Semester II

Course Code	Course Name	Theory	Practical	Tutorial	Theory	Practical/ Oral	Tutorial	Total
ME-ITC201	WEB X.0	03	--	--	03	--	--	03

Course Code	Course Name	Examination Scheme							
		Theory Marks				Term Work	Practical	Oral	Total
		Internal assessment			End Sem. Exam				
		Test1	Test 2	Avg. of 2 Tests					
ME-ITC201	WEB X.0	20	20	20	80	--	--	--	100

Course Objectives:

Sr.No	The course aims:
1	To understand the digital evolution of web technology.
2	To learn Type Script and understand how to use it in web applications.
3	To learn the fundamentals of Node.js.
4	To make Node.js applications using the express framework.
5	To enable the use of AngularJS to create web applications that depend on the Model-View-Controller Architecture.
6	To gain expertise in a leading document-oriented NoSQL database, designed for speed, scalability, and developer agility using MongoDB and Mongoose.

Sr. No.	Course Outcomes	Cognitive levels of attainment as per Bloom's Taxonomy
On successful completion, of course, learner/student will be able to:		
1	Understand the basic concepts related to web analytics and semantic web.	L1, L2
2	Understand how Type Script can help you eliminate bugs in your code and enable you to scale your code.	L1, L2
3	Develop back-end applications using Node.js.	L1,L2,L3
4	Construct web based Node.js applications using Express.	L1,L2,L3
5	Understand Angular Js framework and build dynamic, responsive single-page web applications.	L1,L2,L3

6	Apply MongoDB for frontend and backend connectivity using Mongoose and REST API.	L1, L2, L3

DETAILED SYLLABUS:

Sr. No.	Module	Detailed Content	Hours	CO Mapping
0	Prerequisite	**Introduction to HTML5,CSS3, Basics of JavaScript**	02	-
I	Introduction to WebX.0	Evolution of WebX.0; **Web Analytics 2.0**: Introduction to Web Analytics, Web Analytics 2.0, Clickstream Analysis, Strategy to choose your web analytics tool, Measuring the success of a website; **Web3.0 and Semantic Web**: Characteristics of Semantic Web, Components of Semantic Web, Semantic Web Stack, N-Triples and Turtle, Ontology, RDF and SPARQL **Self-learning Topics**: Semantic Web Vs AI, SPARQL Vs SQL.	04	CO1
II	TypeScript	Overview, TypeScript Internal Architecture, TypeScript Environment Setup, TypeScript Types, variables and operators, Decision Making and loops, TypeScript Functions, TypeScript Classes and Objects, TypeScript Inheritance and Modules **Self-learning Topics**: Javascript Vs TypeScript	06	CO2
III	Node.js	Introducing the Node.js-to-Angular Stack (MEAN Stack), Environment setup for Node.js , First app, Asynchronous programming, Callback concept, Event loops, REPL, NPM, Event emitter, Buffers, Streams, Networking module, File system, Web module. **Self-learning Topics:** Node.js with MongoDB.	06	CO3
IV	Express	Introduction to Express ,Installing Express,Creating First Express application,The application, request, and response objects, Configuring Routes, Understanding Middleware, cookies, Session, Authentication **Self-learning Topics:** Express Js Templates	06	CO4
V	Introduction to AngularJS	Overview of AngularJS, Need of AngularJS in real websites, AngularJS modules, AngularJS built-in directives, AngularJS custom directives, AngularJS expressions,AngularJS	06	CO5

		Data Binding, AngularJS filters, AngularJS controllers, AngularJS scope, AngularJS dependency injection, AngularJS Services, Form Validation, Routing. **Self-learning Topics:** MVC model, DOM model.		
VI	MongoDB and Building REST API using MongoDB	**MongoDB**: Understanding MongoDB, MongoDB Data Types, Administering User Accounts, Configuring Access Control, Adding the MongoDB Driver to Node.js, Connecting to MongoDB from Node.js, Accessing and Manipulating Databases, Manipulating MongoDB Documents from Node.js, Accessing MongoDB from Node.js, Using Mongoose for Structured Schema and Validation. **Mongoose:** Installation and connecting to MongoDB, understanding and extending Mongoose Schema, Define custom model methods and validation, Mongoose Middleware and DBRef. **REST API**: Examining the rules of REST APIs, Evaluating API patterns, Handling typical CRUD functions (Create, Read, Update, Delete), Using Express and Mongoose to interact with MongoDB, Testing API endpoints. **Self-learning Topics**: MongoDB vs SQL Databases	09	CO6

Text Books:

1.Boris Cherny, "Programming TypeScript- Making Your Javascript Application Scale", O'Reilly Media Inc.
2. Amos Q. Haviv, "MEAN Web Development" , PACKT Publishing
3.Brad Dayley, Brendan Dayley, Caleb Dayley, "Node.js, MongoDB and Angular Web Development:The definitive guide to using the MEAN stack to build web applications", 2nd Edition, Addison-Wesley Professional
5. Adam Bretz and Colin J. Ihrig, "Full Stack JavaScript Development with MEAN", SitePoint.
4. Dr. Deven Shah, "Advanced Internet Programming", StarEdu Solutions.

References:

1. Simon Holmes Clive Harber, "Getting MEAN with Mongo, Express, Angular, and Node", Manning Publications.
2. Yakov Fain and Anton Moiseev, "TypeScript Quickly", Manning Publications.

Online References:

1.https://www.coursera.org
2. https://udemy.com
3. https://www.tutorialspoint.com/meanjs/meanjs_overview.htm

Assessment:

Internal Assessment Test:

Assessment consists of two tests out of which; one should be compulsory class test (on minimum 02 Modules) and the other is either a class test or assignment on live problems or course project.

End Semester Examination:

Some guidelines for setting the question papers are as, six questions to be set each of 20 marks, out of these any four questions to be attempted by students. Minimum 80% syllabus should be covered inquestion papers of end semester examination.

Course Code	Course Name	Theory	Practical	Tutorial	Theory	Practical/ Oral	Tutorial	Total
ME-ITC202	Cloud Computing and Services	03	--	--	03	--	--	03

Course Code	Course Name	Examination Scheme							
		Theory Marks				Term Work	Practical	Oral	Total
		Internal assessment			End Sem. Exam				
		Test 1	Test 2	Avg. of 2 Tests					
ME -ITC202	Cloud Computing and Services	20	20	20	80	--	--	--	100

Course Objectives:

Sr.No	The course aims:
1	To learn the perspective of cloud computing and virtualization
2	To understand the idea behind mobile cloud computing
3	To determine the meaning of mobile offloading
4	To assess the concept of green cloud computing
5	To explore the resource allocation techniques and various business models
6	To analyze various cloud and mobile computing environments for real world application

Course Outcomes:

Sr. No.	Course Outcomes	Cognitive levels of attainment as per Bloom's Taxonomy
On successful completion, of course, learner/student will be able to:		
1	Understand the concepts behind cloud computing and virtualization.	L2
2	Apply the knowledge of mobile cloud computing to various applications	L3
3	Determine the various techniques of loading in cloud computing applications.	L4
4	Design applications to make the systems energy efficient.	L6
5	Select the required cloud computing resources and develop a business model.	L1,L2,L3
6	Apply various techniques to develop various high ended mobile cloud computing applications	L3

DETAILED SYLLABUS:

Sr. No.	Module	Detailed Content	Hours	CO Mapping
0	Prerequisite	Cloud Computing models, Virtualization, Primary and Secondary services offered by the cloud.	02	--
I	Introduction to Cloud Computing and virtualization	Virtualization: Need for virtualization, Features and types of virtualization, Hypervisors and its types. Cloud Computing**:** Introduction to Cloud Computing, Layers and Types of Clouds, Features of Cloud computing system , Cloud Infrastructure Management, Infrastructure as a Service , Platform as a Service , software as a service, Challenges and Risks, Secondary services. **Self-learning Topics:** Case study on Service model Dockers, OSGi (Application level virtualization library)	06	CO1
II	Mobile cloud computing	Mobile cloud computing: Need for Mobile cloud computing system, Definition, Architecture, Challenges, Characteristics and Benefits of Mobile cloud computing. Mobile cloud computing service framework Mobile cloud solutions, Mobile cloud service models, Mobile Cloud computation, Mobile Cloud storage, Mobile Cloud security and privacy, Mobile Cloud Computing context awareness, Mobile as a service consumer, Mobile as a service provider, Mobile as service broker. **Self-learning Topics:** Mobile cloud computing platforms and software.	06	CO2
III	Offloading in Mobile Cloud Computing	Definition of offloading, composition, migration Introduction to offloading , Offloading Decision, Types of Offloading, Topologies of Offloading, Offloading in Cloud Computing and in Mobile Cloud Computing: Similarities and Differences, Adaptive Computation Offloading from Mobile Devices, Cloud Path Selection for Offloading, Mobile Data Offloading Using Opportunistic Communication, Three-Tier Architecture of Mobile Cloud Computing, Requirements of Data Offloading, Performance Analysis of Offloading Techniques Multi-Cloud Offloading in Mobile Cloud computing	06	CO3

		environment, Mobile cloud computing offloading models **Self-learning Topics:** Mobile cloud offloading framework: clonecloud, Thinkair, MAUI, Cuckoo, weblet		
IV	Green Mobile Cloud Computing	Introduction**,** Requirements and issues , Devices used, Computational offloading, Resource management, Service provisioning, Green location sensing, Energy saving. **Self-learning Topics:** Measures taken by IT industries towards green computing and challenges in adopting green computing.	06	CO4
V	Resource allocation and business model for mobile cloud computing	Resource allocation in mobile cloud computing: Simple, dynamic and adaptive resource allocation models. Challenges and issues in resource allocation, Techniques in mobile cloud computing. Mobile cloud computing business models: Advantages, issues and applications. Business Models for social mobile cloud **Self-learning Topics:** Business model requirements, cloud computing business model	06	CO5
VI	Applications of Mobile cloud computing	Mobile cloud media computing applications: Location identification, Human Tracking, Mobile learning applications, Cloud streaming applications, Vehicle monitoring and Biometric applications. Tips for creating cloud mobile applications, Context aware mobile computing system, **Self-learning Topics:** Cross cloud communication applications, Elastic application models	07	CO6

Text Books:

1. Cloud Computing: Principles and Paradigms,Rajkumar Buyya , James Broberg,Andrzej M. Goscinski
2. Cloud computing by Kailesh Jayaswal,jagannath kallakurchi, donald j Houde
3. Mobile cloud computing : foundation and service model by Dijiang Huang and Huijun Wu
4. Mobile computing architecture, algorithm and application by Debashis De

References:

1. Cloud computing Bible by barrie Sosinsky.
2. Cloud computing by Dr Kumar Saurabh

Assessment:
Internal Assessment Test:

Assessment consists of two tests out of which; one should be compulsory class test (on minimum 02 Modules) and the other is either a class test or assignment on live problems or course project.

End Semester Examination:
Some guidelines for setting the question papers are as, six questions to be set each of 20 marks, out of these any four questions to be attempted by students. Minimum 80% syllabus should be covered inquestion papers of end semester examination.

Course Code	Course Name	Theory	Practical	Tutorial	Theory	Practical/ Oral	Tutorial	Total
ME-ITPE2011	Web Application Security	03	--	--	03	--	--	03

Course Code	Course Name	Examination Scheme							
		Theory Marks				Term Work	Practical	Oral	Total
		Internal assessment			End Sem. Exam				
		Test1	Test 2	Avg. of 2 Tests					
ME-ITPE2011	Web Application Security	20	20	20	80	--	--	--	100

Course Objectives:

Sr.No	The course aims:
1	To reveal the underlying in web application.
2	To understand the browser security principles.
3	To understand web applications vulnerabilities.
4	To understand web application mitigations.
5	To identify and aid in fixing any security vulnerabilities during the web development process.
6	To understand the security principles in developing a reliable web application.

Course Outcomes:

Sr. No.	Course Outcomes	Cognitive levels of attainment as per Bloom's Taxonomy
On successful completion, of course, learner/student will be able to:		
1	To understand the security principles in developing a reliable web application	L2
2	Identify the various types of security issues in web browser.	L3
3	Identify the various types of threats in developing a web application.	L4
4	Identify the various types of mitigation measures of web applications.	L6
5	Apply the security principles in developing a reliable web application.	L1,L2,L3

6	**1.** Use industry standard tools for web application security.	L3

Prerequisite: Introduction to Information & Network Security.

DETAILED SYLLABUS:

Sr. No.	Module	Detailed Content	Hours	CO Mapping
0	Prerequisite	Overview of Web Applications: Introduction history of web applications interface ad structure benefits and drawbacks of web applications Web application Vs Cloud application	2	
I	Web Application Security Fundamentals	Security Fundamentals: Input Validation - Attack Surface Reduction Rules of Thumb- Classifying and Prioritizing Threads **Self-learning Topics:** Cookies, Access Control.	**4**	**CO1**
II	Browser Security Principles	Origin Policy - Exceptions to the Same-Origin Policy - Cross-Site Scripting and Cross-Site Request Forgery - Reflected XSS - HTML Injection **Self-learning Topics:** HTTPS, HTTP Proxies.	**4**	**CO2**
III	Web Application Vulnerabilities	Understanding vulnerabilities in traditional client server application and web applications, client state manipulation, cookie based attacks, SQL injection, cross domain attack (XSS/XSRF/XSSI) http header injection. SSL vulnerabilities and testing - Proper encryption use in web application - Session vulnerabilities and testing - Cross-site request forgery **Self-learning Topics:** SSH Tunneling Cleaning traces ,Cleaning the event log Advanced phishing attacks	**8**	**CO3**
IV	Web Application Mitigations	HTTP request, HTTP response, rendering and events , html image tags, image tag security, issue, java script on error , Javascript timing , port scanning , remote scripting , running remotecode, frame and iframe , browser sandbox, policy goals, same origin policy, library import, domain relaxation **Self-learning Topics:** Nikto, OWASP ZAP.	**7**	**CO4**
V	Secure Website Design	Secure website design: Architecture and Design Issues for Web Applications, Deployment Considerations Input Validation, Authentication, Authorization, Configuration Management, Sensitive Data, Session Management, Cryptography, Parameter Manipulation, Exception Management, Auditing and Logging, Design Guidelines,	**8**	**CO5**

		Forms and validity, Technical implementation **Self-learning Topics:** Wapiti**,** SQL Map		
VI	Cutting Edge Web Application Security	Clickjacking - DNS rebinding - Flash security - Java applet security - Single-sign-on solution and security - IPv6 impact on web security **Self-learning Topics:** https://owasp.org/www-community/Free_for_Open_Source_Application_Security_Tools	**6**	**CO6**

Text Books:

1. Sullivan, Bryan, and Vincent Liu. Web Application Security, A Beginner's Guide. McGraw Hill Profe ssional, 2011.

2. Stuttard, Dafydd, and Marcus Pinto. The Web Application Hacker's Handbook: Finding and Exploiting Security Flaws. John Wiley Sons, 2011

References:

1. OReilly Web Security Privacy and Commerce 2nd Edition 2011

2. Professional Pen Testing for Web application, Andres andreu, wrox press

3. Carlos Serrao, Vicente Aguilera, Fabio Cerullo, "Web Application Security" Springer; 1st Edition.

Assessment:

Internal Assessment Test:

Assessment consists of two tests out of which; one should be compulsory class test (on minimum 02 Modules) and the other is either a class test or assignment on live problems or course project.

End Semester Examination:

Some guidelines for setting the question papers are as, six questions to be set each of 20 marks, out of these any four questions to be attempted by students. Minimum 80% syllabus should be covered inquestion papers of end semester examination.

Course Code	Course Name	Theory	Practical	Tutorial	Theory	Practical/ Oral	Tutorial	Total
ME-ITPE2012	Machine and Deep Learning	03	--	--	03	--	--	03

Course Code	Course Name	Examination Scheme							
		Theory Marks				Term Work	Practical	Oral	Total
		Internal assessment			End Sem. Exam				
		Test1	Test 2	Avg. of 2 Tests					
ME-ITPE2012	Machine and Deep Learning	20	20	20	80	--	--	--	100

Course Objectives:

Sr.No	The course aims:
1	To introduce the basics of machine learning and foster their abilities in applying different machine learning algorithms to real world problems.
2	To introduce the concept of Bayesian and computational learning.
3	To define and apply metrics to measure the performance of various learning algorithms.
4	To become familiar with Deep Learning Concepts and Architectures.
5	To become familiar with various deep learning networks
6	To explore trends and applications of Deep learning.

Course Outcomes:

Sr. No.	Course Outcomes	Cognitive levels of attainment as per Bloom's Taxonomy
On successful completion, of course, learner/student will be able to:		
1	Understand, choose and apply different machine learning algorithms to real world problems.	L2

2	Apply Bayesian and computational learning in deriving effective learning rules.	L3
3	Evaluate performance of learning algorithms.	L4
4	Understand the basics of Deep Learning	L6
5	Describe the architecture of various deep networks	L1,L2,L3
6	Identify various trends and applications of Deep Learning	L3

DETAILED SYLLABUS:

Sr. No.	Module	Detailed Content	Hours	CO Mapping
0	**Prerequisite**	Data Mining**,** Linear Algebra, Calculus and Basics of Probability	02	-
I	**Introduction to Machine Learning**	Introduction to Machine Learning, Machine learning types, **Supervised Learning**: Linear Regression(LR) and Logistic Regression (LogR), Support Vector Machine(SVM), Decision tree , **Unsupervised Learning**: k-means and hierarchical clustering, choosing the number of clusters ;**Methods of Dimensionality reduction**: subset selection, Principal component analysis (PCA), Feature embedding **Self-learning Topics:** Implementation of the above algorithm, Dimensionality Reduction using Feature extraction, Feature selection	5	CO1
II	**Bayesian and computation learning:**	Bayesian Theorem, Concept learning, Maximum likelihood and least square error hypothesis , maximum likelihood hypothesis for predicting probability, minimum length description, Bayesian optimal classifier,Gibbs Algorithm,NB classifier, Learning to classify text, Bayesian Belief Network(BBN), EM algorithm, Probably Learning an Approximately Correct Hypothesis, sample complexity for finite and infinite hypothesis space, The mistake bounds model of learning .**Self-learning Topics:** Implementation of NB classifier	5	CO2

III	**Advanced ML Classification Techniques and Model Evaluation**	**Metrics for Classification:** Model evaluation, Holdout Method and Random Sub sampling, Cross-Validation, Bootstrap, Model Selection Using Statistical Tests of Significance, Comparing Classifiers Based on Cost–Benefit and ROC Curves. **Ensemble Classifiers**: Introduction to Ensemble Methods, Bagging, Boosting, XG boost, Ada boost, Random forests, Improving classification accuracy of Class-Imbalanced Data, Model performance improvement using Hyper parameter tuning. **Self-learning Topics:** Improving the performance of classifiers	8	CO3
IV	**Introduction to Deep Learning**	Introduction to Deep Learning, Machine Learning Vs Deep Learning, Working of Deep Learning, Perceptrons, Artificial Neural Network (ANN), Architecture of Neural network ,Problems and use cases(examples), single layer and Multilayer networks, back propagation and regularization ,batch normalization. **Self-learning Topics: Issues in ANN**	6	CO3, CO4
V	**Deep Networks**	Introduction to Convolution Neural Network (CNN), Components of CNN ,Architecture of CNN, Properties of CNN, Applications of CNN; **Recurrent Neural Network (RNN):**Introduction to RNN, Simple RNN, LSTM Implementation, Deep RNN; **Autoencoder**: Introduction, Architecture, Applications, properties and hyperparameters, **Types of autoencoder**: Denoising autoencoder, Sparse Autoencoder, Contractive Autoencoder. **Self-learning Topics:** Restricted Boltzmann Machine (RBM)	6	CO5

VI	**Trends and applications in Deep Learning**	Generative adversarial networks (GAN); Transfer learning; Deep Learning for text and voice(Natural Language Processing); Deep Learning for image and video(Computer vision) **Self-learning Topics:** ImageNet Large Scale Visual Recognition Challenge (ILSVRC).	7	CO6

Text Books:

1. Ethem Alpaydin-Introduction to Machine Learning-The MIT Press:

2. Deep Learning by Ian Goodfellow, Yoshua Bengio and Aaron Courville published by MIT Press

3. Anuradha Srinivasaraghavan, Vincy Joseph, "Machine Learning", Wiley.

4. Data Mining: Concepts and Techniques (The Morgan Kaufmann Series in Data Management Systems) by Jiawei Han, Micheline Kamber and Jian Pei

References:

1..Machine Learning with Python Cookbook: Practical Solutions from Preprocessing to Deep Learning by Chris Albon . O'Reilly Media; 1st edition

2.Deep learning with Python, Second Edition by Francois Chollet ,Manning Publications

3. Hands–On Machine Learning with Scikit–Learn and TensorFlow by Aurelien Geron ,O'Reilly Media

4. Tom M. Mitchell. Machine Learning, McGraw-Hill Education

Online References:

1.https://nptel.ac.in/courses/106106139

2.https://machinelearningmastery.com/practical-machine-learning-problems/

1.https://www.deeplearningbook.org/

2.https://www.tensorflow.org/tutorials/images/transfer_learning

Assessment:
Internal Assessment Test:

Assessment consists of two tests out of which; one should be compulsory class test (on minimum 02 Modules) and the other is either a class test or assignment on live problems or course project.

End Semester Examination:

Some guidelines for setting the question papers are as, six questions to be set each of 20 marks, out of these any four questions to be attempted by students. Minimum 80% syllabus should be covered inquestion papers of end semester examination.

Course Code	Course Name	Theory	Practical	Tutorial	Theory	Practical/ Oral	Tutorial	Total
ME-ITPE2013	ARVR	03	--	--	03	--	--	04

Course Code	Course Name	Examination Scheme							
		Theory Marks				Term Work	Practical	Oral	Total
		Internal assessment			End Sem. Exam				
		Test1	Test 2	Avg. of 2 Tests					
ME-ITPE2013	ARVR	20	20	20	80	--	--	--	100

Course Objectives:

Sr. No.	Course Objectives
The course aims:	
1	To understand the concepts of Augmented Reality, VR and related technologies.
2	To understand the AR tracking system and use of computer vision in AR/VR/MR.
3	To describe the technology for multimodal user interaction and authoring in AR.
4	To use different AR toolkits and apply them to develop AR applications.
5	To demonstrate AR Applications using Mobile AR Toolkits and SDKs.
6	To understand the use of AR/MR in interdisciplinary immersive applications.

Course Outcomes:

Sr. No.	Course Outcomes	Cognitive levels of attainment as per Bloom's Taxonomy
On successful completion, of course, learner/student will be able to:		
1	Identify and compare different Augmented Reality, VR and Mixed Reality Technologies.	L1, L2
2	Apply concepts of Computer Vision for tracking in AR, VR and MR Systems.	L3
3	Model different interfaces and authoring in AR/MR.	L3
4	Design AR/MR applications using open source platforms and toolkits.	L6
5	Design Mobile based AR Applications.	L6
6	Apply insights of AR/MR in different applications.	L3

DETAILED SYLLABUS:

Module	Title	Description	Hours	CO
0	**Pre-requisite**	Basics of Computer Graphics, Coordinate Systems, VR Introduction, Tracking in VR	**02**	--
I	**Introduction to Augmented Reality, Virtual Reality and Mixed Reality**	Definition and Scope, A Brief History of Augmented Reality, AR Architecture, Related Fields of AR (like Mixed Reality, Virtual Reality, Immersive Reality, Extended Reality) and Their comparison, General Architecture of Mixed Reality System, Algorithm Steps in Mixed Reality. What is VR, Modern VR Experiences. Bird's Eye View, Geometry Virtual Words. Light and optics. **Self-Learning Topics**: How AR/VR/MR are related to Ubiquitous Computing, Multidimensional Systems.	**05**	CO1
II	**Tracking and Computer Vision for AR, VR and MR**	Multimodal Displays; Visual Perception; Spatial Display Model; Visual Displays; Tracking, Calibration and Registration; Coordinate Systems; Characteristics of Tracking Technology; Stationary Tracking Systems; Mobile Sensors; Optical Tracking; Sensor Fusion; Marker Tracking; Multiple Camera Infrared Tracking; Natural Feature Tracking by Detection; Incremental Tracking; Simultaneous Localization and Tracking; Outdoor Tracking. Visual Perception, Visual Rendering, Motion in real and virtual worlds. **Self-Learning Topics**: Indoor Tracking, Full Body Tracking	**07**	CO2
III	**Interaction, Modeling and Annotation and Authoring**	Output Modalities, Input Modalities, Tangible Interfaces, Virtual User Interfaces on Real Surfaces, Multi-view Interfaces, Haptic Interaction, Multimodal Interaction, Specifying Geometry, Specifying Appearance, Semi-automatic Reconstruction, Free-form Modeling, Annotation, Requirement of AR Authoring, Elements of Authoring, Stand-alone Authoring Solutions, Plug-in Approaches, Web Technology **Self-Learning Topics**: Case Study on Object Annotation in Real Time, Avatar Modeling.	**06**	CO3
IV	**Software Architecture in AR and AR Development Toolkits**	AR Application Requirements, Software Engineering Requirements, Distributed Object Systems, Data Flow, Scene Graphs; Developer Support: Parameter Configuration, Declarative Scripting, Procedural Scripting, Mixed Language Programming, Runtime Reconfiguration, Choosing an AR Platforms and Toolkits; AR Non-programming Frameworks, AR Programming Frameworks, Programming AR using ARToolkit. **Self-Learning Topics**: Commercial AR Frameworks, AR Related Markup Languages	**06**	CO4
V	**Mobile AR**	Types of Mobile Apps, AR Browsers for Smartphones,	**08**	CO5

		Point of Interests (POI) in Mobile AR, POI Authoring and Publishing Tools, AR Applications for Android, AR Games for Android, Mobile AR Toolkits and SDKs, Developing Mobile AR Applications, AR Application Development for Android Smartphone **Self-Learning Topics**: AR Applications for iOS, AR Games for iOS, AR Application Development for iOS Smartphone		
VI	**Applications of AR/MR and Human Factors, Legal and Social Considerations**	Applications of AR/MR in: Edutainment, Medical, Military, Production and Manufacturing, Navigation, Astronomical Observation, E-commerce; What are Human Factors, Physical Side Effects, Visual Side Effects, Legal Considerations, Moral and Ethical Considerations. **Self-Learning Topics**: Applications of AR/MR in Civil Construction and Architecture, Collaboration, Information Control and Big Data Visualization	**05**	CO6

Textbooks:

1. Dieter Schmalsteig and Tobias Hollerer, "Augmented Reality- Principles and Practice", Pearson Education, Inc. 2016 Edition.
2. Chetankumar G Shetty, "Augmented Reality- Theory, Design and Development", Mc Graw Hill, 2020 Edition.
3. Alan B. Craig, "Understanding Augmented Reality – Concepts and Applications", Morgan Kaufmann, Elsevier, 2013 Edition
4. Steven M. LaVelle," Virtual Reality", Cambridge University press, 2019

References:

1. Borko Furht, "Handbook of Augmented Reality", Springer, 2011 Edition.
2. Erin Pangilinan, Steve Lukas, and Vasanth Mohan, "Creating Augmented and Virtual Realities- Theory and Practice for Next-Generation Spatial Computing", O'Reilly Media, Inc., 2019 Edition.
3. Jens Grubert, Dr. Raphael Grasset, "Augmented Reality for Android Application Development", PACKT Publishing, 2013 Edition.

Online Resources:

Sr. No.	Website Name
1.	www.nptel.ac.in
2.	www.coursera.org

Assessment:

Internal Assessment Test:

Assessment consists of two tests out of which; one should be compulsory class test (on minimum 02 Modules) and the other is either a class test or assignment on live problems or course project.

End Semester Examination:

Some guidelines for setting the question papers are as, six questions to be set each of 20 marks, out of these any four questions to be attempted by students. Minimum 80% syllabus should be covered inquestion papers of end semester examination.

Course Code	Course Name	Theory	Practical	Tutorial	Theory	Practical/ Oral	Tutorial	Total
ME-ITPE2014	High Performance Computing	03	--	--	03	--	--	03

Course Code	Course Name	Examination Scheme							
		Theory Marks				Term Work	Practical	Oral	Total
		Internal assessment			End Sem. Exam				
		Test1	Test 2	Avg. of 2 Tests					
ME-ITPE2014	High Performance Computing	20	20	20	80	--	--	--	100

Course Objectives:

Sr. No.	Course Objectives
The course aims:	
1	To learn fundamental concepts of parallel processing
2	To learn utilization of high performance computing resources using programming frameworks
3	To learn usage of modern processor technology as a high performance computing platform
4	To learn and appreciate core design issues in parallel computing
5	To study application of high performance computing to practical problems
6	To understand factors limiting performance of high performance computing systems

Course Outcomes:

Sr. No.	Course Outcomes	Cognitive levels of attainment as per Bloom's Taxonomy
On successful completion, of course, learner/student will be able to:		
1	Memorize and Understand classes of parallel computer architectures and GPU architecture	L1, L2
2	Understand standardized, multi-platform communication methods for parallel programming.	L2
3	Understand CUDA architectural details	L2
4	Analyze fundamental issues in parallel computing	L2
5	Study and develop basic applications using OpenCL	L1
6	Design and Develop GPU based solutions to solve computationally intensive problems in various fields	L6

DETAILED SYLLABUS:

Sr. No.	Module	Detailed Content	Hours	CO Mapping
0	Prerequisite	Concepts of Computer Organization and Architecture, Concepts of Operating System, Concepts of Distributed Computing	2	
I	Introduction to Parallel Processing Concepts	Introduction to Parallel Processing, Parallel Architecture, Parallel Platforms, Performance measures Processor Architecture, Interconnect, communication, Memory Organization, GPU Architecture: Evolution of GPU Architectures, Typical GPU architecture, CPU- GPU interaction, Address Spaces, Software Architecture **Self-learning Topics:** NPTEL Course on GPU Architectures and Programming	**6**	CO1
II	Parallel Programming with MPI, OpenMP	Building blocks of MPI, Overlapping communication and computation, collective communication operations OpenMP Threading Building blocks; An Overview of Memory Allocators, Parallel programming model 2.3 Combining MPI and OpenMP, Shared memory programming **Self-learning Topics:** NPTEL Course on Introduction to parallel programming with OpenMP and MPI	**8**	CO2
III	CUDA: GPU Parallel Development Environment	Compute Unified Device Architecture (CUDA) Architecture, CUDA programming model, execution model Thread organization: Concept of threads, Blocks, grid, thread index generation, warp Scheduling - Memory Handling with CUDA: Shared Memory, Global Memory, Constant Memory and Texture Memory **Self-learning Topics:** http://www.nvidia.com/object/cuda_home_new.html	**8**	CO3, CO6
IV	Fundamental Design Issues in Parallel Computing	Synchronization, Scheduling, Job Allocation, Job Partitioning, Dependency Analysis, Mapping Parallel Algorithms to Parallel Architectures, Performance Analysis of Parallel Algorithms	**6**	CO4
V	OpenCL Basics	OpenCL Standard, Kernels – Host Device Interaction – Execution Environment, Memory	**6**	CO5, CO6

		Model, Basic OpenCL Examples **Self-learning Topics:** http://www.openCL.org		
VI	Fundamental Limitations Facing Parallel Computing	Bandwidth Limitations, Latency Limitations Latency Hiding/Tolerating Techniques and their limitation, **Self-learning Topics:** **Case study of HPC**	**3**	CO4, CO6

Text Books:

1. "Advanced Computer Architecture: Parallelism, Scalability, Programmability", by Kai Hwang, McGraw Hill 1993
2. "Parallel Programming in C with MPI and OpenMP", Michael J. Quinn, McGraw-Hill International Editions, Computer Science Series, 2008.
3. "Introduction to Parallel Computing", AnanthGrama, Anshul Gupta, George Karypis, Vipin Kumar , Pearson Education, Second Edition, 2007
4. Petascale Computing: Algorithms and Applications, David A. Bader (Ed.), Chapman & Hall/CRC Computational Science Series, © 2007
5. "CUDA Programming: A Developer's Guide to Parallel Computing with GPUs (Applications of GPU Computing)", Shane Cook, First Edition, Morgan Kaufmann, 2012.

References:

1. Petascale Computing: Algorithms and Applications, David A. Bader (Ed.), Chapman & Hall/CRC Computational Science Series, © 2007.
2. "CUDA by Example: An Introduction to General Purpose GPU Programming", Addison - Wesley, 2010.
3. "High Performance Computing: Paradigm and Infrastructure", Lawrence Yang, Minyi Guo, Wiley, 2006

Online References:

1. https://cuda-tutorial.readthedocs.io/en/latest/
2. CUDA: docs.nvidia.com/cuda

Assessment:

Internal Assessment Test:

Assessment consists of two tests out of which; one should be compulsory class test (on minimum 02 Modules) and the other is either a class test or assignment on live problems or course project.

End Semester Examination:

Some guidelines for setting the question papers are as, six questions to be set each of 20 marks, out of these any four questions to be attempted by students. Minimum 80% syllabus should be covered inquestion papers of end semester examination.

Course Code	Course Name	Theory	Practical	Tutorial	Theory	Practical/Oral	Tutorial	Total
ME-ITPE2021	Design Thinking	03	--	--	03	--	--	03

Course Code	Course Name	Examination Scheme							
		Theory Marks				Term Work	Practical	Oral	Total
		Internal assessment			End Sem. Exam				
		Test1	Test 2	Avg. of 2 Tests					
ME-ITPE2021	Design Thinking	20	20	20	80	--	--	--	100

Course Objectives:

Sr. No.	Course Objectives
The course aims:	
1	To stress the importance of good design.
2	To recognize the latest and future issues and challenges in innovation.
3	To expose the student with state of the art perspectives, ideas, concepts, and solutions related to the design and innovation using design thinking principles.
4	To develop an advanced innovation and growth mindset form of problem identification and reframing, and insight generation.
5	To provide a social and thinking space for the recognition of innovation challenges and the design of creative solutions.
6	To propose a concrete, feasible, viable and relevant innovation project/challenge with Implementation

Course Outcomes:

Sr. No.	Course Outcomes	Cognitive levels of attainment as per Bloom's Taxonomy
On successful completion, of course, learner/student will be able to:		
1	Understand good features of designs.	L2
2	Understand importance of innovation in day to day life	L2
3	Illustrate and analyze user needs and formulate design and innovation using design thinking principles.	L4
4	Interpret and evaluate the data collected during the process of problem identification and reframing, and insight generation.	L5
5	Evaluate designs based on theoretical frameworks and methodological	L5

	approaches.	
6	Design innovative applications that are usable, effective and efficient for intended users	L6

DETAILED SYLLABUS:

Sr. No.	Module	Detailed Content	Hours	CO Mapping
0	**Prerequisite**	Software Engineering concepts and anyprogramming Language	2	
I	**Introduction to design**	Good and Poor Design, What is Interaction Design, The User Experience, The Process Of Interaction Design, Interaction Design and the User Experience, Necessity of UI/UX, **Self-learning Topics:** Study of Various interactiveday to day application	5	CO1
II	**Design Thinking Background**	Definition of design thinking, business uses of design thinking, variety of approaches within the design thinkingdiscipline, design thinking mindset **Self-learning Topics:** Design thinking in businessapplication	5	CO2
III	**Design Thinking Approach**	Fundamental Concepts: Empathy, ethnography, divergent thinking convergent thinking,visual thinking, assumption testing, prototyping, and validation within design Thinking, Design Thinking Resources Human resource, preferred space prepared, materials commonly used, dynamic between design thinking teams and the organization 3.3 Design Thinking Processes Design thinking approaches, Double Diamond approach, d.School, 5-Stage approach, Growth	8	CO3

		approach, role of project management within design thinking **Self-learning Topics:** Study of Various resources for design thinking		

IV	**Design Thinking inPractice**	4.1 Process Stages of Designing for Growth 4.2 Design Thinking Tools and Methods need to use tools and methods, visualization , journey mapping , value chain analysis , mind mapping , brainstorming, concept development assumption testing, rapid prototyping customer co-creation, learning launch. **Self-learning Topics:** Study of concept development with any application	7	CO4 / CO5
V	UX Evaluation, The Interaction Cycle and the User Action Framework	UX Goals, Metrics and Targets, UX Evaluation Techniques.-Formative vs summative ,Analysis, The interaction cycle, The user action framework adding a structured knowledge base to the interaction cycle, Interaction cycle and user action framework content categories, Role of affordances within the UAF, Practical value of the UAF. **Self-learning Topics:** Study of UI and UX goals with any application	7	CO5
VI	Design Thinking Applicatio n	This section explores practical case study related to product development in a design thinking effort.Any domain is preferable. **Self-learning Topics:** Study of any domain application	5	CO5/ CO6

Text Books:

1. "Designing for growth: A design thinking tool kit for managers", by Jeanne Liedtka and Tim Ogilvie., 2011, ISBN 978-0-231-15838-1
2. "The design thinking playbook: Mindful digital transformation of teams, products, services, businesses and ecosystems", by Michael Lewrick, Patrick Link, Larry Leifer., 2018, ISBN 978-1-119-46747-2
3. "Presumptive design: Design provocations for innovation", by Leo Frishberg and Charles Lambdin., 2016, ISBN: 978-0-12-803086-8

4. "Systems thinking: Managing chaos and complexity: A platform for designing business architecture.", "Chapter Seven: Design Thinking", by Jamshid Gharajedaghi, 2011, ISBN 978-0-12-385915-0
5. Interaction Design, by J. Preece, Y. Rogers and H. Sharp. ISBN 0-471-49278-7.
6. Human Computer Interaction, by Alan Dix, Janet Finlay, Gregory D Abowd, Russell Beale

References:

1. Karmic Design Thinking by Prof. Bala Ramadurai, available at Amazon (paperback), Amazon(e-book),

   Flipkart, Pothi, halfpricebooks.in.

2. Design: Creation of Artifacts in Society by Prof. Karl Ulrich, U. Penn

3. Change by Design by Tim Brown.

4. The UX Book, by Rex Hartson and Pardha S Pyla

5. Donald A. Norman, "The design of everyday things", Basic books.

6. Jeff Johnson, "Designing with the mind in mind", Morgan Kaufmann Publication.

Online References: https://nptel.ac.in/courses/110106124

https://onlinecourses.nptel.ac.in/noc22_mg32/preview

https://onlinecourses.nptel.ac.in/noc21_ar05/preview

https://nptel.ac.in/courses/124/107/124107008/

https://nptel.ac.in/noc/courses/noc19/SEM1/noc19-ar10/

https://nptel.ac.in/courses/107/103/107103083/

https://www.youtube.com/watch?v=6C2Ye1makdY&list=PLW-zSkCnZ-gD5TDfs1eL5EnH2mQ0f9g6B

https://xd.adobe.com/ideas/process/

Assessment:

Internal Assessment Test:

Assessment consists of two tests out of which; one should be compulsory class test (on minimum 02 Modules) and the other is either a class test or assignment on live problems or course project.

End Semester Examination:

Some guidelines for setting the question papers are as, six questions to be set each of 20 marks, out of these any four questions to be attempted by students. Minimum 80% syllabus should be covered inquestion papers of end semester examination.

<table>
<tr><th rowspan="2">Course Code</th><th rowspan="2">Course Name</th><th colspan="3">Teaching Scheme (Contact Hours)</th><th colspan="4">Credits Assigned</th></tr>
<tr><th>Theory</th><th>Pract</th><th>Tut</th><th>Theory</th><th>Pract</th><th>Tut</th><th>Total</th></tr>
<tr><td rowspan="6">ME-ITPE2022</td><td rowspan="6">Internet of Everything</td><td>03</td><td>--</td><td>--</td><td>03</td><td>--</td><td>--</td><td>03</td></tr>
<tr><td colspan="7">Examination Scheme</td></tr>
<tr><td colspan="3">Theory Examination</td><td rowspan="3">Term Work</td><td rowspan="3">Pract</td><td rowspan="3">Oral</td></tr>
<tr><td colspan="2">Internal Assessment</td><td rowspan="2">End Sem Exam</td></tr>
<tr><td>Test 1</td><td>Test 2</td><td>Avg</td></tr>
<tr><td>20</td><td>20</td><td>20</td><td>80</td><td>--</td><td>--</td><td>--</td></tr>
</table>

Course Objectives:

Sr. No.	Course Objectives
The course aims:	
1	To describe the concepts of Objects in IOT, IOT Identifier, IOT Technologies.
2	Discuss and elaborate RFID architecture, RFID Tag and Reader along with the protocols used to solve the RFID issues faced in RFID applications.
3	. Describe the connecting and networking nodes in a secure communication with the help of protocols such as MQTT, CoAP, and REST.
4	. Explain Hadoop MapReduce and demonstrate its usage for real time batch data Analysis using Apache Oozie, Apache Spark and Apache Storm.
5	Summarize the use of ML algorithms in IoT Based application in Healthcare and Smart Transportation.
6	Elaborate and show how the analysis and the evaluation is carried out over the data received through sensors in IOE to ensure security in IOE applications.

Course Outcomes:

Sr. No.	Course Outcomes	Cognitive levels of attainment as per Bloom's Taxonomy
On successful completion, of course, learner/student will be able to:		
1	Identify the Objects in IOT, list the IOT Identifiers and know the different technologies. **Self-Learning Topics**: History of IOT, Compare IOT & IOE	L1
2	Explain RFID architecture, list the Components, identify RFID Tag and Reader along with the protocols used to solve the RFID issues faced in RFID applications. **Self-Learning Topics:** Binary search Algorithms	L2
3	Design applications using the communication protocols such as MQTT, CoAP, and REST. **Self-Learning Topics:** Industrial WSN Standards	L6
4	Use Hadoop MapReduce for real time batch data Analysis using Apache	L3

	Oozie, Apache Spark and Apache Storm. **Self-Learning Topics:** Apache Hadoop Setup	
5	Recall the ML algorithms used in IoT Based applications in Healthcare and Smart Transportation. **Self-Learning Topics:** Deep Learning in IOT	L1
6	Analysis and evaluate the data received through sensors in IOE and Security in IOE applications. **Self-Learning Topics:** Trust based Recommender Systems in IoT	L4

Sr. No.	**Module**	**Detailed Contain**	**Hours**	**CO Mapping**
0	**Prerequisites:**	IOT Lab, Sensor Lab, Wireless Network.	**2**	
1.	Introduction to IOE	Introduction and History of IOT, Objects in IOT IOT Identifier, IOT Technologies **Self-Learning Topics:** History of IOT, Compare IOT & IOE	**5**	**CO1**
2.	Radio-frequency identification (RFID) Technology	Introduction to RFID and Principles of RFID RFID Components and RFID Tag and Reader RFID Transponder and RFID architecture RFID Middleware Protocols: Tree protocols, Tree splitting algorithms, Binary search Algorithms RFID Challenges and Applications **Self-Learning Topics:** Binary search Algorithms	**7**	**CO2**
3.	Wireless Sensor Networks	Connecting and networking nodes, Securing communication, standards, IP Addressing Protocols - MQTT, CoAP, REST **Self-Learning Topics**: Industrial WSN Standards	**6**	**CO3**
4.	Hadoop MapReduce	Introduction to Hadoop MapReduce, Architecture of Hadoop and Hadoop Ecosystem Hadoop MapReduce for Batch Data Analysis Apache Oozie, Apache Spark, Apache Storm Real-time Data Analysis Using Apache Storm **Self-Learning Topics:** Apache Hadoop Setup	**7**	**CO4**
5	**IoT with ML**	Machine Learning in IoT Based Healthcare Applications, General Architecture of H-IoT Overview of Algorithms and Security of health data, Machine Learning in IoT Based Smart Transportation, ML algorithms to support Smart Transportation **Self-Learning Topics:** Deep Learning in IOT	**6**	**CO5**
6.	**Security in IoE**	Common Challenges in OT Security. How IT and OT Security Practices and Systems Vary Formal Risk Analysis Structures: OCTAVE and FAIR Convergence of IoE and Blockchain its security challenges **Self-Learning Topics:** Trust based Recommender	**6**	**CO6**

		Systems in IoT		

Text Books

1.Hakima Chaouchi, Internet of Things connecting objects to the web. Wiley.

2. Arshdeep Bhaga and Vijay Madisetti, Internet of Things - A Hands-on-Approach.

3. David Hanes, Gonzalo Salgueiro, Patrick Grossetete, Rob Barton, Jerome Henry, Fundamentals – Networking Technologies, Protocols, and Use Cases for the Internet Of Things" Edition, Pearson Education, Cisco Press, 2017

Reference Books

1. Samuel Greengard, The Internet of Things (MIT Press).

2. Hakima Chaouchi, The Internet of Things - Connecting objects to the web. Wiley Publications.

3. Herve chabanne, RFID and the Internet of Things. Wiley Publications.

Reference Papers

1. H. K. Bharadwaj et al., "A Review on the Role of Machine Learning in Enabling IoT Based Healthcare Applications," in IEEE Access, vol. 9, pp. 38859-38890, 2021, doi: 10.1109/ACCESS.2021.3059858.

2. Zantalis, F.; Koulouras, G.; Karabetsos, S.; Kandris, D. A Review of Machine Learning and IoT in Smart Transportation. Future Internet 2019, 11, 94. https://doi.org/10.3390/fi11040094

3. L. Wei, J. Wu, C. Long and Y. -B. Lin, "The Convergence of IoE and Blockchain: Security Challenges," in IT Professional, vol. 21, no. 5, pp. 26-32, 1 Sept.-Oct. 2019, doi: 10.1109/MITP.2019.2923602.

Useful Links:	
1 https://nptel.ac.in/courses/106/105/106105166/ 2 https://nptel.ac.in/courses/108/108/108108098/ 3 https://nptel.ac.in/courses/106/105/106105195/ 4 https://www.coursera.org/specializations/IoT	

Assessment:
Internal Assessment Test:

Assessment consists of two tests out of which; one should be compulsory class test (on minimum 02 Modules) and the other is either a class test or assignment on live problems or course project.

End Semester Examination:

Some guidelines for setting the question papers are as, six questions to be set each of 20 marks, out of these any four questions to be attempted by students. Minimum 80% syllabus should be covered inquestion papers of end semester examination.

Course Code	Course Name	Theory	Practical	Tutorial	Theory	Practical/ Oral	Tutorial	Total
ME-ITPE2023	Information Retrieval	03	--	--	03	--	--	03

Course Code	Course Name	Examination Scheme							
		Theory Marks				Term Work	Practical	Oral	Total
		Internal assessment			End Sem. Exam				
		Test1	Test 2	Avg. of 2 Tests					
ME-ITPE2023	Information Retrieval	20	20	20	80	--	--	--	100

Course Objectives:

Sr. No.	Course Objectives
The course aims:	
1	**To** learn the fundamentals of the information retrieval system.
2	To classify various Information retrieval models.
3	To understand application of IR principles in data structures.
4	. To apply text processing techniques and operations in information retrieval system.
5	To understand text search techniques.
6	To make the students understand various techniques of searching multimedia elements.

Course Outcomes:

Sr. No.	Course Outcomes	Cognitive levels of attainment as per Bloom's Taxonomy
On successful completion, of course, learner/student will be able to:		
1	Define and describe the objectives of the basic concepts of the Information retrieval system.	L1
2	Evaluate the taxonomy of different information retrieval models.	L5
3	Apply IR principles to locate relevant information large collections of data.	L3
4	Design different document clustering algorithms.	L6
5	Apply their knowledge of searching techniques to documents.	L3
6	Apply various multimedia elements with the right techniques	L3

DETAILED SYLLABUS:

Sr. No.	Module	Data sDetailed Content	Hours	CO Mapping
0	Prerequisite	**Data Structures**	2	
I	Introduction	Introduction to Information Retrieval Systems ,Definition of Information Retrieval System - Objectives of Information Retrieval Systems - Functional, Information versus Data Retrieval, A Taxonomy of Information Retrieval Models. The Retrieval Process- Ad Hoc and Filtering. Classic Information Retrieval :Basic Concepts, Boolean Model ,Vector Model. Brief Comparison of Classic Models ,Alternative Set Theoretic Models :Fuzzy Set Model, Search engines and Web browsers **Self-learning Topics:** Corpus linguistics , Brown Corpus	5	CO1
II	Retrieval System Functions and Indexing	Search Capabilities - Browse Capabilities - Indexing Process –Automatic Indexing- Statistical Indexing – Natural Language – Concept Indexing - Hypertext Linkages- Information Extraction **Self-learning Topics:** Part of speech.	7	CO2
III	Query Languages and Data structures in Information Retrieval	Query Languages for IR ● Keywords ● Boolean Queries ● Context Queries ● Natural Language Queries ● Structural Queries Stemming Algorithms - Inverted File Structure - N-Gram Data Structures - PAT Data Structure - Signature File Structure - Hypertext and XML Data Structures - Hidden Markov Models **Self-learning Topics:** Advanced Query Operations , Automatic Local Analysis, Automatic Global Analysis	6	CO3
IV	Document and Term Clustering	Introduction to Clustering - Thesaurus Generation - Item Clustering - Hierarchy of Clusters **Self-learning Topics:** Text Compression, Comparing Text Compression Technique	4	CO4
V	Search Techniques	Search Statements and Binding - Similarity Measures and Ranking - Relevance Feedback - Selective	8	CO5

		Dissemination of Information Search - Weighted Searches of Boolean Systems - Searching the INTERNET and Hypertext – Introduction to Text Search Techniques - Software Text Search Algorithms. **Self-learning Topics:** cross-language retrieval		
VI	Visualization & Multimedia Information Retrieval	Introduction to Information Visualization - Cognition and Perception and vision- Information Visualization Technologies and techniques .Spoken Language Audio Retrieval –Non-Speech Audio Retrieval - Graph Retrieval - Imagery Retrieval - Video Retrieval, 3D retrieval, music retrieval **Self-learning Topics:** LIRE (Luce-ne Image Retrieval)	7	CO6

Text Books:

1. Modern Information Retrieval, Ricardo Baeza-Yates,berthier Ribeiro- Neto, ACM Press- Addison Wesley
2. Information storage and retrieval by Robert R Korthage, wiley publication.
3. Information Retrieval Systems: Theory and Implementation, Gerald Kowaski, Kluwer AcademicPublisher.
4. Michael W. Berry " Survey of Text Mining: Clustering, Classification and Retrieval", Springer Verlag,

References:

1. Introduction to Information Retrieval By Christopher D. Manning and Prabhakar Raghavan, Cambridge University Press.
2. Information Storage & Retrieval By Robert Korfhage – John Wiley & Sons
3. Introduction to Modern Information Retrieval. G.G. Chowdhury. NealSchuman.
4. Text Information Retrieval Systems. C.T. Meadow, B.R. Boyce, D.H. Kraft, C.L. Barry.

Online References:

1) **https://nlp.stanford.edu/IR-book/**

2) **https://en.wikipedia.org/wiki/Information_retrieval**

Assessment:

Internal Assessment Test:

Assessment consists of two tests out of which; one should be compulsory class test (on minimum 02 Modules) and the other is either a class test or assignment on live problems or course project.

End Semester Examination:

Some guidelines for setting the question papers are as, six questions to be set each of 20 marks, out of these any four questions to be attempted by students. Minimum 80% syllabus should be covered inquestion papers of end semester examination.

Course Code	Course Name	Theory	Practical	Tutorial	Theory	Practical/ Oral	Tutorial	Total
ME-ITPE2024	Green IT	03	--	--	03	--	--	03

Course Code	Course Name	Examination Scheme							
		Theory Marks				Term Work	Practical	Oral	Total
		Internal assessment			End Sem. Exam				
		Test 1	Test 2	Avg. of 2 Tests					
ME-ITPE2024	Green IT	20	20	20	80	--	--	--	100

Course Objectives:

Sr. No.	Course Objectives
The course aims:	
1	To understand what Green IT is and How it can help improve environmental Sustainability
2	To understand the principles and practices of Green IT.
3	To understand how Green IT is adopted or deployed in enterprises.
4	. To understand how data centers, cloud computing, storage systems, software and networks can be made greener.
5	To measure the Maturity of a Sustainable ICT world.
6	To implement the concept of Green IT in Information Assurance in Communication and Social Media and all other commercial field.

Course Outcomes:

Sr. No.	Course Outcomes	Cognitive levels of attainment as per Bloom's Taxonomy
On successful completion, of course, learner/student will be able to:		
1	Describe awareness among stakeholders and promote green agenda and green initiatives in their working environments leading to green movement	L1
2	Identify IT Infrastructure Management and Green Data Center Metrics for software development	L1
3	Recognize Objectives of Green Network Protocols for Data communication	L1
4	Use Green IT Strategies and metrics for ICT development.	L3
5	Illustrate various green IT services and its roles	L3
6	Use new career opportunities available in IT profession, audits and others with special skills.	L3

DETAILED SYLLABUS:

Sr. No.	Module	Detailed Content	Hours	CO Mapping
0	Prerequisite	Environmental Studies	2	
I	Introduction	Environmental Impacts of IT, Holistic Approach to Greening IT, Green IT Standards and EcoLabeling, Enterprise Green IT Strategy , Green IT: Burden or Opportunity? Hardware: Life Cycle of a Device or Hardware, Reuse, Recycle and Dispose. Software: Introduction, EnergySaving Software Techniques, Evaluating and Measuring Software Impact to Platform Power	6	CO1
II	Software development and data centers	Sustainable Software, Software Sustainability Attributes, Software Sustainability Metrics, Sustainable Software Methodology, Data Centres and Associated Energy Challenges, Data Centre IT Infrastructure, Data Centre Facility Infrastructure: Implications for Energy Efficiency, IT Infrastructure Management, Green Data Centre Metrics	6	CO1 CO2
III	Data storage and communicatio n	Storage Media Power Characteristics, Energy Management Techniques for Hard Disks, System-Level Energy Management, Objectives of Green Network Protocols, Green Network Protocols and Standards	6	CO1 CO3
IV	Information systems, green it strategy and metrics	Approaching Green IT Strategies, Business Drivers of Green IT Strategy, Business Dimensions for Green IT Transformation, Multilevel Sustainable Information, Sustainability Hierarchy Models, Product Level Information, Individual Level Information, Functional Level Information, Organizational Level Information, Regional/City Level Information, Measuring the Maturity of Sustainable ICT.	6	CO1 CO4
V	Green it services and roles	Factors Driving the Development of Sustainable IT, Sustainable IT Services (SITS), SITS Strategic Framework, Sustainable IT Roadmap, Organizational and Enterprise Greening, Information Systems in Greening Enterprises, Greening the Enterprise: IT Usage and Hardware, Inter-organizational Enterprise Activities and Green Issues, Enablers and Making the Case for IT and the Green Enterprise.	6	CO1 CO4 CO5
VI	Managing and regulating green it	Strategizing Green Initiatives, Implementation of Green IT, Information Assurance, Communication and Social Media, The Regulatory Environment and IT Manufacturers, Nonregulatory Government Initiatives, Industry Associations and Standards Bodies, Green Building Standards, Green Data Centres, Social Movements and Greenpeace	7	CO1 CO5 CO6

Text Books:

1. San Murugesan, G. R. Gangadharan, Harnessing Green IT,WILEY 1st Edition-2018
2. Mohammad Dastbaz Colin Pattinson Babak Akhgar, Green Information Technology A Sustainable

Assessment:
Internal Assessment Test:

Assessment consists of two tests out of which; one should be compulsory class test (on minimum 02 Modules) and the other is either a class test or assignment on live problems or course project.

End Semester Examination:

Some guidelines for setting the question papers are as, six questions to be set each of 20 marks, out of these any four questions to be attempted by students. Minimum 80% syllabus should be covered in question papers of end semester examination.

		Teaching Scheme (Contact Hours)			Credits Assigned			
Course Code	**Course Name**	**Theory**	**Practical**	**Tutorial**	**Theory**	**Practical & Oral**	**Tutorial**	**Total**
ME-ITL201	Program Lab-II	--	2	--	--	1	--	01

Course Code	**Course Name**	**Examination Scheme**						
		Theory Marks				**Term Work**	**Practical/ Oral**	**Total**
		Internal assessment			**End Sem. Exam**			
		Test1	**Test 2**	**Avg. of 2 Tests**				
ME-ITL201	Program Lab-II	--	--	--	--	25	25	50

Lab Objectives:

Sr. No	**Lab Objectives**
1	AngularJS Framework for Single Page Web Applications.
2	AJAX for Rich Internet Applications.
3	REST API and MongoDB for Frontend and Backend Connectivity.
4	To understand the concept of cloud computing and virtualization.
5	To understand the concept of mobile computing.
6	To understand the concept of mobile offloading.

Lab Outcomes:

Sr. No	**Lab Outcomes**	**Cognitive levels of attainment as per Bloom's Taxonomy**
1	Implement Single Page Applications using AngularJS Framework.	L1, L2, L3
2	Develop Rich Internet Applications using AJAX.	L1, L2, L3
3	Create REST Web services using MongoDB.	L1, L2, L3, L4
4	Understand and apply the concept of cloud computing and virtualization	L1,L2,L3
5	Understand and apply the concept of mobile computing	L1,L2,L3
6	Understand and apply the concept of mobile offloading	L1,L2,L3

Prerequisite: Computer Networks, HTML/HTML5, CSS/CSS3, JavaScript, Python

DETAILED SYLLABUS:

Sr. No.	Module	Detailed Content	Hours	LO Mapping
I	AngularJS	Perform **Any 2** from the following 1. Create a simple HTML "Hello World" Project using AngularJS Framework and apply ng-controller, ng-model and expressions. 2. Events and Validations in AngularJS. (Create functions and add events, adding HTML validators, using $valid property of Angular, etc.) 3. Create an application for like Students Record using AngularJS	**05**	LO1
II	Rich Internet Application using AJAX	Perform **Any 3** from the following 1. Write a JavaScript program for a AJAX. 2. Write a program to use AJAX for user validation using and to show the result on the same page below the submit button. 3. Design and develop small web application using AJAX, HTML and JSP.	**04**	LO2
III	MongoDB and Building REST API using MongoDB	Perform **Any 1** from the following 1. Build a RESTful API using MongoDB. 2. Build a TypeScript REST API using MongoDB.	**04**	LO3
IV	Cloud computing and virtualization	1) Demonstrate database as a cloud computing service 2) Demonstrate memory virtualization in single machine 3) Demonstrate virtualization by using VMware 4) Demonstrate the installation of open source cloud platform	**05**	LO4

V	Mobile cloud computing	5) 5)Demonstrate how to built ML/AL capabilities on cloud for mobile applications 6) 6) Explain how mobile offline data synchronization can be done using any cloud platform	**04**	LO5
VI	Mobile offloading	) Demonstrate how cloud can be used to implement push notifications for mobile apps. 8) Demonstrate how cloud platform can be used to device testing of mobile apps 9) Demonstrate the user sign-up and sign-in management using any cloud platform 10) Demonstrate how server less architecture can be used to build APIs for mobile applications 11) Demonstrate how speech recognition can be implemented for mobile apps using cloud platform 12) Demonstrate how the user engagements and analytics of mobile apps can be managed by cloud services 13) Demonstrate and explain how cloud can be used for content delivery on mobile phones	**04**	LO6

Text Books:

1. John Hebeler, Matthew Fisher, Ryan Blace, Andrew Perez-Lopez, "Semantic Web Programming", Wiley Publishing, Inc, 1st Edition, 2009.
2. Boris Cherny, "Programming TypeScript- Making Your Javascript Application Scale", O'Reilly Media Inc., 2019 Edition.
3. Adam Bretz and Colin J. Ihrig, "Full Stack JavaScript Development with MEAN", SitePoint Pty. Ltd., 2015 Edition.
4. Simon Holmes Clive Harber, "Getting MEAN with Mongo, Express, Angular, and Node", Manning Publications, 2019 Edition.
5. Dr. Deven Shah, "Advanced Internet Programming", StarEdu Solutions, 2019 Edition.
6. Miguel Grinberg, "Flask Web Development: Developing Web Applications with Python", O'Reilly, 2018 Edition.
7. Cloud Computing: Principles and Paradigms,Rajkumar Buyya , James Broberg,Andrzej M. Goscinski
8. Cloud computing by Kailesh Jayaswal,jagannath kallakurchi, donald j Houde
9. Mobile cloud computing : foundation and service model by Dijiang Huang and Huijun Wu
10. Mobile computing architecture, algorithm and application by Debashis De

References:

1. John Davies, Rudi Studer and Paul Warren, "Semantic Web Technologies Trends and Research in Ontology-based Systems", Wiley, 2006 Edition.
2. Yakov Fain and Anton Moiseev, "TypeScript Quickly", Manning Publications, 2020 Edition.

3. Steve Fenton, "Pro TypeScript: Application - Scale Javascript Development", Apress, 2014 Edition.
4. Brad Dayley, Brendan Dayley, Caleb Dayley, "Node.js, MongoDB and Angular Web Development: The definitive guide to using the MEAN stack to build web applications", 2nd Edition, Addison-Wesley Professional, 2018 Edition.
5. Cloud computing Bible by barrie Sosinsky.
6. Cloud computing by Dr Kumar Saurabh

Term Work:

Term Work shall consist of at least 10 practical based on the above list. Also Term Work Journal must include Assignement as mentioned in above syllabus.

Term Work Marks: 25 Marks (Total marks) = 15 Marks (Experiments) + 5 Marks (Assignments) + 5 Marks (Attendance)

Oral Exam: An Oral exam will be held based on the above syllabus.

		Teaching Scheme (Contact Hours)			Credits Assigned			
Course Code	**Course Name**	**Theory**	**Practical**	**Tutorial**	**Theory**	**Practical & Oral**	**Tutorial**	**Total**
ME-ITSBL201	Design Thinking Lab (SBL)	--	4	--	--	2	--	02

Course Code	Course Name	Examination Scheme						
		Theory Marks				Term Work	Practical/ Oral	Total
		Internal assessment			End Sem. Exam			
		Test1	Test 2	Avg. of 2 Tests				
ME-ITSBL201	Design Thinking Lab (SBL)	--	--	--	--	50	50	100

Lab Objectives:

Sr. No	Lab Objectives
1	Understand the design thinking process.
2	Understand and prepare a detail journey map for your problem.
3	Understand and design a mock-up and innovation model of your problem.
4	Understand the different technologies and apply it.
5	Understand and create a prototype
6	Use testing software by apply different test modes.

Lab Outcomes:

Sr. No	Lab Outcomes	Cognitive levels of attainment as per Bloom's Taxonomy
1	Understand and apply the design thinking process.	L1,L2,L3
2	Prepare a detail journey map for your problem.	L1,L2,L3
3	Design a mock-up and innovation model of your problem.	L6
4	Understand the different technologies and apply it.	L1,L2
5	create a prototype for your problem	L6
6	Use testing software by apply different test modes.	L1,L2,L3,L4

Prerequisite: Any programming language.

DETAILED SYLLABUS:

Sr. No.	Module	Detailed Content	Hours	LO Mapping

I	Introduction	Concept of design thinking, what is design thinking, core elements of design thinking. Key principles and mindset. Mindset & attitudes. Five different phases of Design thinking.	**06**	LO1
II	Deconstructing stereotypes through creative collaboration & Immersion.	. Structure of the project Focus: gender equality Results of the creative collaboration. Immersion, Reframing, Exploratory Research, Desk Research.	**04**	LO2
III	A step-by-step guide	A thousand and one methods Facilitate your team Be curious! Be compassionate! Be creative! Be constructive!	**04**	LO3
IV	Analysis and Synthesis	Insight Cards, Affinity Diagram, Conceptual Map, Guiding Criteria, Personas, Empathy Map, User's journey, Blueprint.	**06**	LO4
V	Ideation	Brainstorming, Co-creation workshop, Idea Menu, Decision Matrix.	**05**	LO4,LO5
VI	Prototyping and tesing	Paper Prototyping, Volumetric Model, Staging, Storyboard, Service Prototyping. Use tools for testing.	**05**	LO6

Text & Refernces Books:

1. An introduction to design thingking, standard.
2. A practical guide for design thinking, 2019
3. Design thinking a guide book
4. Design Thinking Business Innovation.
5. Handbook of Design Thinking tips and tools for how to design thinking.
6. Design Thinking Handbook, Eli Woolery.

Guidelines for Mini Project as per above syllabus.

- Students shall form a group of 3 to 4 students, while forming a group shall not be allowed less than three or more than four students, as it is a group activity.
- Students should do survey and identify needs, which shall be converted into problem statement how to contribute to open source mini project in consultation with faculty supervisor/head of department/internal committee of faculties.
- Students shall submit implementation plan in the form of Gantt/PERT/CPM chart, which will cover weekly activity of recent contribute to open source mini project.
- A log book to be prepared by each group, wherein group can record weekly work progress, guide/supervisor can verify and record notes/comments.

- Faculty supervisor may give inputs to students during mini project activity; however, focus shall be on self-learning.
- Students in a group shall understand contribute to open source problem effectively, propose multiple solution and select best possible solution in consultation with guide/ supervisor.
- Students shall convert the best solution into working model using various components of their domain areas and demonstrate.
- The solution to be validated with proper justification and report using open source tools to be compiled in standard format of University of Mumbai.
- With the focus on the self-learning, innovation, addressing societal problems and entrepreneurship quality development within the students through the open source Mini Projects.

Guidelines for Assessment of Mini Project:

Term Work

- The review/ progress monitoring committee shall be constituted by head of departments of each institute. The progress of mini project to be evaluated on continuous basis, minimum two reviews in each semester.
- In continuous assessment focus shall also be on each individual student, assessment based on individual's contribution in group activity, their understanding and response to questions.
- Distribution of Term work marks for both semesters shall be as below;
    - Marks awarded by guide/supervisor based on log book : 30
    - Marks awarded by review committee : 10
    - Quality of Project Report :05

Term Work:

Term Work shall consist of at least 10 practical based on the above list. Also Term Work Journal must include Mini-Project as mentioned in above syllabus.

Term Work Marks: 50 Marks (Total marks) = 40 Marks (Mini-project) + 5 Marks (Attendance)

Oral Exam: An Oral exam will be held based on the above syllabus.

Course Code	Course Name	Credits
IE2011	Project Management	03

Objectives:

1. To familiarize the students with the use of a structured methodology/approach for each and every unique project undertaken, including utilizing project management concepts, tools and techniques.
2. To appraise the students with the project management life cycle and make them knowledgeable about the various phases from project initiation through closure.

Outcomes: Learner will be able to…

1. Apply selection criteria and select an appropriate project from different options.
2. Write work break down structure for a project and develop a schedule based on it.
3. Identify opportunities and threats to the project and decide an approach to deal with them strategically.
4. Use Earned value technique and determine & predict status of the project.
5. Capture lessons learned during project phases and document them for future reference

Module	Detailed Contents	Hrs
01	**Project Management Foundation:** Definition of a project, Project Vs Operations, Necessity of project management, Triple constraints, Project life cycles (typical & atypical) Project phases and stage gate process. Role of project manager. Negotiations and resolving conflicts. Project management in various organization structures. PM knowledge areas as per Project Management Institute (PMI).	5
02	**Initiating Projects:** How to get a project started, Selecting project strategically, Project selection models (Numeric /Scoring Models and Non-numeric models), Project portfolio process, Project sponsor and creating charter; Project proposal. Effective project team, Stages of team development & growth (forming, storming, norming & performing), team dynamics.	6
03	**Project Planning and Scheduling:** Work Breakdown structure (WBS) and linear responsibility chart, Interface Co-ordination and concurrent engineering, Project cost estimation and budgeting, Top down and bottoms up budgeting, Networking and Scheduling techniques. PERT, CPM, GANTT chart. Introduction to Project Management Information System (PMIS).	8
04	**Planning Projects:** Crashing project time, Resource loading and leveling, Goldratt's critical chain, Project Stakeholders and Communication plan. Risk Management in projects: Risk management planning, Risk identification and risk register. Qualitative and quantitative risk assessment, Probability and impact matrix. Risk response strategies for positive and negative risks	6
05	**5.1 Executing Projects:** Planning monitoring and controlling cycle. Information needs and reporting,	8

	engaging with all stakeholders of the projects. Team management, communication and project meetings. **Monitoring and Controlling Projects:** Earned Value Management techniques for measuring value of work completed; Using milestones for measurement; change requests and scope creep. Project audit. **Project Contracting** Project procurement management, contracting and outsourcing,	
06	**Project Leadership and Ethics:** Introduction to project leadership, ethics in projects. Multicultural and virtual projects. **Closing the Project:** Customer acceptance; Reasons of project termination, Various types of project terminations (Extinction, Addition, Integration, Starvation), Process of project termination, completing a final report; doing a lessons learned analysis; acknowledging successes and failures; Project management templates and other resources; Managing without authority; Areas of further study.	6

REFERENCES:

1. Jack Meredith & Samuel Mantel, Project Management: A managerial approach, Wiley India, 7thEd.
2. A Guide to the Project Management Body of Knowledge (PMBOK® Guide), 5th Ed, Project Management Institute PA, USA
3. Gido Clements, Project Management, Cengage Learning.
4. Gopalan, Project Management, , Wiley India
5. Dennis Lock, Project Management, Gower Publishing England, 9 th Ed.

Assessment:

Internal:
Assessment consists of two tests out of which; one should be compulsory class test and the other is either a class test or assignment on live problems or course project.

End Semester Theory Examination:
Some guidelines for setting up the question paper. Minimum 80% syllabus should be covered in question papers of end semester examination. **In question paper weightage of each module will be proportional to number of respective lecture hours as mention in the syllabus.**

1. Question paper will comprise of total six question
2. All question carry equal marks
3. Questions will be mixed in nature (for example supposed Q.2 has part (a) from module 3 then part (b) will be from any module other than module 3)
4. Only Four question need to be solved.

Course Code	Course Name	Credits
IE2012	Finance Management	03

Objectives:

1. Overview of Indian financial system, instruments and market
2. Basic concepts of value of money, returns and risks, corporate finance, working capital and its management
3. Knowledge about sources of finance, capital structure, dividend policy

Outcomes: Learner will be able to…

1. Understand Indian finance system and corporate finance
2. Take investment, finance as well as dividend decisions

Module	Detailed Contents	Hrs
01	**Overview of Indian Financial System:** Characteristics, Components and Functions of Financial System. **Financial Instruments:** Meaning, Characteristics and Classification of Basic Financial Instruments — Equity Shares, Preference Shares, Bonds-Debentures, Certificates of Deposit, and Treasury Bills. **Financial Markets:** Meaning, Characteristics and Classification of Financial Markets — Capital Market, Money Market and Foreign Currency Market **Financial Institutions:** Meaning, Characteristics and Classification of Financial Institutions — Commercial Banks, Investment-Merchant Banks and Stock Exchanges	06
02	**Concepts of Returns and Risks:** Measurement of Historical Returns and Expected Returns of a Single Security and a Two-security Portfolio; Measurement of Historical Risk and Expected Risk of a Single Security and a Two-security Portfolio. **Time Value of Money:** Future Value of a Lump Sum, Ordinary Annuity, and Annuity Due; Present Value of a Lump Sum, Ordinary Annuity, and Annuity Due; Continuous Compounding and Continuous Discounting.	06
03	**Overview of Corporate Finance:** Objectives of Corporate Finance; Functions of Corporate Finance—Investment Decision, Financing Decision, and Dividend Decision. **Financial Ratio Analysis:** Overview of Financial Statements—Balance Sheet, Profit and Loss Account, and Cash Flow Statement; Purpose of Financial Ratio Analysis; Liquidity Ratios; Efficiency or Activity Ratios; Profitability Ratios; Capital Structure Ratios; Stock Market Ratios; Limitations of Ratio Analysis.	09
04	**Capital Budgeting:** Meaning and Importance of Capital Budgeting; Inputs for Capital Budgeting Decisions; Investment Appraisal Criterion—Accounting Rate of Return, Payback Period, Discounted Payback Period, Net Present Value(NPV), Profitability Index, Internal Rate of Return (IRR), and Modified Internal Rate of Return (MIRR)	10

	Working Capital Management: Concepts of Meaning Working Capital; Importance of Working Capital Management; Factors Affecting an Entity's Working Capital Needs; Estimation of Working Capital Requirements; Management of Inventories; Management of Receivables; and Management of Cash and Marketable Securities.	
05	**Sources of Finance:** Long Term Sources—Equity, Debt, and Hybrids; Mezzanine Finance; Sources of Short Term Finance—Trade Credit, Bank Finance, Commercial Paper; Project Finance. **Capital Structure:** Factors Affecting an Entity's Capital Structure; Overview of Capital Structure Theories and Approaches— Net Income Approach, Net Operating Income Approach; Traditional Approach, and Modigliani-Miller Approach. Relation between Capital Structure and Corporate Value; Concept of Optimal Capital Structure	05
06	**Dividend Policy:** Meaning and Importance of Dividend Policy; Factors Affecting an Entity's Dividend Decision; Overview of Dividend Policy Theories and Approaches—Gordon's Approach, Walter's Approach, and Modigliani-Miller Approach	03

REFERENCES:

1. Fundamentals of Financial Management, 13th Edition (2015) by Eugene F. Brigham and Joel F. Houston; Publisher: Cengage Publications, New Delhi.
2. Analysis for Financial Management, 10th Edition (2013) by Robert C. Higgins; Publishers: McGraw Hill Education, New Delhi.
3. Indian Financial System, 9th Edition (2015) by M. Y. Khan; Publisher: McGraw Hill Education, New Delhi.
4. Financial Management, 11th Edition (2015) by I. M. Pandey; Publisher: S. Chand (G/L) & Company Limited, New Delhi.

Assessment:

Internal:
Assessment consists of two tests out of which; one should be compulsory class test and the other is either a class test or assignment on live problems or course project.

End Semester Theory Examination:
Some guidelines for setting up the question paper. Minimum 80% syllabus should be covered in question papers of end semester examination. **In question paper weightage of each module will be proportional to number of respective lecture hours as mention in the syllabus.**

1. Question paper will comprise of total six question
2. All question carry equal marks
3. Questions will be mixed in nature (for example supposed Q.2 has part (a) from module 3 then part (b) will be from any module other than module 3)
4. Only Four question need to be solved.

Course Code	Course Name	Credits
IE2013	Enterpreneurship Development and Management	03

Objectives:

1. To acquaint with entrepreneurship and management of business
2. Understand Indian environment for entrepreneurship
3. Idea of EDP, MSME

Outcomes: Learner will be able to…

1. Understand the concept of business plan and ownerships
2. Interpret key regulations and legal aspects of entrepreneurship in India
3. Understand government policies for entrepreneurs

Module	Detailed Contents	Hrs
01	**Overview Of Entrepreneurship:** Definitions, Roles and Functions/Values of Entrepreneurship, History of Entrepreneurship Development, Role of Entrepreneurship in the National Economy, Functions of an Entrepreneur, Entrepreneurship and Forms of Business Ownership Role of Money and Capital Markets in Entrepreneurial Development: Contribution of Government Agencies in Sourcing information for Entrepreneurship	04
02	**Business Plans And Importance Of Capital To Entrepreneurship:** 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	09
03	Women's Entrepreneurship Development, Social entrepreneurship-role and need, EDP cell, role of sustainability and sustainable development for SMEs, case studies, exercises	05
04	**Indian Environment for Entrepreneurship:** key regulations and legal aspects , MSMED Act 2006 and its implications, schemes and policies of the Ministry of MSME, role and responsibilities of various government organisations, departments, banks etc., Role of State governments in terms of infrastructure developments and support etc., Public private partnerships, National Skill development Mission, Credit Guarantee Fund, PMEGP, discussions, group exercises etc	08
05	**Effective Management of Business:** 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	08
06	**Achieving Success In The Small Business:** 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	05

REFERENCES:

1. Poornima Charantimath, Entrepreneurship development- Small Business Enterprise, Pearson
2. Education Robert D Hisrich, Michael P Peters, Dean A Shapherd, Entrepreneurship, latest edition, The McGrawHill Company
3. Dr TN Chhabra, Entrepreneurship Development, Sun India Publications, New Delhi
4. Dr CN Prasad, Small and Medium Enterprises in Global Perspective, New century Publications, New Delhi
5. Vasant Desai, Entrepreneurial development and management, Himalaya Publishing House
6. Maddhurima Lall, Shikah Sahai, Entrepreneurship, Excel Books
7. Rashmi Bansal, STAY hungry STAY foolish, CIIE, IIM Ahmedabad
8. Law and Practice relating to Micro, Small and Medium enterprises, Taxmann Publication Ltd.
9. Kurakto, Entrepreneurship- Principles and Practices, Thomson Publication
10. Laghu Udyog Samachar
11. www.msme.gov.in
12. www.dcmesme.gov.in
13. www.msmetraining.gov.in

Assessment:

Internal:
Assessment consists of two tests out of which; one should be compulsory class test and the other is either a class test or assignment on live problems or course project.

End Semester Theory Examination:
Some guidelines for setting up the question paper. Minimum 80% syllabus should be covered in question papers of end semester examination. **In question paper weightage of each module will be proportional to number of respective lecture hours as mention in the syllabus.**

1. Question paper will comprise of total six question
2. All question carry equal marks
3. Questions will be mixed in nature (for example supposed Q.2 has part (a) from module 3 then part (b) will be from any module other than module 3)
4. Only Four question need to be solved.

Course Code	Course Name	Credits
IE2014	Human Resource Management	03

Objectives:

1. To introduce the students with basic concepts, techniques and practices of the human resource management.
2. To provide opportunity of learning Human resource management (HRM) processes, related with the functions, and challenges in the emerging perspective of today's organizations.
3. To familiarize the students about the latest developments, trends & different aspects of HRM.
4. To acquaint the student with the importance of inter-personal & inter-group behavioral skills in an organizational setting required for future stable engineers, leaders and managers.

Outcomes: Learner will be able to…

1. Understand the concepts, aspects, techniques and practices of the human resource management.
2. Understand the Human resource management (HRM) processes, functions, changes and challenges in today's emerging organizational perspective.
3. Gain knowledge about the latest developments and trends in HRM.
4. Apply the knowledge of behavioral skills learnt and integrate it with in inter personal and intergroup environment emerging as future stable engineers and managers.

Module	Detailed Contents	Hrs
01	**Introduction to HR** • Human Resource Management- Concept, Scope and Importance, Interdisciplinary Approach Relationship with other Sciences, Competencies of HR Manager, HRM functions. • Human resource development (HRD): changing role of HRM – Human resource Planning, Technological change, Restructuring and rightsizing, Empowerment, TQM, Managing ethical issues.	5
02	**Organizational Behavior (OB)** • Introduction to OB Origin, Nature and Scope of Organizational Behavior, Relevance to Organizational Effectiveness and Contemporary issues • Personality: Meaning and Determinants of Personality, Personality development, Personality Types, Assessment of Personality Traits for Increasing Self Awareness • Perception: Attitude and Value, Effect of perception on Individual Decision-making, Attitude and Behavior. • Motivation: Theories of Motivation and their Applications for Behavioral Change (Maslow, Herzberg, McGregor); • Group Behavior and Group Dynamics: Work groups formal and informal groups and stages of group development. Team Effectiveness: High performing teams, Team Roles, cross functional and self-directed team. • Case study	7
03	**Organizational Structure &Design** • Structure, size, technology, Environment of organization; Organizational Roles & conflicts: Concept of roles; role dynamics; role conflicts and	6

	stress. • Leadership: Concepts and skills of leadership, Leadership and managerial roles, Leadership styles and contemporary issues in leadership. • Power and Politics: Sources and uses of power; Politics at workplace, Tactics and strategies.	
04	**Human resource Planning** • Recruitment and Selection process, Job-enrichment, Empowerment - Job-Satisfaction, employee morale. • Performance Appraisal Systems: Traditional & modern methods, Performance Counseling, Career Planning. • Training & Development: Identification of Training Needs, Training Methods	5
05	**Emerging Trends in HR** • Organizational development; Business Process Re-engineering (BPR), BPR as a tool for organizational development , managing processes & transformation in HR. Organizational Change, Culture, Environment • Cross Cultural Leadership and Decision Making**:** Cross Cultural Communication and diversity at work**,** Causes of diversity, managing diversity with special reference to handicapped, women and ageing people, intra company cultural difference in employee motivation.	6
06	**HR & MIS** Need, purpose, objective and role of information system in HR, Applications in HRD in various industries (e.g. manufacturing R&D, Public Transport, Hospitals, Hotels and service industries **Strategic HRM** Role of Strategic HRM in the modern business world, Concept of Strategy, Strategic Management Process, Approaches to Strategic Decision Making; Strategic Intent – Corporate Mission, Vision, Objectives and Goals **Labor Laws & Industrial Relations** Evolution of IR, IR issues in organizations, Overview of Labor Laws in India; Industrial Disputes Act, Trade Unions Act, Shops and Establishments Act	10

REFERENCES:

1. Stephen Robbins, Organizational Behavior, 16th Ed, 2013
2. V S P Rao, Human Resource Management, 3rd Ed, 2010, Excel publishing
3. Aswathapa, Human resource management: Text & cases, 6th edition, 2011
4. C. B. Mamoria and S V Gankar, Dynamics of Industrial Relations in India, 15th Ed, 2015, Himalaya Publishing, 15thedition, 2015
5. P. Subba Rao, Essentials of Human Resource management and Industrial relations, 5th Ed, 2013, Himalaya Publishing
6. Laurie Mullins, Management & Organizational Behavior, Latest Ed, 2016, Pearson Publications

Assessment:

Internal:
Assessment consists of two tests out of which; one should be compulsory class test and the other is either a class test or assignment on live problems or course project.

End Semester Theory Examination:

Some guidelines for setting up the question paper. Minimum 80% syllabus should be covered in question papers of end semester examination. **In question paper weightage of each module will be proportional to number of respective lecture hours as mention in the syllabus.**

1. Question paper will comprise of total six question
2. All question carry equal marks
3. Questions will be mixed in nature (for example supposed Q.2 has part (a) from module 3 then part (b) will be from any module other than module 3)
4. Only Four question need to be solved.

Course Code	Course Name	Credits
IE2015	Professional Ethics and Corporat Social Responsibility (CSR)	03

Objectives:

1. To understand professional ethics in business
2. To recognized corporate social responsibility

Outcomes: Learner will be able to…

1. Understand rights and duties of business
2. Distinguish different aspects of corporate social responsibility
3. Demonstrate professional ethics
4. Understand legal aspects of corporate social responsibility

Module	Detailed Contents	Hrs
01	**Professional Ethics and Business:** The Nature of Business Ethics; Ethical Issues in Business; Moral Responsibility and Blame; Utilitarianism: Weighing Social Costs and Benefits; Rights and Duties of Business	04
02	**Professional Ethics in the Marketplace:** Perfect Competition; Monopoly Competition; Oligopolistic Competition; Oligopolies and Public Policy **Professional Ethics and the Environment:** Dimensions of Pollution and Resource Depletion; Ethics of Pollution Control; Ethics of Conserving Depletable Resources	08
03	**Professional Ethics of Consumer Protection:** Markets and Consumer Protection; Contract View of Business Firm's Duties to Consumers; Due Care Theory; Advertising Ethics; Consumer Privacy **Professional Ethics of Job Discrimination:** Nature of Job Discrimination; Extent of Discrimination; Reservation of Jobs.	06
04	**Introduction to Corporate Social Responsibility:** Potential Business Benefits—Triple bottom line, Human resources, Risk management, Supplier relations; Criticisms and concerns—Nature of business; Motives; Misdirection. Trajectory of Corporate Social Responsibility in India	05
05	**Corporate Social Responsibility:** Articulation of Gandhian Trusteeship Corporate Social Responsibility and Small and Medium Enterprises (SMEs) in India, Corporate Social Responsibility and Public-Private Partnership (PPP) in India	08
06	**Corporate Social Responsibility in Globalizing India:** Corporate Social Responsibility Voluntary Guidelines, 2009 issued by the Ministry of Corporate Affairs, Government of India, Legal Aspects of Corporate Social Responsibility—Companies Act, 2013.	08

REFERENCES:

1. Business Ethics: Texts and Cases from the Indian Perspective (2013) by Ananda Das Gupta; Publisher: Springer.
2. Corporate Social Responsibility: Readings and Cases in a Global Context (2007) by Andrew Crane, Dirk Matten, Laura Spence; Publisher: Routledge.
3. Business Ethics: Concepts and Cases, 7th Edition (2011) by Manuel G. Velasquez; Publisher: Pearson, New Delhi.
4. Corporate Social Responsibility in India (2015) by BidyutChakrabarty, Routledge, New Delhi.

Assessment:

Internal:
Assessment consists of two tests out of which; one should be compulsory class test and the other is either a class test or assignment on live problems or course project.

End Semester Theory Examination:

Some guidelines for setting up the question paper. Minimum 80% syllabus should be covered in question papers of end semester examination. **In question paper weightage of each module will be proportional to number of respective lecture hours as mention in the syllabus.**

1. Question paper will comprise of total six question
2. All question carry equal marks
3. Questions will be mixed in nature (for example supposed Q.2 has part (a) from module 3 then part (b) will be from any module other than module 3)
4. Only Four question need to be solved.

Course Code	Course Name	Credits
IE2016	Research Methodology	03

Objectives:

1. To understand Research and Research Process
2. To acquaint students with identifying problems for research and develop research strategies
3. To familiarize students with the techniques of data collection, analysis of data and interpretation

Outcomes: Learner will be able to…

1. Prepare a preliminary research design for projects in their subject matter areas
2. Accurately collect, analyze and report data
3. Present complex data or situations clearly
4. Review and analyze research findings

Module	Detailed Contents	Hrs
01	**Introduction and Basic Research Concepts** Research – Definition; Concept of Construct, Postulate, Proposition, Thesis, Hypothesis, Law, Principle.Research methods vs Methodology Need of Research in Business and Social Sciences Objectives of Research **Issues** and Problems in Research Characteristics of Research:Systematic, Valid, Verifiable, Empirical and Critical	09
02	**Types of Research** Basic Research Applied Research Descriptive Research Analytical Research Empirical Research **2.6** Qualitative and Quantitative Approaches	07
03	**Research Design and Sample Design** Research Design – Meaning, Types and Significance Sample Design – Meaning and Significance Essentials of a good sampling Stages in Sample Design Sampling methods/techniques Sampling Errors	07
04	**Research Methodology** **4.1** Meaning of Research Methodology **4.2**. Stages in Scientific Research Process: **a.** Identification and Selection of Research Problem **b.** Formulation of Research Problem **c.** Review of Literature **d.** Formulation of Hypothesis **e.** Formulation of research Design **f.** Sample Design **g.** Data Collection **h.** Data Analysis **i.** Hypothesis testing and Interpretation of Data	08

	j. Preparation of Research Report	
05	**Formulating Research Problem** **5.1** Considerations: Relevance, Interest, Data Availability, Choice of data, Analysis of data, Generalization and Interpretation of analysis	**04**
06	**Outcome of Research** Preparation of the report on conclusion reached Validity Testing & Ethical Issues Suggestions and Recommendation	**04**

REFERENCES:

1. Dawson, Catherine, 2002, Practical Research Methods, New Delhi, UBS Publishers Distributors.
2. Kothari, C.R.,1985, Research Methodology-Methods and Techniques, New Delhi, Wiley Eastern Limited.
3. Kumar, Ranjit, 2005, Research Methodology-A Step-by-Step Guide for Beginners, (2nd ed), Singapore, Pearson Education

Assessment:

Internal:
Assessment consists of two tests out of which; one should be compulsory class test and the other is either a class test or at least 6 assignment on complete syllabus or course project.

End Semester Theory Examination:

Some guidelines for setting up the question paper. Minimum 80% syllabus should be covered in question papers of end semester examination. **In question paper weightage of each module will be proportional to number of respective lecture hours as mention in the syllabus.**

1. Question paper will comprise of total six question
2. All question carry equal marks
3. Questions will be mixed in nature (for example supposed Q.2 has part (a) from module 3 then part (b) will be from any module other than module 3)
4. Only Four question need to be solved.

Course Code	Course Name	Credits
IE2017	IPR and Patenting	03

Objectives:

1. To understand intellectual property rights protection system
2. To promote the knowledge of Intellectual Property Laws of India as well as International treaty procedures
3. To get acquaintance with Patent search and patent filing procedure and applications

Outcomes: Learner will be able to…

1. understand Intellectual Property assets
2. assist individuals and organizations in capacity building
3. work for development, promotion, protection, compliance, and enforcement of Intellectual Property and Patenting

Module	Detailed Contents	Hr
01	**Introduction to Intellectual Property Rights (IPR)**: Meaning of IPR, Different category of IPR instruments - Patents, Trademarks,Copyrights, Industrial Designs, Plant variety protection, Geographical indications,Transfer of technology etc. **Importance of IPR in Modern Global Economic Environment:** Theories of IPR, Philosophical aspects of IPR laws, Need for IPR, IPR as an instrument of development	05
02	**Enforcement of Intellectual Property Rights:** Introduction, Magnitude of problem, Factors that create and sustain counterfeiting/piracy, International agreements, International organizations (e.g. WIPO, WTO) activein IPR enforcement **Indian Scenario of IPR:**Introduction, History of IPR in India, Overview of IP laws in India, Indian IPR, Administrative Machinery, Major international treaties signed by India, Procedure for submitting patent and Enforcement of IPR at national level etc.	07
03	**Emerging Issues in IPR:**Challenges for IP in digital economy, e-commerce, human genome,biodiversity and traditional knowledge etc.	05
04	**Basics of Patents:**Definition of Patents, Conditions of patentability, Patentable and non-patentable inventions, Types of patent applications (e.g. Patent of addition etc), Process Patent and Product Patent, Precautions while patenting, Patent specification Patent claims, Disclosures and non-disclosures, Patent rights and infringement, Method of getting a patent	07
05	**Patent Rules:** Indian patent act, European scenario, US scenario, Australia scenario, Japan scenario, Chinese scenario, Multilateral treaties where India is a member (TRIPS agreement, Paris convention etc.)	08
06	**Procedure for Filing a Patent (National and International):** Legislation and Salient Features, Patent Search, Drafting and Filing Patent Applications, Processing of patent, Patent Litigation, Patent Publicationetc, Time frame and cost, Patent Licensing, Patent Infringement	07

	Patent databases: Important websites, Searching international databases	

REFERENCE BOOKS:

1. Rajkumar S. Adukia, 2007, A Handbook on Laws Relating to Intellectual Property Rights in India, The Institute of Chartered Accountants of India
2. Keayla B K, Patent system and related issues at a glance, Published by National Working Group on Patent Laws
3. T Sengupta, 2011, Intellectual Property Law in India, Kluwer Law International
4. Tzen Wong and Graham Dutfield, 2010, Intellectual Property and Human Development: Current Trends and Future Scenario, Cambridge University Press
5. Cornish, William Rodolph & Llewelyn, David. 2010, Intellectual Property: Patents, Copyrights, Trade Marks and Allied Right, 7th Edition, Sweet & Maxwell
6. Lous Harns, 2012, The enforcement of Intellactual Property Rights: A Case Book, 3rd Edition, WIPO
7. Prabhuddha Ganguli, 2012, Intellectual Property Rights, 1st Edition, TMH
8. R Radha Krishnan & S Balasubramanian, 2012, Intellectual Property Rights, 1st Edition, Excel Books
9. M Ashok Kumar and mohd Iqbal Ali, 2-11, Intellectual Property Rights, 2nd Edition, Serial Publications
10. Kompal Bansal and Praishit Bansal, 2012, Fundamentals of IPR for Engineers, 1st Edition, BS Publications
11. Entrepreneurship Development and IPR Unit, BITS Pilani, 2007, A Manual on Intellectual Property Rights,
12. Mathew Y Maa, 2009, Fundamentals of Patenting and Licensing for Scientists and Engineers, World Scientific Publishing Company
13. N S Rathore, S M Mathur, Priti Mathur, Anshul Rathi**,** IPR: Drafting,Interpretation of Patent Specifications and Claims**,** New India Publishing Agency
14. Vivien Irish, 2005, Intellectual Property Rights for Engineers,IET
15. Howard B Rockman, 2004, Intellectual Property Law for Engineers and scientists, Wiley-IEEE Press

Assessment:

Internal:
Assessment consists of two tests out of which; one should be compulsory class test and the other is either a class test or at least 6 assignment on complete syllabus or course project.

End Semester Theory Examination:

Some guidelines for setting up the question paper. Minimum 80% syllabus should be covered in question papers of end semester examination. **In question paper weightage of each module will be proportional to number of respective lecture hours as mention in the syllabus.**

1. Question paper will comprise of total six question
2. All question carry equal marks
3. Questions will be mixed in nature (for example supposed Q.2 has part (a) from module 3 then part (b) will be from any module other than module 3)
4. Only Four question need to be solved.

Course Code	Course Name	Credits
IE2018	**Digital Business Management**	**03**

Objectives:

1. To familiarize with digital business concept
2. To acquaint with E-commerce
3. To give insights into E-business and its strategies

Outcomes: The learner will be able to …..

1. Identify drivers of digital business
2. Illustrate various approaches and techniques for E-business and management
3. Prepare E-business plan

Module	Detailed content	Hours
1	**Introduction to Digital Business-** Introduction, Background and current status, E-market places, structures, mechanisms, economics and impacts Difference between physical economy and digital economy, **Drivers of digital business**- Big Data & Analytics, Mobile, Cloud Computing, Social media, BYOD, and Internet of Things(digitally intelligent machines/services) Opportunities and Challenges in Digital Business,	09
2	**Overview of E-Commerce** **E-Commerce-** Meaning, Retailing in e-commerce-products and services, consumer behavior, market research and advertisement B2B-E-commerce-selling and buying in private e-markets, public B2B exchanges and support services, e-supply chains, Collaborative Commerce, Intra business EC and Corporate portals Other E-C models and applications, innovative EC System-From E- government and learning to C2C, mobile commerce and pervasive computing EC Strategy and Implementation-EC strategy and global EC, Economics and Justification of EC, Using Affiliate marketing to promote your e- commerce business, Launching a successful online business and EC project, Legal, Ethics and Societal impacts of EC	06

3	**Digital Business Support services**: ERP as e –business backbone, knowledge Tope Apps, Information and referral system **Application Development:** Building Digital business Applications and Infrastructure	06
4	**Managing E-Business**-Managing Knowledge, Management skills for e-business, Managing Risks in e –business Security Threats to e-business -Security Overview, Electronic Commerce Threats, Encryption, Cryptography, Public Key and Private Key Cryptography, Digital Signatures, Digital Certificates, Security Protocols over Public Networks: HTTP, SSL, Firewall as Security Control, Public Key Infrastructure (PKI) for Security, Prominent Cryptographic Applications	06
5	**E-Business Strategy**-E-business Strategic formulation- Analysis of Company's Internal and external environment, Selection of strategy, E-business strategy into Action, challenges and E-Transition (Process of Digital Transformation)	04
6	**Materializing e-business: From Idea to Realization**-Business plan preparation **Case Studies and presentations**	08

References:

1. A textbook on E-commerce**,** Er Arunrajan Mishra, Dr W K Sarwade,Neha Publishers & Distributors, 2011
2. E-commerce from vision to fulfilment, Elias M. Awad, PHI-Restricted, 2002
3. Digital Business and E-Commerce Management, 6th Ed, Dave Chaffey, Pearson, August 2014
4. Introduction to E-business-Management and Strategy, Colin Combe, ELSVIER, 2006
5. Digital Business Concepts and Strategy, Eloise Coupey, 2nd Edition, Pearson
6. Trend and Challenges in Digital Business Innovation, VinocenzoMorabito, Springer
7. Digital Business Discourse Erika Darics, April 2015, Palgrave Macmillan
8. E-Governance-Challenges and Opportunities in : Proceedings in 2nd International Conference theory and practice of Electronic Governance
9. Perspectives the Digital Enterprise –A framework for Transformation, TCS consulting journal Vol.5
10. Measuring Digital Economy-A new perspective -DOI:10.1787/9789264221796-enOECD Publishing

Assessment:

Internal:
Assessment consists of two tests out of which; one should be compulsory class test and the other is either a class test or at least 6 assignment on complete syllabus or course project.

End Semester Theory Examination:

Some guidelines for setting up the question paper. Minimum 80% syllabus should be covered in question papers of end semester examination. **In question paper weightage of each module will be proportional to number of respective lecture hours as mention in the syllabus.**

1. Question paper will comprise of total six question
2. All question carry equal marks
3. Questions will be mixed in nature (for example supposed Q.2 has part (a) from module 3 then part (b) will be from any module other than module 3)
4. Only Four question need to be solved.

Course Code	Course Name	Credits
IE2019	Environmental Management	03

Objectives:

1. Understand and identify environmental issues relevant to India and global concerns
2. Learn concepts of ecology
3. Familiarise environment related legislations

Outcomes: Learner will be able to…

1. Understand the concept of environmental management
2. Understand ecosystem and interdependence, food chain etc.
3. Understand and interpret environment related legislations

Module	Detailed Contents	Hrs
01	Introduction and Definition of Environment: Significance of Environment Management for contemporary managers, Career opportunities. Environmental issues relevant to India, Sustainable Development, The Energy scenario.	10
02	Global Environmental concerns : Global Warming, Acid Rain, Ozone Depletion, Hazardous Wastes, Endangered life-species, Loss of Biodiversity, Industrial/Man-made disasters, Atomic/Biomedical hazards, etc.	06
03	Concepts of Ecology: Ecosystems and interdependence between living organisms, habitats, limiting factors, carrying capacity, food chain, etc.	05
04	Scope of Environment Management, Role & functions of Government as a planning and regulating agency. Environment Quality Management and Corporate Environmental Responsibility	10
05	Total Quality Environmental Management, ISO-14000, EMS certification.	05
06	General overview of major legislations like Environment Protection Act, Air (P & CP) Act, Water (P & CP) Act, Wildlife Protection Act, Forest Act, Factories Act, etc.	03

REFERENCES:

1. Environmental Management: Principles and Practice, C J Barrow, Routledge Publishers London, 1999
2. A Handbook of Environmental Management Edited by Jon C. Lovett and David G. Ockwell, Edward Elgar Publishing
3. Environmental Management,**T V Ramachandra and Vijay Kulkarni, TERI Press**
4. Indian Standard Environmental Management Systems — Requirements With Guidance For Use, Bureau Of Indian Standards, February 2005
5. Environmental Management: An Indian Perspective, S N Chary and Vinod Vyasulu, Maclillan India, 2000

6. Introduction to Environmental Management, Mary K Theodore and Louise Theodore, CRC Press
7. Environment and Ecology, Majid Hussain, 3rd Ed. Access Publishing.2015

Assessment:

Internal:
Assessment consists of two tests out of which; one should be compulsory class test and the other is either a class test or assignment on live problems or course project.

End Semester Theory Examination:
Some guidelines for setting up the question paper. Minimum 80% syllabus should be covered in question papers of end semester examination. **In question paper weightage of each module will be proportional to number of respective lecture hours as mention in the syllabus.**

1. Question paper will comprise of total six question
2. All question carry equal marks
3. Questions will be mixed in nature (for example supposed Q.2 has part (a) from module 3 then part (b) will be from any module other than module 3)
4. Only Four question need to be solved.

8. Introduction to Environmental Management, Mary K Theodore and Louise Theodore, CRC Press
9. Environment and Ecology, Majid Hussain, 3rd Ed. Access Publishing.2015

Assessment:

Internal:
Assessment consists of two tests out of which; one should be compulsory class test and the other is either a class test or assignment on live problems or course project.

End Semester Theory Examination:
Some guidelines for setting up the question paper. Minimum 80% syllabus should be covered in question papers of end semester examination. **In question paper weightage of each module will be proportional to number of respective lecture hours as mention in the syllabus.**

5. Question paper will comprise of total six question
6. All question carry equal marks
7. Questions will be mixed in nature (for example supposed Q.2 has part (a) from module 3 then part (b) will be from any module other than module 3)
8. Only Four question need to be solved.

\I	**Process Models**	Generic process Model, Prescriptive process model, Specialized process model.	**4**
II	**Agile development**	What is agile process, Extreme programming, ASD, Scrum, DSDM, Crystel FDD, LSD, AM, AUP	**4**
III	**Principles that guide practice and Understanding requirements**	Core principles, principles thar guide framework activities, Requirements engineering, establishing groundwork, eliciting requirements, building requirements model, negotiating requirements, Validating requirements.	**4**
IV	**Architectural Design**	Software architecture, Architectural genres, Architectural styles, Architectural design, Design patterns, Pattern based software design, Architectural patterns, User interface design patterns.	**8**
V	**Quality Management**	Quality concepts, Review techniques, Software quality assurance, testing strategies, Formal modeling, and verification, product metrics.	**8**
VI	**Software process improvement**	What is SPI, The SPI process, CMMI, SPI frameworks, SPI ROI, SPI trends, cleanroom software engineering	**8**

Textbook

2. Software Engineering, A Practitioner's Approach, Seventh Edition, Roger s.

Pressman

Reference Book.

3. An integrated approach to Software Engineering, Pankaj Jalote
4. Software Engineering, Tenth Edition, Ian Sommerville

Assessment

Internal: Assessment consists of two tests out of which; one should be compulsory class test (on minimum 03 Modules) and the other is either a class test or assignment or seminar or paper reading.

End Semester Examination: End semester examination will be on complete syllabus for 80 marks.