity Lifecycle, Intents Fragments, Fragment Lifecycle		
2	Android UI And Component	9	L1, L2, L3
	Create Android UI, Working with Layout, Create Custom Layouts, Work with UI Components and Events, Material Design Toolbar, Tab Layout, RecyclerView and Card View, Android Menus.		
3	Database Connectivity	9	L1, L2, L3
	Storage in Android, Shared Preferences, Shared Preferences Layout, Android Requesting Permission at run time (Android 6.0), Work with SD Card and Files, Database in Android, Realm-No SQL Database		
4	Applicability to Industrial Projects	8	L1, L2, L3
	Web services and Parsing, JSON Parsing, Access web data with JSON, Connect to Web Services, Using Async Task & Third Party Library : Retrofit Graphics and Animation		
5	Applicability using files	7	L1, L2, L3
	Work with 2D Graphics, Bitmap, Animation, Frame Animation, Tween Animation, View Animation, Multimedia in Android, Play Audio Files, Play Video Files Work in Background, Services, Notification Services, Broadcast Receiver Introduction to Firebase with simple CRUD Operation		
6	Work with android system	6	L1, L2, L3, L4
	Text to Speech, Camera, Taking Picture with Camera, Manage Bluetooth Connection, Monitor and Manage Wi-Fi, Accelerometer Sensor & Gyroscope		
Total Hours		45	

Books and References:

SN	Title	Authors	Publisher	Edition	Year
1	Android Application Development Black Book	Pradeep Kothari	DreamTech		
2	Beginning Android 4 Application Development by,	Wei Meng Lee	Wrox		
3	Android Wireless Application Development By Lauren Darcey	Shane Conder	Pearson		

Online References:

S. No.	Website Name	URL	Modules Covered
1	www.tutorialspoint.com	https://www.tutorialspoint.com/cloud_computing	M1-M6
3	www.geeksforgeeks.org	https://www.geeksforgeeks.org/cloud-computing/	M1-M6

Capstone Project Hours Distribution:

Practical Number	Practical/ Experiment Topic	Hrs.	Cognitive levels of attainment as per Bloom's Taxonomy
1	Study Research papers, articles, mini project	4	L1, L2, L3
2	title Identification	2	L1, L2, L3
3	Project Title finalization and development of Modules	4	L1, L2, L3
4	Design methodology and tools for implementation	4	L1, L2, L3
5	Implementation of Modules phase-1	2	L1, L2, L3
6	Result Phase	4	L1, L2, L3
7	Implementation of Modules Phase-2	2	L1, L2, L3
8	Result Phase II	2	L1, L2, L3
9	Result validation	2	L1, L2, L3, L4
10	Report Writing	4	L1, L2, L3, L4
	Total Hours	30	

T.T. Semester –VI B. TECH Internet of Things (IOT)
Choice Based Credit Grading Scheme with Holistic and Multidisciplinary Education (CBCGS- HME 2020)
Syllabus under Autonomy Scheme

B. TECH Internet of Things (IOT)					T.T. SEM: VI					
Course Name: Software Engineering					Course Code: PCE-IoT6012					
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/OR	TW	150
3	-	2	5	4	20	20	60	25	25	
ISE: In-Semester Examination - Paper Duration – 1 Hours IE: Innovative Examination ESE: End Semester Examination - Paper Duration - 2 Hours The weightage of marks for continuous evaluation of Term work/ Report: Formative (40%), and Attendance/Learning Attitude (20%)										
Prerequisite: Knowledge of programming languages, database										

Course Objective: The purpose of this subject is to cover the underlying concepts and techniques used in Software Engineering & Project Management. Some of these techniques can be used in software design & its implementation.

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 software products and software process.	L1, L2
2	Identify requirements and do an analysis of them.	L1, L2, L3
3	Apply UML design on requirements.	L1, L2, L3
4	Understand and apply testing cases.	L1, L2, L3
5	Perform software maintenance.	L1, L2, L3
6	Understand and apply project management.	L1, L2, L3, L4

Detailed Syllabus:

Module No.	Topics	Hrs.	Cognitive levels of attainment as per Bloom's Taxonomy
1	The Software Product and Software Process	6	L1, L2
	Software Product and Process Characteristics, Software Process Models: Linear Sequential Model, Prototyping Model, RAD Model, Evolutionary Process Models like Incremental Model, Spiral Model, Component Assembly Model, RUP and Agile processes. Software Process customization and improvement, CMM, Product and Process Metrics		
2	Requirement Elicitation, Analysis, and Specification	9	L1, L2, L3
	Functional and Non-functional requirements, Requirement Sources and Elicitation Techniques, Analysis Modeling for Function-oriented and Object-oriented software development, Use case Modeling, System and Software Requirement Specifications, Requirement Validation, Traceability		
3	Software Design	9	L1, L2, L3
	The Software Design Process, Design Concepts and Principles, Software Modeling and UML, Architectural Design, Architectural Views and Styles, User Interface Design, Function oriented Design, SA/SD Component Based Design, Design Metrics.		
4	Software Analysis and Testing	8	L1, L2, L3
	Software Static and Dynamic analysis, Code inspections, Software Testing, Fundamentals, Software Test Process, Testing Levels, Test Criteria, Test Case Design, Test Oracles, Test Techniques, Black-Box Testing, White-Box Unit Testing and Unit, Testing Frameworks, Integration Testing, System Testing and other Specialized, Testing, Test Plan, Test Metrics, Testing Tools. , Introduction to Object-oriented analysis, design and comparison with structured Software Engg.		
5	Software Maintenance	7	L1, L2, L3
	Need and Types of Maintenance, Software Configuration Management (SCM), Software Change Management, Version Control, Change control and Reporting, Program Comprehension Techniques, Re-engineering, Reverse Engineering, Tool Support		
6	Software Project Management	6	L1, L2, L3, L4
	Project Management Concepts, Feasibility Analysis, Project and Process Planning, Resources Allocations, Software efforts, Schedule, and Cost estimations, Project Scheduling and Tracking, Risk Assessment and Mitigation, Software Quality Assurance(SQA). Project Plan, Project Metrics.		
Total Hours		45	

Books and References:

SN	Title	Authors	Publisher	Edition	Year
1	An Integrated Approach to Software Engineering	Pankaj Jalote	Narosa Pub, 2005		
2	Fundamentals of Software Engineering	Rajib Mall	PHI Learning	Second Edition	
3	Software Engineering: A Practitioner's Approach	R S. Pressman	McGraw-Hill	Sixth edition	
4	Software Engineering	Sommerville	Pearson Education		

Online References:

S. No.	Website Name	URL	Modules Covered
1	www.guru99.com	https://www.guru99.com/software-engineering-tutorial.html	M1-M6

2	www.javatpoint.com	https://www.javatpoint.com/software-engineering	M1-M6
3	www.educba.com	https://www.educba.com/software-development/software-development-tutorials/software-engineering-tutorial/	M1-M6

Capstone Project Hours Distribution:

Practical Number	Practical/ Experiment Topic	Hrs.	Cognitive levels of attainment as per Bloom's Taxonomy
1	Study Research papers, articles, mini project	4	L1, L2, L3
2	title Identification	2	L1, L2, L3
3	Project Title finalization and development of Modules	4	L1, L2, L3
4	Design methodology and tools for implementation	4	L1, L2, L3
5	Implementation of Modules phase-1	2	L1, L2, L3
6	Result Phase	4	L1, L2, L3
7	Implementation of Modules Phase-2	2	L1, L2, L3
8	Result Phase II	2	L1, L2, L3
9	Result validation	2	L1, L2, L3, L4
10	Report Writing	4	L1, L2, L3, L4
	Total Hours	30	

T.T. Semester – VI
Choice

Based Credit Grading Scheme with Holistic and Multidisciplinary Education
(CBCGS- HME 2020) Syllabus under Autonomy Scheme

B.TECH. Internet of Things (IOT)					S.T. SEM: VI					
Course Name: Signals and Systems					Course Code: PEC-IOT6013					
Teaching Scheme (Program Specific)					Examination scheme					
Modes of Teaching / Learning / Weightage					Modes of Continuous Assessment / Evaluation					
Hours Per Week- Theory (100)					IA		ESE	Practical/O ral (25)	Term Work (25)	Total
Theory	Tutorial	Practical	Contact Hours	Credits	ISA	IE	-	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 (20%)										
Prerequisite: Mathematics I, Mathematics II, Mathematics III										

Course Objective:

This course provides the basic toolkit for any signal processing application - the abstraction of signals and systems, from the point of view of analysis and characterization.

Course Outcomes: Students will be able to

SN	Course Outcomes	Cognitive Levels as per Bloom's Taxonomy
1	Identify and represent mathematically continuous and discrete time signals and systems	L1, L2, L3
2	Define and analyze Linear time invariant System	L1, L2, L3, L4
3	Analyze and characterize continuous LTI System in frequency domain	L1, L2, L3, L4
4	Analyze and characterize discrete LTI System in frequency domain	L1, L2, L3, L4
5	Define and analyze continuous time signals in frequency domain	L1, L2, L3, L4
6	Define and analyze discrete time signals in frequency domain	L1, L2, L3, L4

Detailed Syllabus:

Module No.	Topics	Hrs	Cognitive Levels as per Bloom's Taxonomy
1	Continuous and Discrete Time Signals	6	L1, L2, L3

	Mathematical Representation and Classification of CT and DT signals, Orthogonality of signals, Arithmetic operations on the signals, Time Shifting, Time scaling, Time Reversal of signals, Sampling and Reconstruction, Aliasing effect		
2	Continuous and Discrete Systems	6	L1, L2, L3, L4
	Mathematical Representation and classification of CT and DT systems, Properties of LTI systems, impulse and step response, Use of convolution integral, convolution sum and correlation for analysis of LTI systems, Properties of convolution integral and convolution sum		
3	Frequency Domain Analysis of Continuous Time System using Laplace Transform	8	L1, L2, L3, L4
	Concept of Complex frequency, Region of Convergence for Causal, Non-causal and Anti-causal systems, Poles and Zero of transfer function, Unilateral Laplace Transform, Analysis and characterization of LTI system using Laplace Transform: Impulse and Step Response, Causality, Stability, Stability of Causal system		
4	Frequency Domain Analysis of Discrete Time System using Z Transform	12	L1, L2, L3, L4
	Need for Z transform, definition, properties of unilateral and bilateral Z Transform, mapping with s plane, relationship with Laplace transform, Z transform of standard signals, ROC, poles and zeros of transfer function, Inverse Z transform, Analysis and characterization of LTI system using Z transform: impulse and step response, causality, stability, stability of causal system, System realization-Direct, Direct Canonic, Cascade and Parallel forms		
5	Frequency Domain Analysis of Continuous Signals	7	L1, L2, L3, L4
	Frequency Domain Analysis of periodic non-sinusoidal signals, Frequency Domain Analysis of aperiodic Signals-Introduction, Properties of Fourier Transform, Fourier Transform based amplitude and phase response of standard signals, Relationship with Laplace and Z transform, Energy Spectral		
6	Frequency Domain Analysis of Discrete Signals	6	L1, L2, L3, L4
	Discrete Time Fourier Series, Evaluation of DTFS coefficients, Magnitude and Phase Spectrum of Discrete time periodic signals, Power Spectral Density, Discrete Time Fourier Transform – Concept of discrete time signal in frequency domain, definition of DTFT, determination of magnitude and phase functions using DTFT		

Books and References:

SN	Title	Authors	Publisher	Edition	Year
1	Signals and Systems	Tarun Kumar Rawat	Oxford University Press		2016
2	Signals and Systems	A. Nagoor Kani	Tata McGraw-Hill Education		
3	Digital Signal Processing	John Proakis and Dimitris Monolakis	Pearson Publication	4 th Edition	
4	Signals and Systems	Alan V. Oppenheim, Alan S. Willsky, and S. Hamid Nawab	PHI learning	2 nd Edition	2010

5	Linear Signals and Systems	B. P. Lathi	Oxford University Press		
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Capstone Project Hours Distribution:

Practical Number	Practical/ Experiment Topic	Hrs.	Cognitive levels of attainment as per Bloom's Taxonomy
1	Study Research papers, articles, mini project	4	L1, L2, L3
2	title Identification	2	L1, L2, L3
3	Project Title finalization and development of Modules	4	L1, L2, L3
4	Design methodology and tools for implementation	4	L1, L2, L3
5	Implementation of Modules phase-1	2	L1, L2, L3
6	Result Phase	4	L1, L2, L3
7	Implementation of Modules Phase-2	2	L1, L2, L3
8	Result Phase II	2	L1, L2, L3
9	Result validation	2	L1, L2, L3, L4
10	Report Writing	4	L1, L2, L3, L4
	Total Hours	30	

T.T. Semester –VI B. Tech. Internet of Things
Choice Based Credit Grading Scheme with Holistic and Multidisciplinary Education (CBCGS- HME 2020)
Syllabus under Autonomy Scheme

B. Tech. Internet of Things					T.T. SEM: VI					
Course Name: Foundation for Data Science					Course Code: PEC-IoT6014					
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/OR	TW	
3	-	2	5	4	20	20	60	25	25	150
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: Data Structures, Programming Languages, basic linear algebra, basic probability, and statistics, database										

Course Objective: The objective of the course is to develop an understanding of how the nature of the data collection, the data itself, and the analysis processes relate to the kinds of inferences that can be drawn, Understand the limitations of data sets based on their contents and provenance, Knowledge of what statistical analysis techniques to choose, to visualize Data and Perform Exploratory Data Analysis and to expose many different applications of the data science approach.

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, L3,L4
2	Understand and apply EDA using Python programming	L1, L2, L3
3	Understand statistics and its types	L1, L2, L3, L4
4	Analyze and apply Feature Selection Techniques using Python programming	L1, L2, L3
5	Understand, Apply and Demonstrate different tools for Data Visualization	L1, L2, L3, L4
6	Analyze different case studies on Applications of Data Science to solve real-world problems	L1, L2

Detailed Syllabus:

Module No.	Topics	Hrs.	Cognitive levels of attainment as per Bloom's Taxonomy
1	Introduction	6	L1, L2, L3, L4
	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		
2	Exploratory Data Analysis	9	L1, L2, L3
	Introduction, Steps in Data Preprocessing, Understanding Data, Looking at the Data, Dealing with Missing Values, Standardizing Data, Steps involved in EDA using Python Programming		
3	Statistics	9	L1, L2, L3, L4
	What is statistics, population, Sampling, types of statistics, Central Tendencies, Variation, Correlation, Normal Distribution, Empirical Rule, Z Score, Probability Distribution		
4	Data Modelling: Feature Selection, Engineering, and Data Pipelines	8	L1, L2, L3
	Feature Selection, Dimensionality Reduction, Independent and Dependent Variables, Relationship between Variables: Correlation, Multicollinearity, Factor Analysis, Treatment of Outliers		
5	Data Visualization	8	L1, L2, L3, L4
	Importance of Data Visualization, Looking at Data, Data Visualization Techniques: Line Plot, Bar Plot, Histogram, Boxplot, Scatter Plot, Pie Chart, Data Visualization for Machine Learning,		
6	Applying Domain Expertise to Solve Real-World Problems Using Data Science	5	L1, L2
	Applications of Analytics in Healthcare, Applications of Analytics in Agriculture, Applications of Analytics in Business, Applications of Analytics in Sports		
	Total Hours	45	

Books and References:

SN	Title	Authors	Publisher	Edition	Year
1	Introduction to Data Science	B.Uma Maheshwari, R.Sujatha	Wiley	First Edition	2021
2	Doing Data Science	Rachel Shutts and Cathy O'Neil	O Reilly	Second Edition	2014
3	Data Science for Dummies	Lillian Pierson	Wiley	Second Edition	2019
4	Data Science and Analytics for Ordinary People	Dr. Jeffrey Strickland	Lulu Inc.	-	-
5	Python for Data Science	Dr. Mohd Abdul Hameed	Wiley	First Edition	2021

Online References:

S. No.	Website Name	URL	Modules Covered
1	www.geeksforgeeks.org	https://www.geeksforgeeks.org/introduction-data-science-skills-required/	M1
2	www.edureka.co	https://www.edureka.co/blog/what-is-data-science/	M1-M6
3	www.w3schools.in	https://www.w3schools.in/python-data-science/	M1-M3, M5

Capstone Project Hours Distribution:

Practical Number	Practical/ Experiment Topic	Hrs.	Cognitive levels of attainment as per Bloom's Taxonomy
1	Study Research papers, articles, mini project	4	L1, L2, L3
2	title Identification	2	L1, L2, L3
3	Project Title finalization and development of Modules	4	L1, L2, L3
4	Design methodology and tools for implementation	4	L1, L2, L3
5	Implementation of Modules phase-1	2	L1, L2, L3
6	Result Phase	4	L1, L2, L3
7	Implementation of Modules Phase-2	2	L1, L2, L3
8	Result Phase II	2	L1, L2, L3
9	Result validation	2	L1, L2, L3, L4
10	Report Writing	4	L1, L2, L3, L4
	Total Hours	30	



TCET

DEPARTMENT OF INTERNET OF THINGS

Choice Based Credit Grading Scheme with Holistic and Multidisciplinary Education [CBCGS-HME 2020]
Under TCET - Autonomy Scheme - 2020

University of Mumbai



B.Tech. Semester VI
Choice Based Credit Grading Scheme with Holistic Student Development (CBCGS- H 2020) Proposed Syllabus under Autonomy Scheme

B.Tech (Internet of Things)					B. Tech. (SEM: VI)					
Course Name Block Chain and Applications					Course Code: PEC-IOT6015					
Teaching Scheme (Program Specific)					Examination Scheme (Formative/ Summative)					
Modes of Teaching / Learning / Weightage					Modes of Continuous Assessment / Evaluation					
Hours Per Week- Theory (100)					IA		ESE	Practical/Oral (25)	Term Work (25)	Total
Theory	Tutorial	Practical	Contact Hours	Credits	ISA	IE	-	OR	25	150
3	-	2@	5	4	20	20	60	25		
@-Professional Elective Courses Lab will be conducted in the form Capstone Project IA: In Semester Assessment- Paper Duration 1 Hours ESE: End Semester Evaluation- 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: linux										

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	Cognitive levels of attainment as per Bloom's Taxonomy
1	Understand the components of blockchain and cryptocurrencies	L1, L2
2	Describe the concepts, technology and applications of Blockchain to be applied in the application	L1, L2, L3
3	Distinguish and apply different consensus algorithm as per the requirement of application	L1, L2, L3, L4, L5
4	Get acquainted with different crypto currencies and their characteristics	L1, L2, L3
5	Apply blockchain technology thinking to improve on existing products in IT	L1, L2, L3, L4
6	Design, build, and deploy a distributed application	L1, L2, L3, L4, L5

Detailed Syllabus:

Module No	Topics	Hrs	Cognitive levels of attainment as per Bloom's Taxonomy
1	Basics of Blockchain	07	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	08	L1, L2, L3
	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, PKI and Cryptography, Private keys, Public keys, Hashing, Digital Signature		
3	Distributed Consensus	08	L1, L2, L3, L4, L5
	Introduction, The Broadcast Storm, Broadcasting: Ad Hoc Broadcast Protocol, Lightweight and Efficient Network-Wide Broadcast Geo-casting: Location-Based Multicast, Voronoi Diagram Based Geo-casting, Flooding-Based Geogrid, Route Creation Oriented		
4	Cryptocurrency: bitcoin	07	L1, L2, L3
	Currency, Double Spending, Cryptocurrency, P2P Payment Gateway, Wallet, Mining, , , what is bitcoin, uses of bit coin, bitcoin ecosystem, application, scripting language		
5	Ethereum and DAPPs	07	L1, L2, L3, L4
	Ethereum network , EVM ,Transaction fee ,Mist , Ether, gas , Solidity, Smart contracts ,Truffle ,Web3, Design and issue Cryptocurrency , Mining , DApps , DAO , basics of solidity, Sample Code, Layout of Source File, Structure of a Contract, State Variables, Functions Types, Reference Types, Units, Special Variables and Functions		
6	Hyperledger Fabric	08	L1, L2, L3, L4, L5
	Introduction to Hyperledger, What is Hyperledger, Why Hyperledger, Where can Hyperledger be used, Hyperledger Architecture, Membership, Blockchain, Transaction, Chaincode, Hyperledger Fabric , Features of Hyperledger, Business Network Deployment on Hyperledger Composer Playground		
Total Hours		45	

Books and 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/blockchain-professionals	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/blockchain-foundations-and-use-cases	M1.M2,M3
4	https://www.dappuniversity.com	https://www.dappuniversity.com/articles/the-ultimate-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-programming-beginners-guide	M4,M5,M6

Capstone Project Hours Distribution:

Practical Number	Practical/ Experiment Topic	Hrs.	Cognitive levels of attainment as per Bloom's Taxonomy
1	Study Research papers, articles, mini project	4	L1, L2, L3

2	title Identification	2	L1, L2, L3
3	Project Title finalization and development of Modules	4	L1, L2, L3
4	Design methodology and tools for implementation	4	L1, L2, L3
5	Implementation of Modules phase-1	2	L1, L2, L3
6	Result Phase	4	L1, L2, L3
7	Implementation of Modules Phase-2	2	L1, L2, L3
8	Result Phase II	2	L1, L2, L3
9	Result validation	2	L1, L2, L3, L4
10	Report Writing	4	L1, L2, L3, L4
	Total Hours	30	

S.T. Semester –VI

**Choice Based Credit Grading Scheme with Holistic and Multidisciplinary Education (CBCGS- HME 2020)
 Syllabus under Autonomy Scheme**

B.TECH. Internet of Things (IOT)					S.T. SEM: VI					
Course Name: Digital Marketing					Course Code: OEC-IOT6011					
Teaching Scheme (Program Specific)					Examination scheme					
Modes of Teaching / Learning / Weightage					Modes of Continuous Assessment / Evaluation					
Hours Per Week- Theory (100)					IA		ESE	Practical/O ral (25)	Term Work (25)	Total
Theory	Tutorial	Practical	Contact Hours	Credits	ISA	IE	-	OR	TW	1000
3	-	-	3	3	20	20	60	-	-	
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 (20%)										
Prerequisite: Marketing Fundamentals, Digital Assets, Digital System Setup and automation										

Course Objective: The course will transform you into a complete digital marketer with expertise in the top eight digital marketing domains — search engine optimization, social media, pay-per-click, conversion optimization, digital analytics, content, mobile, and email marketing. Fast-track your career in digital marketing today with practical training you can apply on the job.

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 Digital Business Models	L1,L2
2	Understand A.I. and machine learning terminologies, mind-set and its application in marketing	L1,L2
3	Build sophisticated machine learning models – learn how to gather and clean data, select an algorithm, train, evaluate and deploy a model	L1,L2
4	Predict churn, sales or score leads with tools	L1,L2,L5
5	Segment customers; build clustering models to drive personalization.	L1,L2,L5,L6
6	Build computer vision models for social visual listening, use natural language processing to predict consumption preferences.	L2,L5

Detailed Syllabus:

Module No.	Topics	Hrs.	Cognitive levels of attainment as per Bloom's Taxonomy
1	Introduction - Digital Marketing	7	L1,L2
	Digital Marketing Skills empowered by AI :SEO, Search Engine Marketing, Social Media Marketing, Web Analytics, Email Marketing, Content Marketing, Influencer Marketing, Conversion Rate Optimization,Tools Based Marketing, Lifecycle Marketing Automation. Psychographic-segmentation		
2	Full Funnel Marketing	8	L1,L2,L3
	<p>Acquisition: Content marketing, landing page testing, campaign optimization, conversion rate optimization, lead scoring, competition and trend analysis, predict sales, optimize product pricing, programmatic media buying, segmentation and clustering for targeting, personalization.</p> <p>Activation Personalization, , behavioral segmentationb Psychographic-segmentation</p> <p>Retention Predict churn, customer care chatbot, sentiment analysis, visual social listening, personalization</p> <p>Revenue Predict and maximize customer lifetimevalue, recommendersystems, market basket analysis</p> <p>Referral Predict whether user recommend your product</p>		
3	Marketing framework and tools	8	L1,L2,L3,L5
	<p>Planning:Hubspot, Brightedge, Node, Crayon, Equals3, Marketmuse, Pathmatics, Calibermind, Alegion, Netra</p> <p>Production : Acrolinx, Narrative Science,Clarifai, GumGum,phrasee, curate Attention insight</p> <p>Personalization : Uberflip, Klevu, Seventh Sense, Blueshift,</p> <p>Promotion : Yext, Albert, Onespot, Cortex, Siftrock, inPowered,Performance :Monkeylearn, PaveAI,</p>		
4	Predictive Analytics	7	L1,L2,L3,L5
	Fundamentals of predictive analytics, Prediction model for lead scoring and sales forecasting, churnprediction model, Predizctive modelling for customer behaviour, automatedsegmentation		
5	Psychographics, NLP and Computer Vision	7	L1,L2,L3,L5
	Customer psychographics, leveraging personality traits to predict consumption preferences using NLP, Detect emotions, assign labels, understand text from images, detect news events, logos using Computer Vision		
6	Futuristic Marketing	8	L2,L3
	IoTs Augmented Reality, Virtual Reality and XR for Marketing, Blockchain and smart contracts for marketing, NeuroMarketing, Wearable Tech, Personal Chatbots		
Total Hours		45	

Books and References:

Sr. No	Title	Authors	Publisher	Edition	Year
1	Artificial intelligence marketing and predicting consumer choice: an overview of tools and techniques	Struhl, S.	Kogan Page Publishers	Third	2017
2	AI for Marketing and Product Innovation: Powerful New Tools for Predicting Trends, Connecting with Customers, and Closing Sales.	Appel, A., Sthanunathan, S., Pradeep, A. K.	Wiley.	Third	2018
3	Artificial intelligence for marketing: practical applications	Sterne, J.	John Wiley & Sons	Fourth	2017..
4	Using Artificial Intelligence in Marketing: How to harness AI and maintain the competitive edge.	King, K.	Kogan Page Publishers	First	2019

Online References:

Sr. No.	Website Name	URL	Modules Covered
1	https://www.iimcal.ac.in/	https://iimcal.talentsprint.com/ai-powered-marketing/index.html?utm_source=googlesearch&utm_medium=cpc&utm_campaign=iimc-aiim-googlesearch-india&utm_content=ai-in-marketing-by-iimc&gclid=CjwKCAjwyo36BRAXEiwA24CwGVOrXnOTpcARRsFvt8b9VAPqwV7KGPfMpyx36ilZafl_7Br1OJEEhoChC4QAvD_BwE/	M1,M2,M3,M4,M5,M6
2	https://www.coursera.org/	https://www.coursera.org/learn/uva-darden-market-analytics	M4,M5,M6
3	https://academy.hubspot.com/	https://academy.hubspot.com/courses/artificial-intelligence-and-machine-learning-in-marketing?hstc=89107140.de4401799f3edce1fd42a1704a37ab4a.1598174195879.1598174195879.1598174195879.1&__hssc=89107140.1.1598336323938&hsfp=3825083997&hsCtaTracking=e4d097a0-ed0c-4f82-8e93-e9016ea31749%7C00439f3d-17bf-4431-af12-50a507904fcd	M1,M2,M3,M4,M5,M6

S.T. Semester –VI

Choice Based Credit Grading Scheme with Holistic and Multidisciplinary Education (CBCGS- HME 2020)
Syllabus under Autonomy Scheme

B.TECH. Internet of Things (IOT)					S.T. SEM: VI					
Course Name: Software Process Automation					Course Code: OEC-IOT6012					
Teaching Scheme (Program Specific)					Examination scheme					
Modes of Teaching / Learning / Weightage					Modes of Continuous Assessment / Evaluation					
Hours Per Week- Theory (100)					IA		ESE	Practical/O ral (25)	Term Work (25)	Total
Theory	Tutorial	Practical	Contact Hours	Credits	ISA	IE	-	OR	TW	1000
3	-	-	3	3	20	20	60	-	-	
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 (20%)										
Prerequisite: Object Oriented Programming, Frontend Backend connectivity										

Course Objective:

The objective of the course is to introduce to the students about the integration people involved in the software process with the development and tools required for automation of the project development.

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 importance of process automation and models of software process	L1, L2
2	Analyze the security and configuration management	L1, L2, L3,L4
3	Understand and apply the build concepts using a build tool	L1, L2, L3,L4
4	Understand the testing concepts and apply them to the project	L1, L2, L3,L4
5	Identify the activities in agile project management and use a tool for the same	L1, L2, L3,L4
6	Understand and identify the various principles of quality assurance	L1, L2, L3,L4

Detailed Syllabus:

Module No.	Topics	Hrs.	Cognitive levels of attainment as per Bloom's Taxonomy
1	Introduction to process Automation	6	L1, L2,L3
	Importance of process automation, what is a model? Its use, Processes in SDLC, traditional models , WaterFall model , RUP, Agile model, prescriptive and descriptive models, Devops model, process automation objectives and goals, Application Life cycle Management(ALM), benefits of ALM, Use of ALM in agile methodology		
2	Automation of config management	8	L1, L2, L3,L4
	Software Configuration management , SCIs, Overview of configuration management tool Github and git tool, Creating online account, commands to pull data , push data from local git to online and vice versa.create branch, merge branch		
3	Build automation	4	L1, L2, L3,L4
	Overview of build management, continuous integration and delivery, Jenkins tool for build management, configuring Jenkins, integrating Jenkins with Git for continuous integration.		
4	Test automation	8	L1, L2, L3
	Overview of testing concepts, Unit and integration testing, white box and Black box testing, Object oriented testing, writing test cases for Unit and integration testing, selenium tool for testing, Record and playback, Scheduling test scripts in Maven.		
5	Project management	8	L1, L2, L3,L4
	Project management concepts, Work breakdown structure, Gantt charts, Critical path method, agile team, Collaboration tools, Atlassian jira project management tool, Creating project in JIRA, Assigning bugs, burnup chart , Sprint report		
6	Quality management and Security	11	L1, L2, L3,L4
	Quality concepts and metrics, Quality Assurance ,Formal technical reviews CMMI, ISO, spice, six sigma, Total Quality management. Introduction to DevSecOps, Static Application security testing using tool SonarCube		
Total Hours		45	

Books and References:

	Title	Authors	Publisher	Edition	Year
1	The DevOps handbook	Gene Kim, Jez Humble, Prik Debois & John Willis	IT revolution Press	first Edition	2016
2	Selenium WebDriver 3 Practical Guide: End-to-end Automation Testing for Web and Mobile Browsers with Selenium WebDriver	Satya Avasarala	Packt Publishing Ltd,	Second Edition	2018

Online Resources:

S. No.	Website Name	/URL	Modules Covered
1	www,researchgate,com	https://www.researchgate.net/publication/258865356_Software_Process_Definition_and_Management	M6

S.T. Semester –VI

**Choice Based Credit Grading Scheme with Holistic and Multidisciplinary Education (CBCGS- HME 2020)
 Syllabus under Autonomy Scheme**

B.TECH. Internet of Things (IOT)					S.T. SEM: VI					
Course Name: Entrepreneurship Development and Management					Course Code: OEC-IOT6013					
Teaching Scheme (Program Specific)					Examination scheme					
Modes of Teaching / Learning / Weightage					Modes of Continuous Assessment / Evaluation					
Hours Per Week- Theory (100)					IA		ESE	Practical/O ral (25)	Term Work (25)	Total
Theory	Tutorial	Practical	Contact Hours	Credits	ISA	IE	-	OR	TW	100
3	-	-	3	3	20	20	60	-	-	
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 (20%)										
Prerequisite: entrepreneurial mindset										

Course Objective: The course should be able to inculcate, advance, and groom entrepreneurial skills into the students aspiring to establish and successfully run an enterprise.

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	Recognize an overview of basic entrepreneurship concepts	L1, L2
2	Design a business plan and understand importance of capital	L1, L2, L3, L4, L5, L6
3	Discuss the rules and legislation w.r.t. entrepreneurship	L1, L2
4	Identify sources for organizational assistance in this field	L1, L2
5	Use knowledge gained for effective management of business	L1, L2, L3
6	Recognize ways of achieving success in business	L1, L2

Detailed Syllabus:

Module No.	Topics	Hrs.	Cognitive levels of attainment as per Bloom's Taxonomy
1	Overview of Entrepreneurship	5	L1, L2
	Definition, Importance, Roles and Functions, Evolution of term 'Entrepreneurship', Factors influencing Entrepreneurship, Characteristics of an Entrepreneur, of Types of Entrepreneur, Contribution of Government Agencies in Sourcing information for Entrepreneurship, Role of Entrepreneurship in the National Economy		
2	Business Plans and importance of capital to Entrepreneurship	10	L1, L2, L3, L4, L5, L6
	Preliminary and Marketing Plans, Management and Personnel, Start-up Costs and Financing as well as Projected Financial Statements, Legal Section, Insurance, Suppliers and Risks, Assumptions and Conclusion, Capital and its Importance to the Entrepreneur Entrepreneurship And Business Development: Starting a New Business, Buying an Existing Business, New Product Development, Business Growth and the Entrepreneur Law and its Relevance to Business Operations		
3	Rules and Legislation	6	L1, L2
	Applicability of Legislation, Industries Development (Regulations) Act, 1951, Factories Act, 1948, The Industrial Employment (Standing Orders) Act, 1946, West Bengal Shops and Establishment Act, 1963, Environment (Protection) Act, 1986, The sale of Goods Act, 1950, Industrial Dispute Act 1947		
4	Organization Assistance	11	L1, L2
	Assistance to an entrepreneur, New Ventures, Industrial Park (Meaning, features, & examples), Special Economic Zone (Meaning, features & examples), Financial assistance by different agencies, MSME Act Small Scale Industries, Carry on Business (COB) license, Environmental Clearance, National Small Industries Corporation (NSIC), Government Stores Purchase scheme (e-tender process), Excise exemptions and concession, Exemption from income tax, Quality Standards with special reference to ISO, Financial assistance to MSME, Modernization assistance to small scale unit, The Small Industries Development Bank of India (SIDBI), The State Small Industries Development Corporation (SSIDC), Export oriented units, Shilpabandhu-M Incentives for entrepreneurs, Other agencies for industrial assistance, Directorate General of Supplies and Disposals(DGS & D), Khadi and Village Industries Commission (KVIC), Industrial Estate		
5	Effective Management of Business	8	L1, L2, L3
	Issues and problems faced by micro and small enterprises and effective management of M and S enterprises (risk management, credit availability, technology innovation, supply chain management, linkage with large industries), exercises, e-Marketing Women Entrepreneurship Development, Social entrepreneurship-role and need, EDP cell, role of sustainability and sustainable development for SMEs, case studies, exercises		
6	Achieving success in small business	5	L1, L2
	Stages of the small business life cycle, four types of firm-level growth strategies, Options – harvesting or closing small business Critical Success factors of small business		
Total Hours		45	

Books and Reference:

SN	Title	Authors	Publisher	Edition	Year
1	Entrepreneurship Development and Management	Dr. A. K. Singh	Laxmi Pub. Ltd.		2009
2	Entrepreneur and Entrepreneurship	Mohd Asif Hasan			
3	Small Business and Entrepreneurship	S. Anil Kumar	I. K. International pvt. Ltd.		2008

Online References:

S. No.	Website Name	URL	Modules Covered
1	www.nptel.ac.in	https://nptel.ac.in/courses/110/106/110106141/	M1-M6
2	www.coursera.org	https://www.coursera.org/specializations/wharton-entrepreneurship	M1-M6

S.T. Semester –VI

**Choice Based Credit Grading Scheme with Holistic and Multidisciplinary Education (CBCGS- HME 2020)
 Syllabus under Autonomy Scheme**

B.TECH. Internet of Things (IOT)					S.T. SEM: VI						
Course Name: Cyber Security and Laws					Course Code: OEC-IOT6014						
Teaching Scheme (Program Specific)					Examination scheme						
Modes of Teaching / Learning / Weightage					Modes of Continuous Assessment / Evaluation						
Hours Per Week- Theory (100)					IA		ESE	Practical/O ral (25)	Term Work (25)	Total	
Theory	Tutorial	Practical	Contact Hours	Credits	ISA	IE	-	OR	TW	1000	
3	-	-	3	3	20	20	60	-	-		
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 (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:

SN	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	06	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	08	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	09	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	08	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		
6	Indian IT Act.	06	L1, L2, L3, L4
	Cyber Crime and Criminal Justice: Penalties, Adjudication and Appeals Under the IT Act, 2000, IT Act. 2008 and its Amendments		
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	Kennetch J. Knapp	Information Science Publishing.	1 st	2009

S.T. Semester –VI

**Choice Based Credit Grading Scheme with Holistic and Multidisciplinary Education (CBCGS- HME 2020)
 Syllabus under Autonomy Scheme**

B.TECH. Internet of Things (IOT)					S.T. SEM: VI					
Course Name: Reliability Engineering					Course Code: OEC-IOT6015					
Teaching Scheme (Program Specific)					Examination scheme					
Modes of Teaching / Learning / Weightage					Modes of Continuous Assessment / Evaluation					
Hours Per Week- Theory (100)					IA	ESE	Practical/O ral (25)	Term Work (25)	Total	
Theory	Tutorial	Practical	Contact Hours	Credits	ISA	IE	-	OR	TW	1000
3	-	-	3	3	20	20	60	-	-	
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 (20%)										
Prerequisite: Signals and Systems, Control systems										

Course Objective: To impart various aspects of probability theory, system reliability, and maintainability, availability and FMEA procedure.

Course Outcomes: Students will be able to:

SN	Course Outcomes	Cognitive Levels as per Bloom's Taxonomy
1	Understand and apply the concept of Probability to engineering problems	L1,L2,L3
2	Apply various reliability concepts to calculate different reliability parameters	L1,L2,L3,L4
3	Estimate the system reliability of simple and complex systems	L1,L2,L3
4	Carry out a Failure Mode Effect and Criticality Analysis	L1,L2,L3,L4

Detailed Syllabus:

Mod ule No.	Topics	Hrs	Cognitive Levels as per Bloom's Taxonomy
1	Probability theory Probability: Standard definitions and concepts; Conditional Probability, Baye's Theorem. Probability Distributions: Central tendency and Dispersion; Binomial, Normal, Poisson, Weibull, Exponential, relations between them and their significance. Measures of Dispersion: Mean, Median, Mode, Range, Mean Deviation, Standard Deviation, Variance, Skewness and Kurtosis.	08	L1,L2,L3
2	Reliability Concepts Reliability Concepts: Reliability definitions, Importance of Reliability, Quality Assurance and Reliability, Bath Tub Curve. Failure Data Analysis: Hazard rate, failure density, Failure Rate, Mean Time ToFailure (MTTF), MTBF, Reliability Functions. Reliability Hazard Models: Constant Failure Rate, Linearly increasing, TimeDependent Failure Rate, Weibull Model. Distribution functions and reliability analysis.	08	L1,L2,L3,L4

3	System Reliability:	06	L1,L2,L3
	System Reliability: System Configurations: Series, parallel, mixed configuration, k out of n structure, Complex systems		
4	Reliability Improvement:		L1,L2
	Reliability Improvement: Redundancy Techniques: Element redundancy, Unit redundancy, Standby redundancies. Markov analysis. System Reliability Analysis – Enumeration method, Cut-set method, Success, Path method, Decomposition method.		
5	Maintainability and Availability	05	L1,L2,L3,L4
	Maintainability and Availability: System downtime, Design for Maintainability: Maintenance requirements, Design methods: Fault Isolation and self-diagnostics, Parts standardization and Interchangeability, Modularization and Accessibility, Repair Vs Replacement. Availability – qualitative aspects.		
6	Failure Mode, Effects and Criticality Analysis	05	L1,L2,L3,L4
	Failure mode effects analysis: severity/criticality analysis, FMECA examples. Fault tree construction, basic symbols, development of functional reliability block diagram, Fault tree analysis and Event tree Analysis		

Books and References:

S. No	Title	Authors	Publisher	Edition	Year
1	Reliability Engineering”,	L.S. Srinath,	“Affiliated East-Wast Press (P) Ltd	3 rd Edition	1985
2	“Reliability and Maintainability Engineering	Charles E. Ebeling	Tata McGraw Hill.	4 th Edition	2015
3	Engineering Reliability	B. S. Dhillion C. Singh,	John Wiley & Sons	5 th edition	1980
4	Practical Reliability Engg.”,	P.D.T. Conon	John Wiley & Sons	3 rd Edition	1985.
5.	Reliability in Engineering Design	K.C. Kapur, L.R. Lamber son	John Wiley & Sons.	3 rd Edition	1989
6.	Probability and Statistics	Murray R. Spiegel	Tata McGraw-Hill Publishing Co. Ltd.	5 th edition	1980

S.T. Semester –VI

**Choice Based Credit Grading Scheme with Holistic and Multidisciplinary Education (CBCGS- HME 2020)
 Syllabus under Autonomy Scheme**

B.TECH. Internet of Things (IOT)					S.T. SEM: VI					
Course Name: Product Life Cycle Management					Course Code: OEC-IOT6016					
Teaching Scheme (Program Specific)					Examination scheme					
Modes of Teaching / Learning / Weightage					Modes of Continuous Assessment / Evaluation					
Hours Per Week- Theory (100)					IA	ESE	Practical/O ral (25)	Term Work (25)	Total	
Theory	Tutorial	Practical	Contact Hours	Credits	ISA	IE	-	OR	TW	100
3	-	-	3	3	20	20	60	-	-	
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 (20%)										
Prerequisite: Product Design and Development, Quality and Reliability Engineering										

Course Objectives:

Course intend to provide an exposure to new product development program and guidelines for designing and developing a product and apply the knowledge of Product Data Management & PLM strategies.

Course Outcomes:

SN	Course Outcomes	Cognitive levels as per bloom's Taxonomy
1	Illustrate knowledge about phases of PLM, PLM strategies and methodology for PLM feasibility study and PDM implementation	L1, L2
2	Illustrate various approaches and techniques for designing and developing products.	L1
3	Apply product engineering guidelines / thumb rules in designing products for moulding, machining, sheet metal working etc	L1, L2, L3, L4
4	Acquire knowledge in applying virtual product development tools for components, machining and manufacturing plant	L1, L2, L3, L4
5	Apply Integration of Environmental Aspects in Product Design	L1, L2, L3, L4
6.	Illustrate knowledge about Life Cycle Assessment and Life Cycle Cost Analysis	L1, L2

Detailed Syllabus:

Module No.	Topics	Hrs.	Cognitive levels as per bloom's Taxonomy
1	Introduction to Product Lifecycle Management (PLM) and PLM Strategies	10	L1, L2
	Product Lifecycle Management (PLM), Need for PLM, Product Lifecycle Phases, Opportunities of Globalization, Pre-PLM Environment, PLM Paradigm, Importance & Benefits of PLM, Widespread Impact of PLM, Focus and Application, A PLM Project, Starting the PLM Initiative, PLM Applications, Industrial strategies, Strategy elements, its identification, selection and implementation, Developing PLM Vision and PLM Strategy, Change management for PLM		
2	Product Design	9	L1
	Product Design: Product Design and Development Process, Engineering Design, Organization and Decomposition in Product Design, Typologies of Design Process Models, Reference Model, Product Design in the Context of the Product Development Process, Relation with the Development Process Planning Phase, Relation with the Post design Planning Phase, Methodological Evolution in Product Design, Concurrent Engineering, Characteristic Features of Concurrent Engineering, Concurrent Engineering and Life Cycle Approach, New Product Development (NPD) and Strategies, Product Configuration and Variant Management, The Design for X System, Objective Properties and Design for X Tools, Choice of Design for X Tools and Their Use in the Design Process		
3	Product Data Management (PDM)	5	L1, L2, L3, L4
	Product Data Management (PDM): Product and Product Data, PDM systems and importance, Components of PDM, Reason for implementing a PDM system, financial justification of PDM, barriers to PDM implementation		
4	Virtual Product Development Tools	5	L1, L2, L3, L4
	Virtual Product Development Tools: For components, machines, and manufacturing plants, 3D CAD systems and realistic rendering techniques, Digital mock-up, Model building, Model analysis, Modeling and simulations in Product Design, Examples/Case studies		
5	Integration of Environmental Aspects in Product Design	5	L1, L2, L3, L4
	Integration of Environmental Aspects in Product Design: Sustainable Development, Design for Environment, Need for Life Cycle Environmental Strategies, Useful Life Extension Strategies, End-of-Life Strategies, Introduction of Environmental Strategies into the Design Process, Life Cycle Environmental Strategies and Considerations for Product Design		
	Life Cycle Assessment and Life Cycle Cost Analysis		

6	Life Cycle Assessment and Life Cycle Cost Analysis: Properties, and Framework of Life Cycle Assessment, Phases of LCA in ISO Standards, Fields of Application and Limitations of Life Cycle Assessment, Cost Analysis and the Life Cycle Approach, General Framework for LCCA, Evolution of Models for Product Life Cycle Cost Analysis. Introduction to Industry4.0, Design principles and Challenges, Applications of Industry 4.0	5	L1, L2
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Books and References:

SN	Title	Authors	Publisher	Edition	Year
1	Product Lifecycle Management: Paradigm for 21st Century Product Realisation	John Stark	Springer-Verlag	1st Edition	2004

T.T. Semester – VI
Choice Based Credit Grading Scheme with Holistic and Multidisciplinary Education
(CBCGS- HME 2020) Syllabus under Autonomy Scheme

T.T. Semester –VI										
B. TECH Internet of Things (IOT)					T.T. SEM: VI					
Course Name: Essence of Indian Knowledge Tradition					Course Code: MC-IOT601					
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	
Theory	Tutorial	Practical	Contact Hours	Credits	IA	ESE	OR	TW	25	
1	-	-	1	-	-	-	-	25		
The weightage of marks for continuous evaluation of Term work/Report: Formative (40%), Timely completion of practical (40%) and Attendance (20%)										
Prerequisite: N.A.										

Course Objectives:

To facilitate the students with the concepts of Indian traditional knowledge and to make them understand the Importance of roots of knowledge system.

Course Outcomes:

SN	Course Outcomes	RBT Level
1	Understand the concept of Traditional knowledge and its importance	L1,L2,L3
2	Know the need and importance of protecting traditional knowledge.	L1,L2,L3
3	Know the various enactments related to the protection of traditional knowledge.	L1,L2,L3
4	Understand importance of legal framework and traditional knowledge.	L1,L2,L3
5	Understand the concepts of Intellectual property to protect the traditional knowledge.	L1,L2,L3

Detailed Syllabus:

Module No.	Topics	Hrs.	RBT Levels
1	Introduction to traditional knowledge: Define traditional knowledge, nature and characteristics, scope and importance, kinds of traditional knowledge, the physical and social contexts in which traditional knowledge develop, the historical impact of social change on traditional knowledge systems. Indigenous Knowledge (IK), characteristics, traditional knowledge vis-à-vis indigenous knowledge, traditional knowledge Vs western knowledge traditional knowledge vis-à-vis formal knowledge.	02	L1,L2,L3

2	Protection of traditional knowledge: the need for protecting traditional knowledge Significance of TK Protection, value of TK in global economy, Role of Government to harness TK.	02	L1,L2,L3
3	The Scheduled Tribes and Other Traditional Forest Dwellers Recognition of Forest Rights) Act, 2006, Plant Varieties Protection and Farmer's Rights Act, 2001 (PPVFR Act).	04	L1,L2,L3
4	The Biological Diversity Act 2002 and Rules 2004, the protection of traditional knowledge bill, 2016. Geographical indicators act 2003.	03	L1,L2,L3
5	Traditional knowledge and intellectual property: Systems of traditional knowledge protection, Legal concepts for the protection of traditional knowledge, Certain non IPR mechanisms of traditional knowledge protection, Patents and traditional knowledge, Strategies to increase protection of traditional knowledge, global legal FORA for increasing protection of Indian Traditional Knowledge.	01	L1,L2,L3
6	Traditional knowledge in different sectors: Traditional knowledge and engineering, Traditional medicine system, TK and biotechnology, TK in agriculture, Traditional societies depend on it for their food and healthcare needs, Importance of conservation and sustainable development of environment, Management of biodiversity, Food security of the country and protection of TK.	03	L1,L2,L3

Books and References:

SN	Title	Authors	Publisher	Edition	Year
1	Cultural Heritage of India- Course Material	V. Sivaramakrishna	Bharatiya Vidya Bhavan	5th	2014
2	Traditional Knowledge System in India	Amit Jha	Atlantic	1 st	2009
3	Traditional Knowledge System and Technology in India	Basanta Kumar Mohanta and Vipin Kumar Singh	Pratibha Prakashan	1 st	2012
4	Knowledge Traditions and Practices of India	Kapil Kapoor and Michel Danino	Ancient Sci Life	1 st	2012

Online References:

S. No.	Website Name	URL	Modules Covered
1	http://nptel.ac.in	http://nptel.ac.in/courses/121106003/	M1,M2,M3,M4,M5, M6
2	https://www.youtube.com	https://www.youtube.com/watch?v=LZP1StpYEP M	M1,M2,M3,M4,M5, M6

T.T. Semester – VI
Choice Based Credit Grading Scheme with Holistic and Multidisciplinary Education
(CBCGS- HME 2020) Syllabus under Autonomy Scheme

B.TECH. Internet of Things (IOT)				SEM: VI			
Course Name: Summer Internship				Course Code: SI-IOT601			
Teaching Scheme (Program Specific)				Examination Scheme (Formative/ Summative)			
Modes of Teaching / Learning / Weightage				Modes of Continuous Assessment / Evaluation			
Total Hours : Maximum 2 Weeks (60 to 80 Hours during summer vacation)				P	TW		Total
Theory	Tutorial	Practical	Contact Hours	Credits	-	50	50
-	-	-	160*- 240*	4*-6*			
				Note : 1. Internship will be done in institute laboratory in collaboration with industries. 2. Evaluation and assessment will be done as per AICTE guidelines.			
				Prerequisite: Fundamental knowledge of respective programs			

Course Objectives:

To get industry like exposure in the institute laboratories by carrying out activities / projects. Also design innovative techniques / methods to develop the products.

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 subjects knowledge in the college laboratories for carrying out projects	L3, L4,L5
2	Developed innovative techniques / methods to develop the products	L3, L4,L5
3	Contribute for the society	L3, L4,L5

Detailed Syllabus:

Module No.	Topics	Cognitive levels of attainment as per Bloom's Taxonomy
1	Program Specific Internship	L3, L4,L5
	<ul style="list-style-type: none"> • Training and certification on emerging technologies in domains offered by Department of Computer Engineering • Applying classroom and laboratory knowledge to design , develop and deploy the products 	
2	Inter disciplinary Internship	L3, L4,L5
	<ul style="list-style-type: none"> • To explore and understand issues and challenges in the other disciplines (EXTC, ELEX, MECH and CIVIL) • Design , develop and deploy cost effective products using multidisciplinary approach 	
3	Industry Specific Internship	L3, L4,L5
	<ul style="list-style-type: none"> • To explore and understand issues and challenges in industry • Developing solutions for industry specific problems • Design , develop and deploy products for startup and SMEs 	
4	Interpersonal Internship	L3, L4,L5
	<ul style="list-style-type: none"> • To develop interpersonal skills such as leadership, marketing ,publicity and corporate ethics and communication • To get competence in problem solving , presentation , negotiation skills 	
5	Social Internship	L3, L4,L5
	<ul style="list-style-type: none"> • Identify and study different real life issues in the society • Identify societal problems and provide engineering solutions to solve these problems 	
6	Academic Internship	L3, L4,L5
	<ul style="list-style-type: none"> • Study report preparation, preparation of presentations, copy table book preparation , business proposal and IPR • Capture aspirations & expectations through interviews of students. • Ways to connect research in technical institutes with industry. • Taking inputs from self, local stakeholders and global stake holders which will help to develop process with comparative and competitive study 	

Books and References:

Sr. No.	Title	Authors	Publisher	Edition	Year
1	The Ultimate Guide to Internships: 100 Steps to Get a Great Internship and Thrive in It (Ultimate Guides)	Eric Woodard	Allworth	I	2015

Online References:

Sr. No.	Website Name	URL	Modules Covered
1	https://www.letsintern.com/	https://www.letsintern.com/internships/summer-internships	M1-M6
1	https://codegnan.com	https://codegnan.com/blog/benefits-of-internships-and-importance	M1-M6
2	https://www.honorsociety.org	https://www.honorsociety.org/articles?category=internships	M1-M6

S.T. Semester –IV
Choice Based Credit Grading Scheme with Holistic and Multidisciplinary Education (CBCGS- HME 2020) Syllabus under Autonomy Scheme

B.TECH. Internet of Things (IOT)					S.T. SEM : IV		
Course Name :Professional Skills-IV (IoT development Bords)					Course Code :HSD-IOTPS401		
Teaching Scheme (Program Specific)					Examination Scheme (Formative/ Summative)		
Modes of Teaching / Learning / Weightage					Modes of Continuous Assessment / Evaluation		
Hours Per Week					Presentati on	Rep ort	Total
Theo ry	Tutor ial	Practi cal	Conta ct Hour s	Cred its	A C	AC	75
1	-	2	3	2	50	25	
AC: Activity Evaluation The weightage of marks for continuous evaluation of Term work/Report: Formative (40%), Timely completion of practical (40%) and Attendance (20%)							
Prerequisite: HSD- IOTPS301: Professional Skills-III (OOPM)							

Course Objective:

To learn the Basics of Python programs and implement the Object Oriented Programming concepts and GUI using Python.

Course Outcomes:

Upon completion of the course students will be able to:

S N	Course Outcomes	Cognitive Levels as per Bloom's Taxonomy
1	Describe the Numbers, Math functions, Strings in Python.	L1,L2
2	Determine the methods to create and manipulate Python programs by utilizing the data structures like lists, dictionaries, tuples.	L1, L2, L3
3	Express different Decision-Making statements and Functions.	L1, L2,L3
4	Articulate Object oriented programming concepts in Python.	L1,L2,L3
5	Understand and summarize different File handling operations.	L1, L2,L3
6	Implement and Explain how to design GUI Applications in Python	L1,L2,L3, L4

Detailed Syllabus:

Module No.	Topics	Hrs.	Cognitive Levels as per Bloom's Taxonomy
1	Basics of IoT Boards	2	L1,L2
	<p>Theory: Introduction, types and features of IoT development Boards, Selection of IoT development Boards for project, Introduction to IoT Programming, Arduino UNO</p> <p>Lab Experiment: Write a program to Interface Arduino Uno with different types of sensors.</p>		
2	Giant Boards, NodeMCU Esp8266	2	L1, L2,L3
	<p>Theory: Introduction and feature of Giant Boards Introduction about NodeMCU and its GPIO pins, feature of NodeMCU, Wifi Module for ESP8266, Connecting NodeMCU with Wifi Networks.</p> <p>Lab Experiment: Write a program using WifiManager on NodeMCU to scan and connect to Wi-Fi Networks.</p>		
3	Rasbarry pi	2	L1,L2,L3
	<p>Theory: Introduction about Rasbarry Pi, installation of Rasbarry Pi and programming using different types of sensor.</p> <p>Lab Experiment: Write a program for home automation using Rasbarry Pi.</p>		
4	BeagleBone® Green Gateway, Intel Edison	3	L1,L2,L3
	<p>Theory: Properties and types of Beagle Bone Board, GPIO pins, feature of Intel Edition board.</p> <p>Lab Experiment: Write a program to interface with BeagleBone Boards and Sensors.</p>		
5	Omega 2, Banana PI	3	L1,L2,L3
	<p>Theory: Introduction about Omega 2 board and Banana PI board.</p> <p>Lab Experiment: Write a program for home automation using Rasbarry Pi.</p>		
6	ESP32 and ESP32 CAM	3	L1,L2,L3 ,L4
	<p>Theory: ESP32 GPIO pins, Properties of ESP32 and ESP32 CAM, ESP32 programming on Arduino IDE.</p> <p>Lab Experiment: Write a program for Object detection and identification using ESP32 CAM.</p>		
Total		15	

Books and References:

S N	Title	Authors	Publisher	Edition	Year
1	Programming The Internet of Things	Andy King	Shroff Publisher	-	2011
2	IoT product Development with programming	Mahesh Sambhaji Jadhav	HighTechEasy	1st Edition	2019
3	Rasbarry Pi and visual Basic: Programmin g	Gary Wensink	HighTechEasy	-	-
4	Programm ing Arduino Next Steps	Simon Monk	McGraw-Hill Education	2nd Edition	-

Online References:

S. No.	Website Name	U R L	Modules Covered
1	https://youtube.com	https://www.youtube.com/watch?v=5h6WMV4K4zI	M1,M2,M3,M4, M5
2	www.courseera.org	https://in.coursera.org/learn/introduction-iot-boards	M1,M2,M3,M4, M5
3	www.udemy.com	https://www.udemy.com/course/programming-internet-of-things-beginning-to-advance-level/	M1,M2,M3,M4, M5
4	https://udacity.com	https://www.udacity.com/course/intel-edge-ai-for-iot-developers-nanodegree--nd131	M1,M2,M3,M4, M5, M6
5	https://youtube.com	https://www.youtube.com/watch?v=5h6WMV4K4zI	M1,M2,M3,M4, M5, M6

T.E. Semester –VI							
B.E. (Internet of Things)					T.E. SEM:VI		
Course Name: Project Based Learning-IV					Course Code: HSD-IoT PBL 601		
Teaching Scheme (Holistic Student Development-HSD) Industry Specific/Interdisciplinary				Examination Scheme (Formative/ Summative)			
Modes of Teaching / Learning / Weightage				Modes of Continuous Assessment / Evaluation			
Total Hours					Presentation	Report	Term Work
Theory	Tutorial	Practical	Contact Hours	Credits	(AC)	(AC)	25
-	-	30*	-	1	10	15	
AC: Activity Evaluation The weightage of marks for continuous evaluation of Term work/Report: Formative (40%), Timely completion of practical (40%) and Attendance (20%) *Total Number of Hours utilized PBL activities: 40 (30 Hours-Instructional + 10 hours for collaborative and self-learning) hours per semester Course will be conducted in the beginning of the semester during first 03 weeks Prerequisite: Prerequisite: ABLIII, IV, V PS III, IV, V, ESD III, IV, Internship.							

Course Objective:

To provide opportunities for students to explore various stages of the project life cycle and design a 7C's based product to address social challenges with clearly defining applications for end users along with value addition to existing products (if any) .

Course Outcomes:

Students will be able to

Sr No	Course Outcomes	Cognitive levels as per bloom's Taxonomy
1	Discover 7C's for project success	L1, L2,L3
2	Implement the project life cycle in stipulated time frame to develop a Product	L1, L2, L3,L4,L5
3	Prepared to participate in PAN India competition with innovative technical (Software /Hardware based) Product meeting the needs of users along with value addition	L1, L2, L3, L4,L5,L6

Detailed Syllabus:

Module No.	Topics	Hrs.	Cognitive Levels as per Bloom's Taxonomy
1	7 Cs for Project Success	6	L1, L2, L3
	Introduction to & 7Cs for Project success: Communication, Commitment, Cash, Control, Cooperation, Culture, Coaching		
2	Communication, Commitment, Cash:	6	L1, L2, L3
	Conception & Initiation, to design project charter, Project Definition & Project Planning: To revisit the prototype design and identify Constraints, include a risk management plan, Human resources requirements, Project schedule and key milestones, Budget/cost estimates for final Product design		
3	Control: Project to Product execution phase	6	L1, L2, L3, L4
	Assemble a team, assign resources, Start executing the project management plan, Proactive control and manage project execution, Identify KPIs and set-up tracking systems, Distribute and assign tasks, Schedule status meetings, Update project schedule, modify project plans as needed.		
4	Cooperation: Project Performance	6	L1, L2, L3, L4, L5
	Cost tracking, Quality management, Overall project performance monitoring NOISE estimation: five qualitative parameters: Needs, Opportunities, Improvements, Strengths, and Exceptions		
5	Culture and Coaching: Realization management phase	6	L1, L2, L3, L4, L5, L6
	Identify the investment outcomes, define benefit measures for each outcome, Collect current benefit measure data to have a quantitative basis for decision-making, Plan the new or changed capabilities necessary to realize the benefits. The final tested design i e Product will be available for the stakeholder's usage and the student can create valid documentation which can further published as a innovative tool/video/etc.		

Books and References:

SN	Title	Authors	Publisher	Edition	Year
1	NASA's Journey to Project Management Excellence	Edward J. Hoffman and Matt Kohut	National Aeronautics and Space Administration	E Book	2012
2	97 Things Every Project Manager Should Know: Collective Wisdom from the Experts	Barbee Davis	O'Reilly Media, Inc.	E book	2009
3	The Practical Guide to Project Management	Cristine Peterson	Bookboon	E book	2013

*E book: all books are free downloadable

*The faculty members can add books to list as per their department project list and domains as applicable

Suggested List of Practical/ Experiments:

Sr No	Title of Project	Type of Project
1	To be given by PBL coordinator with clear understanding of department domains and its linkage with various industry sector and TV2035 Challenges and students topic of interest while assigning the problem same domain/sector /challenge with different solving aspect also can be considered as a new project	Application
2	The problem statement formed in PBL IV should be considered for the prototype implementation which satisfies Sr. No. 1 criteria	Application
3	Project group formation: 2 to 3 members per group with versatile skillsets and ready to work as team to address identified challenge/s to formulate and address problem statement.	Application
4	Project prototype formation: The project prototype to be designed by the assigned groups and project life cycle study through Project management tools used for prototype design.	Application
5	Prototype to Product design: with the help of 7C's for Project Success. The executable model ready for stakeholders' usage	Application
6	Some groups can design Online Educational Games based on Graduate Attributes as Product. The executable model ready for stakeholders' usage	Application
7	IoT Based Health monitoring System.	Application
8	IoT Based Home Automation System	Application
9	IoT based security system for Night Patrolling using Robot.	Application
10	IoT Smart City	Application
11	IoT based Solar Power Smart Irrigation System	Application
12	Robotic Arm for inspection, cleaning and painting of tanks on ships to save on time, cost and avoid accidents.	Application



TCET

DEPARTMENT OF INTERNET OF THINGS

Choice Based Credit Grading Scheme with Holistic and Multidisciplinary Education [CBCGS-HME 2020]

Under TCET - Autonomy Scheme - 2020

University of Mumbai



S.E. Semester –VI

**Choice Based Credit Grading Scheme with Holistic and Multidisciplinary Education (CBCGS-HME 2020)
Proposed TCET Autonomy Scheme (w.e.f. A.Y. 2022-23)**

B.E. (Computer Engineering)					S.E. SEM : IV		
Course Name: Research Based Learning II					Course Code :HME- IoTRBL601		
Teaching scheme (Holistic Student Development - HSD) Industry Specific/Interdisciplinary					Examination Scheme (Formative/ Summative)		
Modes of Teaching / Learning / Weightage					Assessment/Evaluation Scheme		
Conducted in the beginning of Semester during first 3 Weeks					Presentation	Report	Term Work
Theory	Tutorial	Practical	Contact Hours	Credits	(AC)	(AC)	50
-	-	30	30	1	25	25	
Audit Course evaluated by Teacher Guardian Mid Semester Assessment for Term work will be on continuous basis							
Prerequisite: Subject knowledge, Domain knowledge							

Course Objective: This course is focused to engage the learner in research using critical thinking, problem solving, coding and technical writing related to upcoming latest technologies..

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

SN	Course Objectives	Cognitive levels of attainment as per Bloom's Taxonomy
1	Upgrade the knowledge of latest technologies and developments in their domain.	L1,L2
2	Develop prototype based on idea which providing solutions to industry, research organization, academic organization, community or society as a whole.	L1, L2, L3,L4,L5,L6
3	Design and develop the code /model for given problem definition in a Competitive environment and contribute for grants.	L1, L2, L3,L4,L5,L6
4	Write a research paper and understand technical writing	L1, L2, L3,L4,L5

Detailed Syllabus:

Module No	Topics	Cognitive Levels as per Bloom's Taxonomy
1	<p>Participation in online community Forums/writing Blogs</p> <p>I.Registration on online community/forum/followblogs /Twitter etc. Creating own Blogs and Linked in profile. II. Evaluation is based on report submission on activities learned through registration on various platforms. Student need to submit LinkedIn profile address, Blog URL is recommended Presentation and Evaluation.</p>	L1, L2
2	<p>Proto type development/ Mathematical model development based on Idea</p> <p>I.Proto type development: Introduction to Research Methodology techniques. Introduction and importance of prototype development. Transforming Idea into prototype with implementation/working model. II. Presentations by students: Experience sharing by entrepreneurs or Hackathon Winners. Presentation and Evaluation.</p>	L1, L2, L3,L4,l5,L6
3	<p style="text-align: center;">Building Competitive Attitude</p> <p>I.Participation in Project competitions/Coding competitions/Working for research grant/Consultancy: a) Participating at institute/National level/University level/Conference /participate in competitions. b) Participation in funded project/consultancy projects c) Experience sharing by goodcoders/winners II. Evaluation based on Presentation/Certificates/ Grant received/Consultancy received Presentation and Evaluation.</p>	L1, L2, L3,L4,l5,L6
4	<p style="text-align: center;">Research Paper Publication</p> <p>I.Introduction to Research paper writing: Write a paper/case study on review of literature based on idea and developed prototype. II. Publishing: Identification of appropriate journal or conference at University level / State level/National level for submission and Preparation of a review paper. Evaluation of Research paper based on quality and acceptance of research paper.</p>	L1, L2, L3,L4,l5,L6

References:

S. No.	Title	Authors	Publisher	Edition	Year
1	Guide to Competitive Programming: Learning and Improving Algorithms	Antti Laaksonen	Springer	Kindle	2018

2	Writing Research Papers: A Complete Guide	James D. Lester	Longman	10 th Edition	2001
3	Creativity in Product Innovation	Jacob Goldenberg	Cambridge University Press	Kindle	2002

Online References:

S. No.	Website Name	U R L	Modules Covered
1	https://www.researchgate.net	http://www.researchgate.net/publication/224372998_Idea_Generation_T	M2
2	https://discuss.codechef.com/	https://discuss.codechef.com/t/programming-contest-detailed-syllabus-along-with-example-problems/17791	M3
3	http://www.statpac.com/	https://www.statpac.com/online-software-manual/Basic-Research-Concepts.htm	M4
4	http://www.slideshare.net/	https://www.slideshare.net/AsirJohnSamuel/1introduction-to-research-methodology?next_slideshow=1	M4



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