CIRCULAR:-

A reference is invited to the syllabi relating to the Master of Engineering (Information Technology) degree course **vide** this office Circular No.UG/35 of 2013-14, dated 23rd May, 2013 and the Principals of affiliated Colleges in Engineering are hereby informed that the recommendation made by Ad-hoc Board of Studies in Electrical Engineering at its meeting held on 8th July, 2016 has been accepted by the Academic Council at its meeting held on 14th July, 2016 **vide** item No. 4.23 and that in accordance therewith, the revised syllabus as per Choice Based Credit System for Master of Engineering (Information Technology) (Sem. I & II), which is available on the University's web site (www.mu.ac.in) and that the same has been brought into force with effect from the academic year 2016-17.

MUMBAI – 400 032   (Dr.M.A.Khan)
9 November, 2016   REGISTRAR

To,

The Principals of affiliated Colleges in Engineering.

A.C/ 4.23/14/07/2016.

****

No. UG/149A of 2016   MUMBAI-400 032   9 November, 2016

Copy forwarded with compliments for information to:-

1. The Dean, Faculty of Technology,
2. The Chairmen, Ad-hoc Board of the Studies in Electrical Engineering,
3. The Director, Board of College and University Development,
4. The Controller of Examinations,
5. The Co-Ordinator, University Computerization Centre.

(Dr.M.A.Khan)
REGISTRAR
… PTO

UNIVERSITY OF MUMBAI

Syllabus for the

M. E. (Information Technology)
Revised 2016

Choice Based Credit and Grading System

(As per Choice Based Credit and Grading System with effect from the academic year 2016–2017)

From Co-ordinator's Desk:-

To meet the challenge of ensuring excellence in engineering education, the issue of quality needs to be addressed, debated taken forward in a systematic manner. Accreditation is the principal means of quality assurance in higher education. The major emphasis of accreditation process is to measure the outcomes of the program that is being accredited. In line with this Faculty of Technology of University of Mumbai has taken a lead in incorporating philosophy of outcome based education in the process of curriculum development.

Faculty of Technology, University of Mumbai, in one of its meeting unanimously resolved that, each Board of Studies shall prepare some Program Educational Objectives (PEO's) give freedom to affiliated Institutes to add few (PEO's) course objectives course outcomes to be clearly defined for each course, so that all faculty members in affiliated institutes understand the depth approach of course to be taught, which will enhance learner's learning process. It was also resolved that, maximum senior faculty from colleges experts from industry to be involved while revising the curriculum. I am happy to state that, each Board of studies has adhered to the resolutions passed by Faculty of Technology, developed curriculum accordingly. In addition to outcome based education, **Choice Based Credit and Grading System** is also introduced to ensure quality of engineering education.

Choice Based Credit and Grading System enables a much-required shift in focus from teacher-centric to learner-centric education since the workload estimated is based on the investment of time in learning not in teaching. It also focuses on continuous evaluation which will enhance the quality of education. University of Mumbai has taken a lead in implementing the system through its affiliated Institutes Faculty of Technology has devised a transparent credit assignment policy adopted ten points scale to grade learner's performance. Credit grading based system was implemented for First Year of Engineering from the academic year 2016-2017. Subsequently this system will be carried forward for Second Year Engineering in the academic year 2017-2018, for Third Year Final Year Engineering in the academic years 2018-2019, 2019-2020, respectively.

Dr. S. K. Ukarande

Co-ordinator,

Faculty of Technology,

Member - Academic Council

University of Mumbai, Mumbai

Preamble

It is an honor and a privilege to present the revised syllabus of Master of Engineering in Information Technology (effective from year 2016-17) with inclusion of cutting edge technology.

Information Technology is comparatively a young branch among other engineering disciplines in University of Mumbai. It is evident from the placement statistics of various colleges affiliated to University of Mumbai that IT branch has taken the lead in the placement. The branch also provides multi-faceted scope like better placement and promotion of entrepreneurship culture among students, and increased Industry Institute Interactions.

It has been observed that graduate engineers having work experience in IT industry would prefer to pursue their post graduate studies in IT in spite of having done their graduation degree in any branch .

Keeping these aspects in mind, University of Mumbai has designed postgraduate courses as per current requirements of IT industry.

The syllabus is peer reviewed by experts from reputed industries and as per their suggestions it covers future trends in IT technology and research opportunities available due to these trends.

I would like to thank senior faculties of IT department of all colleges affiliated to Mumbai University for significant contribution in framing the syllabus. Also behalf of all faculties I thank all the industry experts for their valuable feedback and suggestions.

I sincerely hope that the revised syllabus will help all post graduate engineers to face the future challenges in the field of information and technology

Program Outcome for Postgraduate Program in Information Technology
1.   Apply Core Information Technology knowledge to develop stable and secure IT system
2.   Design, IT infrastructures for an enterprise using concepts of best practices in information Technology management and security to enterprise processes.
3.   Manage IT projects using written and oral communication skills in collaborative environments by Participating on teams that address solutions for IT management challenges.
4.   Identify and discuss professional, individual, organizational, societal, and regulatory implications of Information systems and technology.
5.   Assess Security of the IT Systems and able to respond to any breach in IT system
6.   Ability to work in multidisciplinary projects and make it IT enabled.
7.   Ability to propose the system to reduce carbon footprint.
8.   Ability to adapt the lifelong learning process to be in sync with trends in Information Technology

Dr. Deven Shah

Chairman (Ad-hoc Board Information Technology)

University of Mumbai)

Program Structure for
ME Information Technology
Mumbai University
(With Effect from 2016-2017)

Semester I

Subject Code	Subject Name	Teaching Scheme (Contact Hours)			Credits Assigned			
		Theory	Pract.	Tut.	Theory	Pract.	Tut.	Total
ME-ITC101	Data Science	04	--	--	04	--	--	04
ME-ITC102	IT Infrastructure Design	04	--	--	04	--	--	04
ME-ITC103	Advances in Software Engineering	04	--	--	04	--	--	04
ME-ITDLOC-I104	Department Level Optional Course-I	04	--	--	04	--	--	04
ME-ITILOC-I105	Institute Level Optional Course-I	03	--	--	03	--	--	03
ME-ITL101	Laboratory-I	--	02	--	--	01	--	01
ME-ITL102	Laboratory-II	--	02	--	--	01	--	01
Total		**19**	**04**	**--**	**19**	**02**	**--**	**21**

Subject Code	Subject Name	Examination Scheme							
		Theory					Term Work	Pract./ oral	Total
		Internal Assessment			End Sem.Exam.	Exam Duration (hrs)			
		Test1	Test 2	Avg.					
ME-ITC101	Data Science	20	20	20	80	3	--	--	100
ME-ITC102	IT Infrastructure Design	20	20	20	80	3	--	--	100
ME-ITC103	Advances in Software Engineering	20	20	20	80	3	--	--	100
ME-ITDLOC-I104	Department Level Optional Course-I	20	20	20	80	3	--	--	100
ME-ITILOC-I105	Institute Level Optional Course-I	20	20	20	80	3	--	--	100
ME-ITL101	Laboratory-I	--	--	--	--		25	25	50
ME-ITL102	Laboratory-II	--	--	--	--		25	25	50
Total		**100**	**100**	**100**	**400**		**50**	**50**	**600**

 # Department Level Optional Course (DLOC)

Every student is required to take one Department Elective Course for Semester I and Semester II. Different sets of courses will run in both the semesters. Students can take these courses from the list of department electives, which are closely allied to their disciplines.

 # Institute Level Optional Course (ILOC)

Every student is required to take one Institute Elective Course for Semester I and Semester II, which is not closely allied to their disciplines. Different sets of courses will run in the both the semesters.

Subject Code	Department Level Optional Course (DLOC)	Subject Code	Institute Level Optional Course (ILOC)
Semester I			
ME-ITDLOC-I1041	User Experience Engineering	ME-ITILOC-I1051	Product Lifecycle Management
ME-ITDLOC-I1042	Adhoc Networks	ME-ITILOC-I1052	Reliability Engineering
ME-ITDLOC-I1043	Cloud Computing	ME-ITILOC-I1053	Management Information System
ME-ITDLOC-I1044	IT Strategy	ME-ITILOC-I1054	Design of Experiments
ME-ITDLOC-I1045	Knowledge Management	ME-ITILOC-I1055	Operation Research
		ME-ITILOC-I1056	Cyber Security and Laws
		ME-ITILOC-I1057	Disaster Management and Mitigation Measures
		ME-ITILOC-I1058	Energy Audit and Management

Semester II

Subject Code	Subject Name	Teaching Scheme (Contact Hours)			Credits Assigned			
		Theory	Pract.	Tut.	Theory	Pract.	Tut.	Total
ME-ITC201	Security & Risk Management	04	--	--	04	--	--	04
ME-ITC202	High Performance Computing	04	--	--	04	--	--	04
ME-ITC203	Advance web technology	04	--	--	04	--	--	04
ME-ITDLOC-II204	Department Level Optional Course-I	04	--	--	04	--	--	04
ME-ITILOC-II205	Institute Level Optional Course-I	03	--	--	03	--	--	03
ME-ITL201	Laboratory-III	--	02	--	--	01	--	01
ME-ITL202	Laboratory-IV	--	02	--	--	01	--	01
Total		**19**	**04**	**--**	**19**	**02**	**--**	**21**

Subject Code	Subject Name	Examination Scheme							
		Theory							
		Internal Assessment			End Sem.Exam.	Exam Duration (hrs)	Term Work	Pract./oral	Total
		Test1	Test 2	Avg.					
ME-ITC201	Security & Risk Management	20	20	20	80	3	--	--	100
ME-ITC202	High Performance Computing	20	20	20	80	3	--	--	100
ME-ITC203	Advance web technology	20	20	20	80	3	--	--	100
ME-ITDLOC-II204	Department Level Optional Course-I	20	20	20	80	3	--	--	100
ME-ITILOC-II205	Institute Level Optional Course-I	20	20	20	80	3	--	--	100
ME-ITL201	Laboratory-III	--	--	--	--		25	25	50
ME-ITL202	Laboratory-IV	--	--	--	--		25	25	50
Total		**100**	**100**	**100**	**400**		**50**	**50**	**600**

 # Department Level Optional Course (DLOC)

Every student is required to take one Department Level Optional Course for Semester I and Semester II. Different sets of courses will run in both the semesters. Students can take these courses from the list of department electives, which are closely allied to their disciplines.

 # Institute Level Optional Course (ILOC)

Every student is required to take one Institute Level Optional Course for Semester I and Semester II, which is not closely allied to their disciplines. Different sets of courses will run in the both the semesters.

Subject Code	Department Level Optional Course (DLOC)	Subject Code	Institute Level Optional Course (ILOC)
		Semester II	
ME-ITDLOC-II2041	E-Business & Social Network Analysis	ME-ITILOC-II2051	Project Management
ME-ITDLOC-II2042	AI & Machine Learning	ME-ITILOC-II2052	Finance Management
ME-ITDLOC-II2043	Ethical Hacking & Forensic	ME-ITILOC-II2053	Entrepreneurship Development and Management
ME-ITDLOC-II2044	Internet of Things	ME-ITILOC-II2054	Human Resource Management
ME-ITDLOC-II2045	Advanced Software Quality Assurance	ME-ITILOC-II2055	Professional Ethics and CSR
		ME-ITILOC-II2056	Research Methodology
		ME-ITILOC-II2057	IPR and Patenting
		ME-ITILOC-II2058	Digital Business Management
		ME-ITILOC-II2059	Environmental Management

Semester III

Subject Code	Subject Name	Teaching Scheme (Contact Hours)			Credits Assigned			
		Theory	Pract.	Tut.	Theory	Pract.	Tut.	Total
ME-ITS301	Seminar	--	06	--	--	03	--	03
ME-ITD301	Dissertation 1	--	24	--	--	12	--	12
Total		**--**	30	--	--	15	--	15

Subject Code	Subject Name	Examination Scheme						
		Theory				Term Work	Oral.	Oral
		Internal Assessment			End Sem.Exam.			
		Test1	Test 2	Avg.				
ME-ITS301	Seminar	--	--	--	--	50	50	100
ME-ITD301	Dissertation 1	--	--	--	--	100	--	100
Total		**--**	**--**	**--**	**--**	**150**	**50**	**200**

Semester IV

Subject Code	Subject Name	Teaching Scheme (Contact Hours)			Credits Assigned			
		Theory	Pract.	Tut.	Theory	Pract.	Tut.	Total
ME-ITD401	Dissertation II	--	30	--	--	15	--	15
Total		--	30	--	--	15	--	15

Subject Code	Subject Name	Examination Scheme						
		Theory				Term Work	Oral	Total
		Internal Assessment			End Sem.Exam.			
		Test1	Test 2	Avg.				
ME-ITD401	Dissertation II	--	--	--	--	100	100	200
Total		--	--	--	--	100	100	200

* The Term Work and Oral of Project II of Semester IV should be assessed jointly by the pair of Internal and External Examiners

Note- The Contact Hours for the calculation of load of teacher are as follows
Seminar   - 01 Hour / week / student
A project I and II - 02 Hour / week / student

End Semester Examination: In all, six questions to be set, each of 20 marks, out of these any four questions to be attempted by students. Each question will comprise of mixed questions from different units of the subjects.

Subject Code	Subject Name	Credits
ME-ITC101	**Data Science**	**04**

Course Objectives:

- Provide Insights about the Roles of a Data Scientist and enable to analyze the Big Data.
- Understand the principles of Data Science for the data analysis and learn cutting edge tools and techniques for data analysis.
- Figure Out Machine Learning Algorithms.
- Learn business decision making and Data Visualization

Course Outcomes:

The student should be able:

- Demonstrate knowledge of statistical and exploratory data analysis data analysis techniques utilized in decision making.
- Apply principles of Data Science to the analysis of business problems.
- To use Machine Learning Algorithms to solve real-world problems.
- To provide data science solution to business problems and visualization.

Prerequisite: fundamentals of data base, basic programming skills

Sr. No.	Module	Detailed Content	Hours
	Prerequisite	Relational database, KDD process, Introduction to BIG data, What is Hadoop, Core components of Hadoop, Hadoop ecosystem.	**3**
I	An Introduction to Data Science	Definition, working, benefits and uses of Data Science, Data science vs BI, The data science process, Role of a Data Scientist,	**4**
II	Statistical Data Analysis & Inference	Populations and samples, Statistical modeling, probability distributions, fittings a model, Statistical methods for evaluation, Exploratory Data Analysis, Getting started with R, Manipulating and Processing data in R , working with function in R , Working with descriptive Statistics, Working with graph plot in R.	**8**
III	Learning Algorithms	k-nearest neighbor, Simple and multiple Linear Regression, Logistic Regression, Support vector machine, Model-Based Clustering, Clustering High-Dimensional Data,	**12**
IV	Data Visualization	Data Visualization basics, techniques, types, applications, tools, Data Journalism, Interactive dashboards,	**8**
V	Advance Analytical Methods	Text Analysis- Text analysis steps, A text analysis example, Collecting raw text and representing text, TF and TFIDF, Categorizing documents by topics, determining	**8**

		sentiments, Time series analytics- overview, ARIMA model,	
VI	Business problems and data science solutions	Data Science and Business Strategy: Thinking Data-Analytically, Redux, Competitive Advantage with Data Science, Data Science Case Studies, Case Study: Global Innovation Network and Analysis.	**5**

Text Books:

1. Data science and big data analytics, EMC

2. Doing Data Science, *Rachel Schutt and Cathy O'Neil*

3. Introducing Data Science, Davy Cielen

4. Data Science for Business, Foster Provost and Tom Fawcett, O'Reilly. Copyright © 2013

References:

1. Regression Analysis by Example,

2. Data Mining Concepts and Techniques, Third Edition, Jiawei Han, Micheline Kamber, Jian Pei, Morgan Kaufmann

3. An Introduction to Statistical Learning with Applications in R , Gareth James • Daniela Witten • Trevor Hastie, Robert Tibshirani, Springer

List of Experiments : based on Laboratory Practical's/ Case studies

1. Exploratory Data Analysis and regression using R.

2. Text Analysis using R

3. Business problem : Data science solution.

Assessment:

Internal:	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 the end semester examination.

Subject Code	Subject Name	Credits
ME-ITC102	**IT Infrastructure Design**	**04**

Course Objective:
- Provide knowledge of Enterprise wide Network Design.
- Provide Knowledge of Data center design includes Storage network
- Give insight into the implementation of SDN and how it will impact current Design practice
- Understand latest trend in SDN

Course Outcome: Students should be able to
- Design Enterprise wide network design considering various QoS Parameter
- Explain the design challenge of large scale data center
- Implementation of SDN and how it will impact current Design practice
- explain latest trend in SDN

Prerequisite: Basic knowledge of Networking techniques.

Module	Detailed content	Hours
Prerequisite	- Basic of Networking Topology - OSI Layer Basics - Basics of Internetworking Devices	3
I	Enterprise Network Design: Understanding Network Requirement analysis, Architecture and Design Process Network Architecture: Component Architecture –Routing, Network Management, Performance, Security. Architectural models: topological, flow model, Functional model Addressing And Routing Architecture, Network Management Architecture, Performance Architecture Border less Network Architecture. Network Design: Designing the network topology and solutions-Top Down Approach Network Structure Model: Hierarchical Network Model, Enterprise wide network Architecture model- Enterprise Edge Area. E-commerce, Internet Connectivity to remote, enterprise branch and enterprise Data center module. High Availability Network Services- Workstation to Router redundancy and LAN High Availability protocols, Route, Server Redundancy, Load Balancing., link Media Redundancy.	8
II.	Enterprise LAN Design: Ethernet Design Rule. 100 Mbps Fast Ethernet Design rules, gigabit Ethernet Design Rules, 10 Gigabit Ethernet Design rules, 10GE Media types Understanding Working of Repeater, hub, Bridge, routers, Layer2/3 Switch Campus LAN Design Best Practice Server Farm Design, DMZ design. Campus LAN QoS consideration Multicast Traffic Consideration	6
III.	Data Center Design: Architecture Consideration: Infrastructure Model, Service Layers Model of Cloud computing. Cloud Reference Architecture Framework, Cloud Data Center Building Blocks. Cloud Data Center Technology Architecture Trust in Cloud Data Center The elements of cloud visibility The elements of cloud protection Cloud Control, Compliance and SLA. Telecommunications Infrastructure Standard for Data Centers ANSI/TIA-942 Telecommunications Infrastructure Standard for Data Centers ,	10

	NSI/NECA/BICSI-002 Data Center Design and Implementation Best Practices

Purpose of TIA-942 Design Elements - Cabling Design, Facility Design, Network Design.

Relationship of Spaces, Data Center Topology Data Center Tiers Basic Data Center Design Example. | |
IV.	Enterprise Wireless LAN Architecture: Components of Centralize Architecture: understanding 802.11X standards, LWAPP WLAN Controller. WLAN technologies (Narrow Band, Spread Spectrum, FHSS, DSS) and topologies, Wireless Network Components: Access Point and NICs, Router etc; WLAN enterprise design, WLAN performance, WLAN monitoring and troubleshooting, WLAN security. Intra and inter controller roaming.	5
V.	SAN: Need for storage Network, Data Protection and RAID, Storage Network Architecture and IP storage, Storage Network Backup and Recovery, Storage and Network in Storage Network, Software for Storage Network, Adopting and Managing SAN.	7
VI.	Software Defined Network : Understanding SDN and Open Flow : SDN – Network Virtualization Techniques, SDN Building Blocks, OpenFlow messages – Controller to Switch, Symmetric and Asynchronous messages, Implementing OpenFlow Switch, OpenFlow controllers , PoX and NoX, NetApp Development on top of SDN, Open Flow in Cloud Computing. Case study: how SDN changed Traditional Enterprise network Design	9

References:

1. Network Analysis, Architecture, and Design 3rd Edition, Morgan Kaufman, James D.
2. CCDA Cisco official Guide
3. Cisco Cloud Computing - Data Center Strategy, Architecture, and Solutions by Kapil Bakshi - Cisco Systems White paper
4. https://en.wikipedia.org/wiki/TIA-942
5. "Data Center Top-of-Rack Architecture Design" . *White paper*. Cisco Systems. April 18, 2011. Retrieved July 10, 2013.
6. Software Defined Networking with Open Flow : PACKT Publishing Siamak Azodolmolky

7. Storage Network Management and Retrieval by Dr. Vaishali Khairnar, Nilima Dongre, Wiley India

8. Storage Networks explained by Ulf Troppen, wiley publication

9. Storage Area Network Essentials: A Complete Guide to Understanding and Implementing SANs by Richard Barker, Paul Massiglia, Wiley India

List of Experiments: based on Laboratory Practical's/ Case studies

1. Design on Enterprise LAN.
2. Design on Enterprise Wireless LAN.
3. Case study on SAN and RAID.

Assessment:

Internal: 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 the end semester examination.

Subject Code	Subject Name	Credits
ME-ITC103	**Advances in Software Engineering**	**04**

Course Objectives: Objectives of this course include:

1. To learn and understand the principles of Software Engineering

2. To Learn and understand Software Development Life Cycle

3. To apply Project Management and Requirement analysis principles to S/W project development..

4. To apply Design and Testing principles to S/W project development.

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

1. Compare and chose a process model for a software project development.

2. Analyze and model software requirements of a software system

3. Design and Modeling of a software system with tools

4. Prepare the SRS, Design document, Project plan of a given software system

Prerequisite: Any programming language

DETAILED SYLLABUS:

Sr. No.	Module	Detailed Content	Hours
	Prerequisite	Nature of Software, Software Definition, Software characteristics, Software Application Domains, Software Myths, Software Engineering Practice	**03**
I	Nature of Software	Software Engineering, The Software Process, A Generic Process Model, Prescriptive Process Models: The Waterfall Model, Incremental Process Models, Evolutionary Process Models, Concurrent Models, Specialized Process Models, The Formal Methods Model, The Unified Process Personal, Agility Principles , Extreme Programming (XP), Scrum, Introduction to Clean Room Software Engineering	**06**
II	Requirements Engineering	Requirements Engineering, Eliciting Requirements, Collaborative Requirements Gathering, Quality Function Deployment, Usage Scenarios, Elicitation Work Products, Developing Use Cases, Building the Requirements Model, Negotiating Requirements, Validating Requirements, Analysis: Scenario-Based Modeling, UML Models, Developing an Activity Diagram, Swim-lane Diagrams, Class-Based Modeling, Requirements Modeling Strategies: Flow Oriented Modeling, Creating a Behavioral Patterns for Requirements Modeling, State Machine Diagram with orthogonal states, Requirements Modeling for Web Apps,	**08**

		SRS	
III	Design Methods and Models	The Design Process, Concepts of design, Design Quality, Design Principles, Object-Oriented Design Concepts, Design Classes, The Design Model and elements, Software Architecture, Importance, Architectural Styles, Architectural Design, Assessing Alternative Architectural Designs, using Architectural Styles in Designs, Component Design, Class-Based Components, Conducting Component Level Design, Component-Level Design for WebApps, User Interface Design, The Golden Rules, User Interface Analysis and Design, Interface Analysis Interface Design Steps, WebApp Interface Design, Design Evaluation, Design Document, Modifiability: SAAM Method, ATAM Method, The HASARD Method.	**08**
IV	Testing Principles	Principles A Strategic Approach to Software Testing, Strategic Issues, Test Conventional Software, Test Strategies for Object-Oriented Software, Test Strategies for WebApps, Validation Testing, System Testing, The Art of Debugging, Software Testing Fundamentals, White-Box Testing , Basis Path Testing, Control Structure Testing, Black-Box Testing, Model-Based Testing, Testing for Specialized Environments, Architectures, Object-Oriented Testing Strategies, Object-Oriented Testing Methods, Test Cases and the Class Hierarchy, Testing Concepts for WebApps, Testing Process—An Overview, User Interface Testing , Test plan, Positive Testing Negative Testing	**06**
V	Project Planning and management	The Management Spectrum, Software Scope, Problem Decomposition, Process Decomposition , Process and project metrics, Size-Oriented Metrics, Function Oriented Metrics, Reconciling LOC and FP Metrics, Object-Oriented Metrics, Integrating Metrics within the Software Process, Software Project Estimation, Decomposition, Process-Based Estimation, Estimation with Use Cases, Empirical Estimation Models, The Structure of Estimation Models, The COCOMO II Model , Project scheduling: Basic Concepts, Defining a Task Set for the Software Project , Scheduling : Tracking the Schedule, Earned Value Analysis Risk management: Reactive versus Proactive Risk Strategies, Risk Identification, Assessing Overall Project Risk, Risk Projection, Developing a Risk Table, Assessing Risk, Project Plan	**11**
VI	Advanced Trends in Software Engineering	Introduction to Formal Specification Languages : Object Constraint Language (OCL), Z Specification Language, Software reuse, Distributed software engineering, Service-oriented architecture, Embedded software, Aspect-oriented software engineering, Introduction to DevOps, Docker, Github.	**06**

Text Books:

1. Roger S Pressman "Software Engineering : A Practitioner's Approach " 7th Edition Mcgraw-Hill ISBN:0073375977
2. Ian Sommerville " Software Engineering" 9th edition Pearson Education SBN-13: 978-0- 13-703515-1, ISBN-10: 0-13-703515-2

3. Hong Zhu "Software Design Methodology", Elsevier ISBN: 978-81-312-0356-9

References:

1. Pankaj Jalote " An Integrated Approach to Software Engineering" 3rd Edition Narosa Publication ISBN: 81-7319-702-4

2. Rajib Mall " Fundamentals of Software Engineering" 3rd edition PHI.

3. Pfleejer " Software Engineering- Theory and Practice" 4th edition
4. Martin Fowler "Distilled UML" 3rd edition Stephen H. Kan, "Metrics and Models in Software Quality Engineering", 2nd Edition, Pearson, 2003
5. 5. Hans Van Vilet "Software Engineering Principles and Practice" 3rd edition Wiley

6. Devops.com

List of Experiments: based on Laboratory Practical's

1. Introduction to DevOps, Docker, Github (The tools can be used to implement practical)

2. Technical paper reading. Student will read any technical paper in software engineering and explain its contents to the class.

3. Development of one software project with following deliverables

    a. Analysis Model

    b. Design Model

    c. Working application

    d. Test case Design

    e. RMMM plan

Assessment:

Internal: 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.

Subject Code	Subject Name	Credits
ME-ITDLOC-I1041	**User Experience Engineering**	**04**

Course Objectives :
1 To stress the importance of a User Experience Engineering (UXE).
2 To Learn User Experience Engineering (UXE) Process.
3 To understand how to design Effective and Efficient User Interfaces for intended users.
4 To Learn techquies for Prototyping and Evaluating User Experiences.

Course Outcomes:
1 Understand importance of User Experience (UX).
2 Gain and apply knowledge of the theoretical frameworks, methodological approaches, and problems solving techniques related to user experience design.
3 Criticize existing interface designs, and improve them.
4 Design complete application with end-to-end understanding of current UXE best practices and processes.

Pre-requisites: Web Technologies; Software Engineering; Experience in designing interfaces for applications and web sites. Basic knowledge of designing tools and languages like HTML, Java, etc.

"User experience engineering (UXE)" -describe a structured research, design, and evaluation process whose goal is to make user interactions with a product or service easy, efficient, and enjoyable. It evolved from usability engineering and applies psychological principles and methodologies.

DETAILED SYLLABUS:

Sr. No.	Module	Detailed Content	Hours
	Pre-requisites	HCI and Usability, Usability Paradigms and Usability Principles, User Interface Design Tools.	3
I	Introduction	What is UX, Ubiquitous interaction, Emerging desire for usability, From usability to user experience, Emotional impact as part of the user experience, User experience needs a business case, Roots of usability.	6
II	The Wheel: A Lifecycle Template	Introduction, A UX process lifecycle template, Choosing a process instance for your project, The system complexity space, Meet the user interface team, Scope of UX presence within the team, More about UX lifecycles.	6
III	Contextual Inquiry: Eliciting Work Activity Data	Introduction, The system concept statement, User work activity gathering, Look for emotional aspects of work practice, Abridged contextual inquiry process, Data-driven vs. model-driven inquiry, History. ,Contextual Analysis, Extracting Interaction Design Requirements, Constructing Design-Information Models.	10
IV	Design Thinking, Ideation, and Sketching, Prototyping	Introduction, Design paradigms, Design thinking, Design perspectives, User personas, Ideation, Sketching, More about phenomenology, Mental Models and Conceptual Design, Wireframe, Prototyping	10
V	UX Evaluation, The Interaction	UX Goals, Metrics and Targets, UX Evaluation Techniques.- Formative vs summative ,Analysis.	8

	Cycle and the User Action Framework	Introduction, 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.	
VI	UX Design Guidelines	Introduction, Using and interpreting design guidelines, Human memory limitations, Selected UX design guidelines and examples, Planning, Translation, Physical actions, Outcomes, Assessment, Overall.	5

Text Books:

1. The UX Book by Rex Hartson and Pardha Pyla

2. Smashing UX Design by Jesmond Allen and James Chudley

3. Lean UX: Applying Lean Principles to Improve User Experience by Jeff Gothelf and Josh Seiden

4. Don't Make Me Think, Revisited by Steve Krug

5. The User Experience Team of One by Leah Buley

6. The Elements of User Experience by Jesse James Garrett

7. Sketching User Experiences: The Workbook by Saul Greenberg, Sheelagh Carpendale, Nicolai Marquardt and Bill Buxton

References:

1. A Project Guide to UX Design by Russ Unger and Carolyn Chandler

2. Agile Experience Design by Lindsay Ratcliffe and Marc McNeill

3. Universal Principles of Design by William Lidwell, Kritina Holden and Jill Butler

4. Human Computer Interaction by Alan Dix

Lab Practical's: For any Case Study perform following practicals:-
Sr.No.   Description

1. **Indentify and describe the objectives for UXE project-**

    a. Perform user research

    b. User requirement collection

    c. User Requirement Analysis

    d. Create User personas, user scenarios , customer journey maps etc

2. **UX Design –**

    a. Conceptual Design- Site Maps

    b. Create Wireframe

    c. Create Prototype

3. **UX Evaluation**

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a. Set UX Goals

b. Perform UX Evaluation and Reporting

Assessment:

Term work consists of any two case studies or mini project covering the above syllabus.

Internal :　　　　　　　　　　Internal assessment will be of **20** marks .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: Theory paper will be of **80** marks. 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.

Subject Code	Subject Name		Credits
ME-ITDLOC-I1042	**Ad-hoc Networks**		**04**

Course Objectives:

1. Understand the basic concepts of ad-hoc networks

2. Explain the basics of mobile telecommunication system

3. Be familiar with network protocol stack

4. Gain knowledge of different mobile platforms and application development

Course Outcomes:

1. Explain the basic concepts of ad-hoc networks

2. Explain the basics of mobile telecommunication system

3. Identify the network protocol stack

4. Develop different mobile application using different platform.

Prerequisite: Network, Operating System, Wireless Technology

DETAILED SYLLABUS:

Sr. No.	Module	Detailed Content	Hours
	Prerequisite:	Introduction – Fundamentals of Wireless Communication Technology – The Electromagnetic Spectrum – Radio Propagation Mechanisms.	**3**
I	**Introduction**	Wireless Network. Characteristics of the Wireless channel. Cellular and Ad-Hoc Wireless Networks, Applications of Ad-Hoc Wireless Networks/MANET/Wireless Sensor Network/VANET. Challenges for Wireless Sensor Networks, Enabling Technologies for Wireless Sensor Networks. Mobility, Hidden and Exposed terminal Problems, Characteristics of an Ideal Routing Protocol for Ad-Hoc Wireless Networks	**7**
II	**Medium access protocols**	MAC Protocols: design issues, goals and classification. Contention based protocols- with reservation, scheduling algorithms, protocols using directional antennas. IEEE standards: 802.11a, 802.11b, 802.11g, 802.11p, 802.15. HIPER LAN	**8**
III	**Ad hoc routing protocols**	Introduction – Issues in Designing a Routing Protocol for Ad Hoc Wireless Networks – Classifications of Routing Protocols – Table–Driven Routing Protocols – Destination Sequenced Distance Vector (DSDV) – Wireless Routing Protocol (WRP) – Cluster Switch Gateway Routing (CSGR) – Source–Initiated On–Demand Approaches – Ad hoc On–Demand Distance Vector Routing (AODV) – Dynamic Source Routing (DSR) –Temporally Ordered Routing Algorithm (TORA) – Signal Stability Routing (SSR) – Location–Aided Routing (LAR) – Power–Aware Routing	**8**

		(PAR) – Zone Routing Protocol (ZRP).	
IV	**Multicast routing in ad-hoc networks**	Introduction – Issues in Designing a Multicast Routing Protocol – Operation of Multicast Routing Protocols – An Architecture Reference Model for Multicast Routing Protocols –Classifications of Multicast Routing Protocols – Tree–Based Multicast Routing Protocols– Mesh–Based Multicast Routing Protocols – Summary of Tree and Mesh based Protocols – Energy–Efficient Multicasting – Multicasting with Quality of Service Guarantees – Application – Dependent Multicast Routing – Comparisons of Multicast Routing Protocols.	**8**
V	**Transport layer– security protocols**	Introduction – Issues in Designing a Transport Layer Protocol for Ad hoc Wireless Networks – Design Goals of a Transport Layer Protocol for Ad hoc Wireless Networks – Classification of Transport Layer Solutions – TCP over Ad hoc Wireless Networks – Other Transport Layer Protocols for Ad hoc Wireless Networks – Security in Ad Hoc Wireless Networks – Network Security Requirements – Issues and Challenges in Security Provisioning – Network Security Attacks – Key Management – Secure Routing in Ad hoc Wireless Networks.	**8**
VI	**Mobile/vehicular Ad-hoc Networks**	MANET, VANET, Design issues, Routing, MANET vs VANET, Various Attacks on MANET/VANET, Attacks on Routing Mechanisms, Security Mechanisms in the Network Layer, Security Mechanisms in the Data - Link Layer, Key Management.	**6**

Text book
1. S. Sarkar, T. Basavraju and C. Puttamdappa, "Ad hoc mobile wireless networks principles, protocols and applications" , second edition, CRC Press, 2016.
2. Al-Sakib Khan Pathan, Muhammad Mostafa Monowar, Zubair Md. Fadlullah, "Building Next-Generation Converged Networks: Theory and Practice, CRC Press, 2013.
3. Stefano Basagni, Marco Conti, Silvia Giordano, Ivan Stojmenovic, "Mobile Ad Hoc Networking: The Cutting Edge Directions", John Wiley 2013.
4. Feng Zhao & Leonidas J. Guibas, "Wireless Sensor Networks- An Information Processing Approach", Elsevier, 2007

References
1. C. K. Toh, "Ad Hoc Mobile Wireless Networks Protocols and Systems", Prentice Hall, PTR, 2001.
2. Charles E. Perkins, "Ad Hoc Networking", Addison Wesley, 2000
3. C. Siva Ram Murthy and B. S. Manoj, "Ad Hoc Wireless Networks Architectures and Protocols", Prentice Hall, PTR, 2004
4. Holger Karl & Andreas Willig, " Protocols And Architectures for Wireless Sensor Networks" , John Wiley, 2005

Practical

1. Implement Ad-hoc network using BlueHoc Simulator.

2. Implement MANET using DARS Simulator.

3. Implement simple VANET/WSN using NS2.

Assessment:

Internal: 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.

Subject Code	Subject Name	Credits
ME-ITDLOC-I1043	**Cloud Computing**	**04**

Course Objectives:

1. Introduce the broad perceptive of cloud architecture and model

2. Able to set up private cloud

3. Understand the Business Aspects of Mobile Cloud Computing

4. Understands research challenges in mobile cloud computing systems

Course Outcomes:

1) Apply suitable virtualization concept

2) Design cloud services

3) Design various applications by integrating cloud services using mobile cloud

4) Apply the concepts of mobile cloud computing for implementing mobile cloud applications

Prerequisite: Mobile Computing, Cloud Computing

DETAILED SYLLABUS:

Sr. No.	Module	Detailed Content	Hours
	Prerequisite:	Mobile Computing**,** Generations of Mobile Communication, Mobile architecture, Mobile Operating Systems, Applications of Mobile Communication, Challenges of Mobile Communication, Cloud Computing**,** Cloud Computing Architecture, Cloud Computing Deployment Models, Issues of Cloud Computing.	3
I	**Cloud Computing**	Virtualization Techniques, Cloud Infrastructure , Architecture Design of Compute and Storage Clouds, Design challenges-Inter Cloud Resource Management, Resource Provisioning and Platform Deployment, Cloud Sim Simulator	7
II	**Mobile Cloud Computing**	Introduction, Motivation to Mobile Cloud Computing, Architecture of Mobile Cloud Computing, Platform and Technologies, Mobile Augmentation Approaches, Issues of Mobile Cloud Computing, Advantages of Mobile Cloud Computing, Applications of Mobile Cloud computing, Research Challenges in Mobile Cloud Computing	8
III	**Offloading in Mobile Cloud Computing**	Introduction, 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 TechniquesMulti-Cloud Offloading in Mobile Cloud	8

		Computing Environment	
IV	**Green Mobile Cloud Computing**	Introduction, Green Mobile Computing, Green Mobile Network, Green Cloud Computing, Green Mobile Cloud Computing, Green Mobile Devices Using Mobile Cloud Computing, Green Femtocell Using Mobile Cloud Computing, Green Seamless Service Provisioning with Mobile Cloud Computing, Green Location Sensing within Mobile Cloud Computing Environment	8
V	**Resource Allocation and Business Aspects of Mobile Cloud Computing**	Significance of Resource Allocation in Mobile Cloud Computing, Resource-Allocation Strategies in Mobile Cloud Computing, Research Challenges in Resource Allocation in Mobile Cloud Computing. Cloud Business Models, Business Model of Mobile Computing Environment, Cooperation among Service Providers, Weblet-Based Mobile Cloud Computing Model, Mobile Cloud Service Insurance Brokerage, Business Aspects of Social Mobile Cloud Computing	6
VI	**Application of Mobile Cloud Computing and Future Research Scope of Mobile Cloud Computing**	Introduction, Cloud Mobile Media Application, Biometric Application, Vehicle Monitoring, Mobile Learning, Application in Social Cloud, Context-Aware Navigation System. Efficient Bandwidth Allocation, Use of Cloudlet in Mobile Cloud Computing, Cross-Cloud communication, Elastic Application Model, Resource Management	8

Text Books:

1. Mobile Cloud Computing: Architectures, Algorithms and Applications, by Debashis De , CRC press

2. Mobile Clouds: Exploiting Distributed resources in wireless mobile and social networks,by Frank Fitzek, Marcos D. Katz Wiley

3. Mobile Cloud computing: Principles and paradigms by Khanna, Sarishma

References:

1. Architecting the cloud by Kavis Wiley publication

2. Advances in Mobile cloud computing systems by F. Richard Yu. , Victor Leung, CRC press

3. Mobile computing with Cloud byIshwaryaChandrasekaran Springer

4. Mobile cloud computing: An Introduction by Jyoti Grover and Gaurav KLheterpal , IGI GLobal

List of Experiments: based on Laboratory Practical's/ Case studies

1. Offloading the applications from mobile to cloud

2. Traffic analyses and measurements

3. Application in Social Cloud

Assessment:

Internal: 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.

Subject Code	Subject Name	Credits
ME-ITDLOC-I1044	**IT Strategy**	**04**

Course Objectives:

1. To appraise the operational, competitive and strategic value of information technology, and how its management and governance contributes to the realization of that value

2. To introduce key concepts to develop a broad and critical understanding of IT strategy development, implementation and value issues (such as IT and business alignment, IT capability, strategic relevance of emerging IT, change management) and provide a conceptually and theoretically sound explanation about these issues.
3. To introduce methods for evaluating emerging technologies and forecasting the rate of technological advance.
4. To focus on procedures for quantifying various types of risk in IT investments, identifying tangible and intangible costs and benefits.

Course Outcomes: Learner will be able to:

1. To develop variety of ways were IT can enable and create business opportunities.

2. Design and develop the business strategy map and the IT strategy with end-to-end strategic business-IT alignment enabling management, coordination and monitoring the firm's strategy to ensure desired business outcomes.

3. Use data driven approaches to evaluate extant and predicting future directions and likely developments in technologies, identify solutions based on industry and technology trends that improve IT and business alignment, and business performance.
4. Analyze and evaluate the IT capabilities, develop ways to mitigate risky IT initiatives

Prerequisite: Fundamental of Computer Technology.

DETAILED SYLLABUS:

Sr. No.	Module	Detailed Content	Hours
	Prerequisite	Basic of IT infrastructure and Internet Technology.	3
I	Business Models, Competitive Strategy and Organization Mission	How businesses are modeled, and how they compete. The mission of businesses and other organizations, and the relationship between an organization's mission and its strategy. Competitive Domains, Competitive Consequences of Technological Change – Creation of New Products, Changes in the Value Chain, Changes in the Value Constellation, Competitive Rivalry. Technological Characteristics of Competitive Domains – Technological Opportunity, Resource Requirements, Collateral Assets, Institutional Milieu, Speed. Dynamics of Change in the Competitive Domain – Technology Emergence Phase, Incremental Change Phase. Framework for Analysis of Technology Emergence, Influence of Environmental trends on competition. Technology as critical to Business Outcomes – Technology Strategy and Technology Leadership	9
II	Technology Intelligence	Signals of New Technology, What is Technology Intelligence, Importance of Technology Intelligence, Levels of Technology Intelligence, External versus Internal Technology Intelligence. Mapping the Technology	8

		Environment – Steps in Mapping, Mapping the Macro level and Industry Level Environment. Mechanisms for Data Collection – Challenges, Organizational Arrangements and Key Principles for Data Collection	
III	Business Strategy and Technology Strategy	Business Strategy , Strategic Analysis and Decision Making using Product Evaluation Matrix, Market-Growth-Market-Share Analysis Matrix, X-Y Coordinating Method, M-by-N Matrix, SWOT Matrix, Formulation of Technology Strategy, Core Competencies, Exploitation of Core Competencies, Integration, Linking Technology & Business Strategies, Creating the Product-Technology-Business Connection. Technology's Interface with – Market, Customers and Suppliers. Customer Supplier and Product-User relationships.	8
IV	IT and the Digital Organization	The functionality of the digital organization, and the role that IT plays in supporting it. Competitive and operational perspectives on IT, including analysis of both benefits and risk.	4
V	Alignment of IT with Business strategy	IT and Michael Porter's Competitive Forces Framework IT and Value Chain Framework IT and Business Process Reengineering; Virtual Organizations IT and Competitive Advantage	8
VI	Enterprise architecture & strategic planning	IT Strategy Initiation, IT management best practices Control Objectives for Information and related Technology (COBIT) framework , IT Strategy Planning, Outsourcing, Off shoring & IT Subsidy, Critical success factors of IT strategy	8

Text Books:

1. IT strategy issues and practices, James D. McKeen and Heather A. Smith, Pearson

2. IT strategy and man agent, S.S. Dubey, PHI

3. Management of Technology – The Key to Competitiveness and Wealth Technology & Business Strategy – An Introduction, Edited by Prashanta Kumar Banerjea, ICFAI books

References:

1. Strategic Management of Technology & Innovation, Robert A Burgelman, Modesto A Maidique, Steven C Wheelwright, MGH International Edition.

2. Managing Technology and Innovation for Competitive Advantage, V K Narayanan, Pearson Education, and 2009 Edition.

3. Technology Management – Text and International Cases, Norma Harrison and Danny Samson, MGH

List of Experiments: based on Laboratory Practical's/ Case studies

1. Prahalad, C. K., & Krishnan, M. S. (2002). The dynamic synchronization of strategy and information technology. *MIT Sloan management review*, *43*(4), 24. (Develop a set of questions based on this article for teaching)

2. IT-LED BUSINESS TRANSFORMATION AT RELIANCE ENERGY Deepa Mani; Geetika Shah; Revati Nehru available from Harvard Business Publishing

3. ENABLING THE STRATEGY-FOCUSED IT ORGANIZATION Robert S. Gold available   from Harvard Business Publishing

Assessment:

Internal:	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.

Subject Code	Subject Name	Credits
ME-ITDLOC-I1045	**Knowledge Management**	**04**

Course Objectives:

1 Establish a foundation of key terms and concepts, historical events and contributions, organizational benefits, and guiding principles on which to build greater understanding of knowledge management

2 Appreciate the role and use of knowledge for individuals, as well as organizations and institutions.

3 Increase information and understanding about knowledge transfer using low- and high technology strategies

4 Explore the future of knowledge management and its influence on our jobs, communities, and society

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

1) Discuss KM, learning organizations, intellectual capital and related terminologies in clear terms and understand the role of knowledge management in organizations.

2) Demonstrate an understanding of the history, concepts, and the antecedents of management of knowledge and describe several successful knowledge management systems

3) Evaluate the impact of technology including telecommunications, networks, and Internet/intranet role in managing knowledge.

4) Discuss new jobs, roles and responsibilities resulting from the New or Knowledge Economy Ponder KM's current and future impact on individuals, organizations and society at large

Prerequisite: An introductory course in IT/ IS

DETAILED SYLLABUS:

Sr. No.	Module	Detailed Content	Hours
	Prerequisite	Meaning of data, information, knowledge and expertise Meaning of epistemology, Types of Knowledge -Subjective & Objective views of knowledge, procedural Vs. Declarative, tacit Vs. explicit, general Vs. specific.	**3**
I	Introduction to Knowledge Management	What is Knowledge? Types of expertise – associational, motor skill,¬ theoretical Characteristics of knowledge – explicitness, codifiability, teachability, specificity Reservoirs of knowledge, Meaning of Knowledge Management, Forces Driving Organizational issues in KM, KM Systems & their role Relevance of KM in today's dynamic & complex environment Future of Knowledge Management	**5**
II	Knowledge management system life cycle	Challenges in Building KM Systems – Conventional versus KM System Life Cycle (KMSLS) – Knowledge Creation and Knowledge Architecture – Nonaka's Model of Knowledge Creation and Transformation. Knowledge Architecture.	**8**
III	KM Solutions for capture, sharing & applications	KM Processes, KM Systems, Mechanisms & Technologies Knowledge Capturing Techniques: Brain Storming – Protocol Analysis – Consensus Decision Making – Repertory	**8**

		Grid- Concept Mapping –Blackboarding, Nominal Group Technique, Delphi method,	
IV	Knowledge codification	Modes of Knowledge Conversion – Codification Tools and Procedures – Knowledge Developer's Skill Sets – System Testing and Deployment – Knowledge Testing –Approaches to Logical Testing, User Acceptance Testing – KM System Deployment Issues – User Training – Post implementation.	**8**
V	Knowledge transfer and sharing	Transfer Methods – Role of the Internet – Knowledge Transfer in e-world – KM System Tools – Neural Network – Association Rules – Classification Trees – Data Mining and Business Intelligence – Decision Making Architecture – Data Management – Knowledge Management Protocols – Managing Knowledge Workers.	**8**
VI	KM Impact	Dimensions of KM Impact – People, Processes, Products & Organizational Performance Factors influencing impact – universalistic & contingency views Assessment of KM Impact – Qualitative & quantitative measures Identification of appropriate KM solutions, Ethical Legal and Managerial Issues	**8**

Text Books:

1. Irma Becerra-Fernandez, Avelino Gonzalez, Rajiv Sabherwal (2004). Knowledge Management Challenges, Solutions, and Technologies . Prentice Hall. ISBN: 0-13-109931-0.

2. Elias M. Awad, Hassan M. Ghaziri (2004). Knowledge Management. Prentice Hall. ISBN: 0-13-034820-1

3. Donald Hislop, Knowledge Management in Organizations, Oxford 2nd Edition. Ian Watson (2002).

4. Shelda Debowski, Knowledge Management, Wiley India Edition.

References:

1. Madanmohan Rao (2004). Knowledge Management Tools and Techniques: Practitioners and Experts Evaluate KM Solutions. Butterworth-Heinemann. ISBN: 0750678186.

2. Stuart Barnes (Ed.) (2002). Knowledge Management Systems Theory and Practice. Thomson Learning.

3. Kimiz Dalkir, Knowledge Management in Theory and Practice, Elsevier, Butterworth Hinemann.

4. Applying Knowledge Management: Techniques for Building Corporate Memories. Morgan Kaufmann. ISBN: 1558607609.

List of Experiments : based on Laboratory Practical's/ Case studies

1. Daimler Chrysler Knowledge Management strategy, Michael G Rukstad and Peter Coughlan , Harvard Publishing

2. Andreu, R., Grau, A., Lara, E., & Sieber, S. (2003). Knowledge Management at Siemens Spain, PRISM case# 9.5. 3, University of Navarra, IESE, Spain. *Distributed by The European Case Clearing house, England and USA*.

3. 5 Big Companies That Got Knowledge Management Right – John Mc Cormick

Assessment:

Internal: 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.

Course Code	Course Name	Credits
ME-ITILOCI1051	**Product Life Cycle Management**	**03**

Objectives:
1. To familiarize the students with the need, benefits and components of PLM
2. To acquaint students with Product Data Management & PLM strategies
3. To give insights into new product development program and guidelines for designing and developing a product
4. To familiarize the students with Virtual Product Development

Outcomes: Learner will be able to…
1. Gain knowledge about phases of PLM, PLM strategies and methodology for PLM feasibility study and PDM implementation.
2. Illustrate various approaches and techniques for designing and developing products.
3. Apply product engineering guidelines / thumb rules in designing products for moulding, machining, sheet metal working etc.
4. Acquire knowledge in applying virtual product development tools for components, machining and manufacturing plant

Module	Detailed Contents	Hrs
01	**Introduction to Product Lifecycle Management (PLM):**Product Lifecycle Management (PLM), Need for PLM, Product Lifecycle Phases, Opportunities of Globalization, Pre-PLM Environment, PLM Paradigm, Importance & Benefits of PLM, Widespread Impact of PLM, Focus and Application, A PLM Project, Starting the PLM Initiative, PLM Applications **PLM Strategies:**Industrial strategies, Strategy elements, its identification, selection and implementation, Developing PLM Vision and PLM Strategy , Change management for PLM	10
02	**ProductDesign:**Product Design and Development Process, Engineering Design, Organization and Decomposition in Product Design, Typologies of Design Process Models, Reference Model, Product Design in the Context of the Product Development Process, Relation with the Development Process Planning Phase, Relation with the Post design Planning Phase, Methodological Evolution in Product Design, Concurrent Engineering, Characteristic Features of Concurrent Engineering, Concurrent Engineering and Life Cycle Approach, New Product Development (NPD) and Strategies, Product Configuration and Variant Management, The Design for X System, Objective Properties and Design for X Tools, Choice of Design for X Tools and Their Use in the Design Process	09
03	**Product Data Management (PDM):**Product and Product Data, PDM systems and importance, Components of PDM, Reason for implementing a PDM system, financial justification of PDM, barriers to PDM implementation	05
04	**Virtual Product Development Tools:**For components, machines, and manufacturing plants, 3D CAD systems and realistic rendering techniques, Digital mock-up, Model building, Model analysis, Modeling and simulations in Product Design, Examples/Case studies	05
05	**Integration of Environmental Aspects in Product Design:**Sustainable Development, Design for Environment,Need for Life Cycle Environmental Strategies, Useful Life Extension Strategies, End-of-Life Strategies, Introduction of Environmental Strategies into the Design Process, Life Cycle Environmental Strategies and Considerations for	05

	Product Design	
06	**Life Cycle Assessment and Life Cycle Cost Analysis:**Properties, and Framework of Life Cycle Assessment, Phases of LCA in ISO Standards, Fields of Application and Limitations of Life Cycle Assessment, Cost Analysis and the Life Cycle Approach, General Framework for LCCA, Evolution of Models for Product Life Cycle Cost Analysis	05

REFERENCES:

1. John Stark, "Product Lifecycle Management: Paradigm for 21st Century Product Realisation", Springer-Verlag, 2004. ISBN: 1852338105
2. Fabio Giudice, Guido La Rosa, AntoninoRisitano, "Product Design for the environment-A life cycle approach", Taylor & Francis 2006, ISBN: 0849327229
3. SaaksvuoriAntti, ImmonenAnselmie, "Product Life Cycle Management", Springer, Dreamtech, ISBN: 3540257314
4. Michael Grieve, "Product Lifecycle Management: Driving the next generation of lean thinking", Tata McGraw Hill, 2006, ISBN: 0070636265

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
ME-ITILOCI1052	**Reliability Engineering**	**03**

Objectives:
1. To familiarize the students with various aspects of probability theory
2. To acquaint the students with reliability and its concepts
3. To introduce the students to methods of estimating the system reliability of simple and complex systems
4. To understand the various aspects of Maintainability, Availability and FMEA procedure

Outcomes: Learner will be able to…
1. Understand and apply the concept of Probability to engineering problems
2. Apply various reliability concepts to calculate different reliability parameters
3. Estimate the system reliability of simple and complex systems
4. Carry out a Failure Mode Effect and Criticality Analysis

Module	Detailed Contents	Hrs
01	**Probability theory:** Probability: Standard definitions and concepts; Conditional Probability, Baye's Theorem. **Probability Distributions:** Central tendency and Dispersion; Binomial, Normal, Poisson, Weibull, Exponential, relations between them and their significance. **Measures of Dispersion:** Mean, Median, Mode, Range, Mean Deviation, Standard Deviation, Variance, Skewness and Kurtosis.	08
02	**Reliability Concepts:** Reliability definitions, Importance of Reliability, Quality Assurance and Reliability, Bath Tub Curve. **Failure Data Analysis:** Hazard rate, failure density, Failure Rate, Mean Time To Failure (MTTF), MTBF, Reliability Functions. **Reliability Hazard Models:** Constant Failure Rate, Linearly increasing, Time Dependent Failure Rate, Weibull Model. Distribution functions and reliability analysis.	08
03	**System Reliability:** System Configurations: Series, parallel, mixed configuration, k out of n structure, Complex systems.	05
04	**Reliability Improvement:** Redundancy Techniques: Element redundancy, Unit redundancy, Standby redundancies. Markov analysis. System Reliability Analysis – Enumeration method, Cut-set method, Success Path method, Decomposition method.	08
05	**Maintainability and Availability:** System downtime, Design for Maintainability: Maintenance requirements, Design methods: Fault Isolation and self-diagnostics, Parts standardization and Interchangeability, Modularization and Accessibility, Repair Vs Replacement. Availability – qualitative aspects.	05
06	**Failure Mode, Effects and Criticality Analysis:** Failure mode effects analysis, severity/criticality analysis, FMECA examples. Fault tree construction, basic symbols, development of functional reliability block diagram, Fau1t tree analysis and Event tree Analysis	05

REFERENCES:

1. L.S. Srinath, "Reliability Engineering", Affiliated East-Wast Press (P) Ltd., 1985.
2. Charles E. Ebeling, "Reliability and Maintainability Engineering", Tata McGraw Hill.
3. B.S. Dhillion, C. Singh, "Engineering Reliability", John Wiley & Sons, 1980.
4. P.D.T. Conor, "Practical Reliability Engg.", John Wiley & Sons, 1985.
5. K.C. Kapur, L.R. Lamberson, "Reliability in Engineering Design", John Wiley & Sons.
6. Murray R. Spiegel, "Probability and Statistics", Tata McGraw-Hill Publishing Co. Ltd.

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
ME-ITILOCI1053	**Management Information System**	**03**

Objectives:
1. The course is blend of Management and Technical field.
2. Discuss the roles played by information technology in today's business and define various technology architectures on which information systems are built
3. Define and analyze typical functional information systems and identify how they meet the needs of the firm to deliver efficiency and competitive advantage
4. Identify the basic steps in systems development

Outcomes: Learner will be able to…
1. Explain how information systems Transform Business
2. Identify the impact information systems have on an organization
3. Describe IT infrastructure and its components and its current trends
4. Understand the principal tools and technologies for accessing information from databases to improve business performance and decision making
5. Identify the types of systems used for enterprise-wide knowledge management and how they provide value for businesses

Module	Detailed Contents	Hrs
01	Introduction To Information Systems (IS): Computer Based Information Systems, Impact of IT on organizations, Imporance of IS to Society. Organizational Strategy, Competitive Advantages and IS.	4
02	Data and Knowledge Management: Database Approach, Big Data, Data warehouse and Data Marts, Knowledge Management. Business intelligence (BI): Managers and Decision Making, BI for Data analysis and Presenting Results	7
03	Ethical issues and Privacy: Information Security. Threat to IS, and Security Controls	7
04	Social Computing (SC): Web 2.0 and 3.0, SC in business-shopping, Marketing, Operational and Analytic CRM, E-business and E-commerce – B2B B2C. Mobile commerce.	7
05	Computer Networks Wired and Wireless technology, Pervasive computing, Cloud computing model.	6
06	Information System within Organization: Transaction Processing Systems, Functional Area Information System, ERP and ERP support of Business Process. Acquiring Information Systems and Applications: Various System development life cycle models.	8

REFERENCES:

1. Kelly Rainer, Brad Prince,Management Information Systems, Wiley
2. K.C. Laudon and J.P. Laudon, Management Information Systems: Managing the Digital Firm, 10th Ed., Prentice Hall, 2007.
3. D. Boddy, A. Boonstra, Managing Information Systems: Strategy and Organization, Prentice Hall, 2008

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
ME-ITILOCI1054	**Design of Experiments**	**03**

Objectives:
1. To understand the issues and principles of Design of Experiments (DOE)
2. To list the guidelines for designing experiments
3. To become familiar with methodologies that can be used in conjunction with experimental designs for robustness and optimization

Outcomes: Learner will be able to…
1. Plan data collection, to turn data into information and to make decisions that lead to appropriate action
2. Apply the methods taught to real life situations
3. Plan, analyze, and interpret the results of experiments

Module	Detailed Contents	Hrs
01	**Introduction** 1.1 Strategy of Experimentation 1.2 Typical Applications of Experimental Design 1.3 Guidelines for Designing Experiments 1.4 Response Surface Methodology	06
02	**Fitting Regression Models** 2.1 Linear Regression Models 2.2 Estimation of the Parameters in Linear Regression Models 2.3 Hypothesis Testing in Multiple Regression 2.4 Confidence Intervals in Multiple Regression 2.5 Prediction of new response observation 2.6 Regression model diagnostics 2.7 Testing for lack of fit	08
03	**Two-Level Factorial Designs** 3.1 The 2^2 Design 3.2 The 2^3 Design 3.3 The General 2^k Design 3.4 A Single Replicate of the 2^k Design 3.5 The Addition of Center Points to the 2^k Design, 3.6 Blocking in the 2^k Factorial Design 3.7 Split-Plot Designs	07
04	**Two-Level Fractional Factorial Designs** 4.1 The One-Half Fraction of the 2^k Design 4.2 The One-Quarter Fraction of the 2^k Design 4.3 The General 2^{k-p} Fractional Factorial Design 4.4 Resolution III Designs 4.5 Resolution IV and V Designs 4.6 Fractional Factorial Split-Plot Designs	07
05	**Response Surface Methods and Designs** 5.1 Introduction to Response Surface Methodology 5.2 The Method of Steepest Ascent 5.3 Analysis of a Second-Order Response Surface	07

| 06 | **Taguchi Approach**
6.1 Crossed Array Designs and Signal-to-Noise Ratios
6.2 Analysis Methods
6.3 Robust design examples | 04 |

REFERENCES:

1. Raymond H. Mayers, Douglas C. Montgomery, Christine M. Anderson-Cook, Response Surface Methodology: Process and Product Optimization using Designed Experiment, 3rd edition,John Wiley & Sons, New York, 2001

2. D.C. Montgomery, Design and Analysis of Experiments, 5th edition, John Wiley & Sons, New York, 2001

3. George E P Box, J Stuart Hunter, William G Hunter, Statics for Experimenters: Design, Innovation and Discovery, 2nd Ed. Wiley

4. W J Dimond, Peactical Experiment Designs for Engineers and Scintists, John Wiley and Sons Inc. ISBN: 0-471-39054-2

5. Design and Analysis of Experiments (Springer text in Statistics), Springer by A.M. Dean, and D. T.Voss

Assessment:

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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.**

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2. All question carry equal marks
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4. Only Four question need to be solved.

Course Code	Course Name	Credits
ME-ITILOCI1055	**Operations Research**	**03**

Objectives:
1. Formulate a real-world problem as a mathematical programming model.
2. Understand the mathematical tools that are needed to solve optimization problems.
3. Use mathematical software to solve the proposed models.

Outcomes: Learner will be able to…
1. Understand the theoretical workings of the simplex method, the relationship between a linear program and its dual, including strong duality and complementary slackness.
2. Perform sensitivity analysis to determine the direction and magnitude of change of a model's optimal solution as the data change.
3. Solve specialized linear programming problems like the transportation and assignment problems, solve network models like the shortest path, minimum spanning tree, and maximum flow problems.
4. Understand the applications of integer programming and a queuing model and compute important performance measures

Module	Detailed Contents	Hrs
01	**Introduction to Operations Research**: Introduction, , Structure of the Mathematical Model, Limitations of Operations Research **Linear Programming**: Introduction, Linear Programming Problem, Requirements of LPP, Mathematical Formulation of LPP, Graphical method, Simplex Method Penalty Cost Method or Big M-method, Two Phase Method, Revised simplex method, **Duality**, Primal – Dual construction, Symmetric and Asymmetric Dual, Weak Duality Theorem, Complimentary Slackness Theorem, Main Duality Theorem, Dual Simplex Method, Sensitivity Analysis **Transportation Problem**: Formulation, solution, unbalanced Transportation problem. Finding basic feasible solutions – Northwest corner rule, least cost method and Vogel's approximation method. Optimality test: the stepping stone method and MODI method. **Assignment Problem**: Introduction, Mathematical Formulation of the Problem, Hungarian Method Algorithm, Processing of n Jobs Through Two Machines and m Machines, Graphical Method of Two Jobs m Machines Problem Routing Problem, Travelling Salesman Problem **Integer Programming Problem**: Introduction, Types of Integer Programming Problems, Gomory's cutting plane Algorithm, Branch and Bound Technique. Introduction to Decomposition algorithms.	14
02	**Queuing models**: queuing systems and structures, single server and multi-server models, Poisson input, exponential service, constant rate service, finite and infinite population	05
03	**Simulation**: Introduction, Methodology of Simulation, Basic Concepts, Simulation Procedure, Application of Simulation Monte-Carlo Method: Introduction, Monte-Carlo Simulation, Applications of Simulation, Advantages of Simulation, Limitations of Simulation	05

04	**Dynamic programming**. Characteristics of dynamic programming. Dynamic programming approach for Priority Management employment smoothening, capital budgeting, Stage Coach/Shortest Path, cargo loading and Reliability problems.	05
05	**Game Theory**. Competitive games, rectangular game, saddle point, minimax (maximin) method of optimal strategies, value of the game. Solution of games with saddle points, dominance principle. Rectangular games without saddle point – mixed strategy for 2 X 2 games.	05
06	**Inventory Models**: Classical EOQ Models, EOQ Model with Price Breaks, EOQ with Shortage, Probabilistic EOQ Model,	05

REFERENCES:

1. Taha, H.A. "Operations Research - An Introduction", Prentice Hall, (7th Edition), 2002.
2. Ravindran, A, Phillips, D. T and Solberg, J. J. "Operations Research: Principles and Practice", John Willey and Sons, 2nd Edition, 2009.
3. Hiller, F. S. and Liebermann, G. J. "Introduction to Operations Research", Tata McGraw Hill, 2002.
4. Operations Research, S. D. Sharma, KedarNath Ram Nath-Meerut.
5. Operations Research, KantiSwarup, P. K. Gupta and Man Mohan, Sultan Chand & Sons.

<u>**Assessment:**</u>

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
ME-ITILOCI1056	**Cyber Security and Laws**	03

Objectives:
1. To understand and identify different types cybercrime and cyber law
2. To recognized Indian IT Act 2008 and its latest amendments
3. To learn various types of security standards compliances

Outcomes: Learner will be able to…
1. Understand the concept of cybercrime and its effect on outside world
2. Interpret and apply IT law in various legal issues
3. Distinguish different aspects of cyber law
4. Apply Information Security Standards compliance during software design and development

Module	Detailed Contents	Hrs
01	**Introduction to Cybercrime:** Cybercrime definition and origins of the world, Cybercrime andinformation security, Classifications of cybercrime, Cybercrime and the Indian ITA 2000, A global Perspective on cybercrimes.	4
02	**Cyber offenses & Cybercrime:** How criminal plan the attacks, Social Engg, Cyber stalking, Cyber café and Cybercrimes, Botnets, Attack vector, Cloud computing, Proliferation ofMobile and Wireless Devices, Trends in Mobility, Credit Card Frauds in Mobile and Wireless Computing Era, Security Challenges Posed byMobile Devices, Registry Settings for Mobile Devices, AuthenticationService Security, Attacks on Mobile/Cell Phones, Mobile Devices:Security Implications for Organizations, Organizational Measures forHandling Mobile, Devices-Related Security Issues, OrganizationalSecurity Policies and Measures in Mobile Computing Era, Laptops	9
03	**Tools and Methods Used in Cyberline** Phishing, Password Cracking, Keyloggers and Spywares, Virus and Worms, Steganography, DoS and DDoS Attacks, SQL Injection, Buffer Over Flow, Attacks on Wireless Networks, Phishing, Identity Theft (ID Theft)	6
04	**The Concept of Cyberspace** E-Commerce , The Contract Aspects in Cyber Law ,The Security Aspect of Cyber Law ,The Intellectual Property Aspect in Cyber Law , The Evidence Aspect in Cyber Law , The Criminal Aspect in Cyber Law, Global Trends in Cyber Law , Legal Framework for Electronic Data Interchange Law Relating to Electronic Banking , The Need for an Indian Cyber Law	8
05	**Indian IT Act.** Cyber Crime and Criminal Justice : Penalties, Adjudication and Appeals Under the IT Act, 2000, IT Act. 2008 and its Amendments	6
06	**Information Security Standard compliances** SOX, GLBA, HIPAA, ISO, FISMA, NERC, PCI.	6

REFERENCES:

1. Nina Godbole, Sunit Belapure, *Cyber Security*, Wiley India, New Delhi
2. The Indian Cyber Law by Suresh T. Vishwanathan; Bharat Law House New Delhi
3. The Information technology Act, 2000; Bare Act- Professional Book Publishers, New Delhi.
4. Cyber Law & Cyber Crimes By Advocate Prashant Mali; Snow White Publications, Mumbai
5. Nina Godbole, *Information Systems Security,* Wiley India, New Delhi
6. Kennetch J. Knapp, *Cyber Security &Global Information Assurance* Information Science

Publishing.
7. William Stallings, *Cryptography and Network Security,* Pearson Publication
8. Websites for more information is available on : The Information Technology ACT, 2008- TIFR : https://www.tifrh.res.in
9. Website for more information , A Compliance Primer for IT professional : https://www.sans.org/reading-room/whitepapers/compliance/compliance-primer-professionals-33538

Assessment:

Internal:
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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
ME-ITILOCI1057	**Disaster Management and Mitigation Measures**	**03**

Objectives:

1. To understand physics and various types of disaster occurring around the world
2. To identify extent and damaging capacity of a disaster
3. To study and understand the means of losses and methods to overcome /minimize it.
4. To understand role of individual and various organization during and after disaster
5. To understand application of GIS in the field of disaster management
6. To understand the emergency government response structures before, during and after disaster

Outcomes: Learner will be able to…

1. Get to know natural as well as manmade disaster and their extent and possible effects on the economy.
2. Plan of national importance structures based upon the previous history.
3. Get acquainted with government policies, acts and various organizational structure associated with an emergency.
4. Get to know the simple do's and don'ts in such extreme events and act accordingly.

Module	Detailed Contents	Hrs
01	**Introduction** 1.1 **Definition of Disaster, hazard, global and Indian scenario, general perspective, importance of study in human life, Direct and indirect effects of disasters, long term effects of disasters. Introduction to global warming and climate change.**	03
02	**Natural Disaster and Manmade disasters:** **2.1 Natural Disaster: Meaning and nature of natural disaster, Flood, Flash flood, drought, cloud burst, Earthquake, Landslides, Avalanches, Volcanic eruptions, Mudflow, Cyclone, Storm, Storm Surge, climate change, global warming, sea level rise, ozone depletion** **2.2 Manmade Disasters: Chemical, Industrial, Nuclear and Fire Hazards. Role of growing population and subsequent industrialization, urbanization and changing lifestyle of human beings in frequent occurrences of manmade disasters.**	09
03	**Disaster Management, Policy and Administration** **3.1 Disaster management: meaning, concept, importance, objective of disaster management policy, disaster risks in India, Paradigm shift in disaster management.** **3.2 Policy and administration:** **Importance and principles of disaster management policies, command and co-ordination of in disaster management, rescue operations-how to start with and how to proceed in due course of time, study of flowchart showing the entire process.**	06
04	**Institutional Framework for Disaster Management in India:** **4.1 Importance of public awareness, Preparation and execution of emergency management programme.Scope and responsibilities of National Institute of Disaster Management (NIDM) and National disaster management authority (NDMA) in India.Methods and measures to avoid disasters, Management of casualties, set up of emergency facilities, importance of effective communication amongst different agencies in such situations.** **4.2 Use of Internet and softwares for effective disaster management. Applications of GIS, Remote sensing and GPS in this regard.**	06
05	**Financing Relief Measures:**	09

	5.1 Ways to raise finance for relief expenditure, role of government agencies and NGO's in this process, Legal aspects related to finance raising as well as overall management of disasters. Various NGO's and the works they have carried out in the past on the occurrence of various disasters, Ways to approach these teams. **5.2 International relief aid agencies and their role in extreme events.**	
06	**Preventive and Mitigation Measures:** 6.1 Pre-disaster, during disaster and post-disaster measures in some events in general 6.2 Structural mapping: Risk mapping, assessment and analysis, sea walls and embankments, Bio shield, shelters, early warning and communication 6.3 Non Structural Mitigation: Community based disaster preparedness, risk transfer and risk financing, capacity development and training, awareness and education, contingency plans. 6.4 Do's and don'ts in case of disasters and effective implementation of relief aids.	06

REFERENCES:

1. 'Disaster Management' by Harsh K.Gupta, Universities Press Publications.
2. 'Disaster Management: An Appraisal of Institutional Mechanisms in India' by O.S.Dagur, published by Centre for land warfare studies, New Delhi, 2011.
3. 'Introduction to International Disaster Management' by Damon Copolla, Butterworth Heinemann Elseveir Publications.
4. 'Disaster Management Handbook' by Jack Pinkowski, CRC Press Taylor and Francis group.
5. 'Disaster management & rehabilitation' by Rajdeep Dasgupta, Mittal Publications, New Delhi.
6. 'Natural Hazards and Disaster Management, Vulnerability and Mitigation – R B Singh, Rawat Publications
7. Concepts and Techniques of GIS –C.P.Lo Albert, K.W. Yonng – Prentice Hall (India) Publications.

(Learners are expected to refer reports published at national and International level and updated information available on authentic web sites)

Assessment:

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End Semester Theory Examination:
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4. Only Four question need to be solved.

Course Code	Course Name	Credits
ME-ITILOCI1058	**Energy Audit and Management**	**03**

Objectives:

1. To understand the importance energy security for sustainable development and the fundamentals of energy conservation.
2. To introduce performance evaluation criteria of various electrical and thermal installations to facilitate the energy management
3. To relate the data collected during performance evaluation of systems for identification of energy saving opportunities.

Outcomes: Learner will be able to…

1. To identify and describe present state of energy security and its importance.
2. To identify and describe the basic principles and methodologies adopted in energy audit of an utility.
3. To describe the energy performance evaluation of some common electrical installations and identify the energy saving opportunities.
4. To describe the energy performance evaluation of some common thermal installations and identify the energy saving opportunities
5. To analyze the data collected during performance evaluation and recommend energy saving measures

Module	Detailed Contents	Hrs
01	**Energy Scenario:** Present Energy Scenario, Energy Pricing, Energy Sector Reforms, Energy Security, Energy Conservation and its Importance, Energy Conservation Act-2001 and its Features. Basics of Energy and its various forms, Material and Energy balance	04
02	**Energy Audit Principles:** Definition, Energy audit- need, Types of energy audit, Energy management (audit) approach-understanding energy costs, Bench marking, Energy performance, Matching energy use to requirement, Maximizing system efficiencies, Optimizing the input energy requirements, Fuel and energy substitution. Elements of monitoring& targeting; Energy audit Instruments; Data and information-analysis. Financial analysis techniques: Simple payback period, NPV, Return on investment (ROI), Internal rate of return (IRR)	08
03	**Energy Management and Energy Conservation in Electrical System:** Electricity billing, Electrical load management and maximum demand Control; Power factor improvement, Energy efficient equipments and appliances, star ratings. **Energy efficiency measures in lighting system, Lighting control:** Occupancy sensors, daylight integration, and use of intelligent controllers. Energy conservation opportunities in: water pumps, industrial drives, induction motors, motor retrofitting, soft starters, variable speed drives.	10
04	**Energy Management and Energy Conservation in Thermal Systems:** Review of different thermal loads; Energy conservation opportunities in: Steam distribution system, Assessment of steam distribution losses, Steam leakages, Steam trapping, Condensate and flash steam recovery system. General fuel economy measures in Boilers and furnaces, Waste heat recovery, use of insulation- types and application. HVAC system: Coefficient of performance, Capacity, factors affecting Refrigeration and Air Conditioning system performance and savings opportunities.	10

05	**Energy Performance Assessment:** On site Performance evaluation techniques, Case studies based on: Motors and variable speed drive, pumps, HVAC system calculations; Lighting System: Installed Load Efficacy Ratio (ILER) method, Financial Analysis.	04
06	**Energy conservation in Buildings:** Energy Conservation Building Codes (ECBC): Green Building, LEED rating, Application of Non-Conventional and Renewable Energy Sources	03

REFERENCES:

1. Handbook of Electrical Installation Practice, Geofry Stokes, Blackwell Science
2. Designing with light: Lighting Handbook, By Anil Valia, Lighting System
3. Energy Management Handbook, By W.C. Turner, John Wiley and Sons
4. Handbook on Energy Audits and Management, edited by A. K. Tyagi, Tata Energy Research Institute (TERI).
5. Energy Management Principles, C.B.Smith, Pergamon Press
6. Energy Conservation Guidebook, Dale R. Patrick, S. Fardo, Ray E. Richardson, Fairmont Press
7. Handbook of Energy Audits, Albert Thumann, W. J. Younger, T. Niehus, CRC Press
8. www.energymanagertraining.com
9. www.bee-india.nic.in

Assessment:

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End Semester Theory Examination:
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4. Only Four question need to be solved.

Subject Code	Subject Name	Credits
ME-ITC201	**Security & Risk Management**	**04**

Course Objective:

1. To gain knowledge about information security and Risk Management

2. To be familiar with Risk assessment methodology and risk mitigation approaches

3. To gain an overview about security management concepts and configuration management

4. To understand IT audit and its activities

Course Outcomes:

After completion of the course the gain knowledge of the following

1. Able to explain the knowledge about information security and Risk Management

2. Able to analysis Risk assessment methodology and risk mitigation approaches

3. Able to explain security management concepts and configuration management

4. Able to explain IT audit and its activities

Pre-requisite : Computer Networks.

DETAILED SYLLABUS:

Module	Detailed content	Hours
Prerequisite	**Overview of Information Security Management** The big picture, Learning from experience, Weaknesses in Information Security. The extent of crime in cyberspace, Cyberspace crimoid syndrome, Policies and technologies, A new frame work for Information security.	3
I	**Introduction to Information Security** Basic information security model, Need for security, Common vulnerabilities, threats and attacks, Asset Identification and Characterization – Asset types, Asset characterization, IT Asset life cycle and asset identification, Threat models, Encryption controls.	5
II	**Information Security Risk Assessment Basics** What is Risk? Information Security Assessment Overview, Risk Assessment Framework: NIST 800-39, OCTAVE, ISO 27000 series, Data Collection and Analysis, Asset scoping, Preparation of Threat and Vulnerability Catalogs, System Risk Computation, Impact Analysis Scheme, Final Risk Score.	8
III	**Risk Assessment Methodology** Introduction to Risk assessment, Defense-in Depth Approach, Qualitative and Quantitative risk assessment approaches, Problems with Quantitative approach, Risk Control Strategies, System Risk Analysis, Risk Prioritization, System Specific Risk Treatment.	8
IV	**Performing the Assessment** Vulnerability scan and Exploitation: Internet Host and network enumeration, IP	10

		network scanning, Assessing Remote Information Services, Assessing Web Servers, Assessing Web Applications, Assessing Remote Maintenance Services, Assessing Database Services, Assessing Windows Networking Services, Assessing Email Services. Scanning and Analysis tools and their working principle. Final Report Preparation and Post Assessment Activities.	
V	**Security Management Concepts and Principles** Measuring ROI on security, security patch management, Purpose of Information Security management, and The building blocks of information security. Overview of SSE CMM, SSE CMM relationship to other initiatives, capability levels, Security Engineering process overview. Configuration management: Role of CM in Security of an organization. CM framework, Three disciplines of CM:Business Process Infrastructure (Chain of Command, CCB), Operations and Services (Operational Group) ,End Products (technical group) with respect to security.	8

VI	**Planning for Security:**
	Information Security Planning and Governance, Information Security Policy Standards, EISP, ISSP,
	  SysSP, Policy management.
	
	 Security Audit Process:
	  Pre-planning audit, Audit Risk Assessment, Performing Audit, Internal Controls, Audit Evidence,
	  Audit Testing, Audit Finding, Follow-up activities.
		6

References

1. Manish Agarwal, Alex Campoe and Eric Pierce, "Information Security and IT Risk Management" Wiley 2016.
2. Principles of Information Security, Michael E Whitman, Herbert J. Mattod, 4th Edition, Cengage Learning.
3. Mark Talabis, "Information Security Risk Assessment Toolkit: Practical Assessments through Data Collection and Data Analysis", Kindle Edition.ISBN:978-1-59749-735-0.
4. David L.Cannon, "CISA Certified Information Systems Auditor Study Guide", SYBEX Publication. ISBN: 978-0-470-23152-4.
5. Network Security Assessment, Chris McNab, O'reilly
6. Inside Security Assessment, Micheal Gregg, Pearson
7. The Security Risk Assessment Handbook: Douglas LanDoll, Auerbach Publication
8. Micki Krause, Harold F.Tripton, "*Information Security Management Handbook*", Auerbach Publications, 2012.

List of Experiments:

1. Working with scanning enumeration tool
2. Understanding practical aspect operating system security, Linux and Windows
3. Working with open source security information management for security audit (OSSIM)

Assessment:

Internal: 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

Subject Code	Subject Name	Credits
ME-ITC202	**High Performance Computing**	**04**

Course Objectives:

1. To learn concepts of parallel processing as it pertains to high-performance computing.
2. To design, develop and analyze parallel programs on high performance computing resources using Parallel programming paradigms.
3. To learn CUDA Programming Language and tools.
4. Performance comparison between CUDA, MPI and OpenMP.

Course Outcomes: Learner will be able to:

1. Determine the complexity of a given parallel algorithm
2. Identify design Issues and limitations in Parallel Computing.
3. Design algorithms suited for Multicore processor and GPU systems using CUDA, MPI, OpenMP.
4. Analyze and optimize performance parameters.

Pre-requisite: Mathematics, Data structures.

DETAILED SYLLABUS:

Sr. No.	Module	Detailed Content	Hours
	Pre-requisite	High performance computing through a number of applications in science and engineering, including problems in linear algebra, partial differential equations (e.g. computational fluid dynamics), molecular dynamics, and agent based modelling. Study of various numerical methods used in engineering practice and how these applied to solving computational problems and hence programmed for execution on a supercomputer.	3
I	Parallel Processing Approaches	**Introduction to Parallel Processing:** Levels of Parallelism (instruction, transaction, task, thread, memory, and function), Models (SIMD, MIMD, SIMT, SPMD, Data Flow Models, Demand-driven Computation etc.), Loosely coupled and Tightly coupled **HPC Platforms:** CUDA, Message-passing Interface (MPI), Shared-memory thread-based OpenMP programs, hybrid (MPI/OpenMP) programs, Grid Computing, Cloud Computing , Multi-Core Processors, accelerators, GPGPUs	6
II	Design Issues and limitations in Parallel Computing	Parallel Architecture, (Interconnection network, processor Array, Multiprocessor) Designing Parallel algorithms (Partitioning, Communication, Mapping, Matrix input/output) **Issues:** Synchronization, Scheduling, Job Allocation, Job Partitioning, Dependency Analysis, Mapping Parallel Algorithms onto Parallel Architectures **Limitations:** Bandwidth Limitations, Latency Limitations,	8

III	Programming using CUDA	CUDA: a) Processor Architecture, Interconnect, Communication, Memory Organization, and Programming Models in high performance computing architectures: (Examples: IBM CELL BE, Nvidia Tesla GPU, Intel Larrabee Microarchitecture and Intel Nehalem microarchitecture) b) Memory hierarchy and transaction specific memory design c) Thread Organization, The Implementation of the Cilk-5 Multithreaded Language, MapReduce: simplified data processing on large clusters, StreamIt: A Language for Streaming Applications, PetaBricks: A Language and Compiler for Algorithmic Choice, Pregel: a system for large-scale graph processing, PowerGraph: Distributed Graph-Parallel Computation on Natural Graphs, GraphChi: Large-Scale Graph Computation on Just a PC, The Tao of Parallelism in Algorithms	12
IV	Programming using MPI and Open MP	MPI: Principles, building blocks, MPI, Overlapping communication and computation, collective communication operations, Composite synchronization constructs; OpenMP: Threading, Building blocks, Memory Allocators, Parallel programming model, combining MPI and OpenMP, Shared memory programing.	8
V	Performance Measures	Performance measures: Speedup, efficiency and scalability. Abstract performance metrics (work, critical paths), Amdahl`s Law, Gustavson's law, weak vs. strong scaling, performance bottlenecks, data races and determinism, data race avoidance (immutability, futures, accumulators, dataflow), deadlock avoidance, abstract vs. real performance (granularity, scalability)	07
VI	HPC enabled Advanced Technologies	(a) Petascale Computing (b) Optics in Parallel Computing (c) Quantum Computers (d) Recent developments in Nanotechnology and its impact on HPC	04

Note: Top of first row reads "Latency Hiding/Tolerating Techniques and their limitations"

Text Books:

1. AnanthGrama, Anshul Gupta, George Karypis, Vipin Kumar , "Introduction to Parallel Computing", Pearson Education, Second Edition, 2007.

2. Kai Hwang, "Advanced Computer Architecture: Parallelism, Scalability, Programmability", McGraw Hill, 1993.

3. Edward Kandrot and Jason Sanders, CUDA By Example – An Introduction to General Purpose GPU Programming, Addison-Wesley Professional ©, 2010.

4. Benedict R Gaster, Lee Howes, David R KaeliPerhaad Mistry Dana Schaa, "Heterogeneous Computing with OpenCL", McGraw-Hill, New York, 2011.

5. CUDA C PROGRAMMING GUIDE, September 2015.

Reference Books:

1. Georg Hager, Gerhard Wellein, "Introduction to High Performance Computing for Scientists and Engineers", Chapman & Hall / CRC Computational Science series, 2011.

2. Michael J. Quinn, "Parallel Programming in C with MPI and OpenMP", McGraw-Hill International Editions, Computer Science Series, 2004.

3. Kai Hwang, "Scalable Parallel Computing: technology, architecture, programming", McGraw Hill 1998

4. Laurence T. Yang, MinyiGuo, "High- Performance Computing: Paradigm and Infrastructure " Wiley

List of Experiments:

1. OpenMP implementation
   workload partitioning based on 1, 2, 4 and 8 core configurations
2. MPI implementation
   workload partitioning based on 1, 2, 4, 8, 16, 32 node configuratations.
3. Performance comparison between CUDA, MPI and OpenMP implementations
   i.   Execution time
   ii. Programming effort
         1. Quantify the speedup you are getting compared to a single processor (single thread) implementation with respect to the amount of programming and design effort you invested
   iii. Limitations of your implementation from both hardware and software perspectives
         1. how does the target architecture impact your paralleization strategy
         2. how does the programming environment effect the speedup you are achieving

Assessment:

Internal: 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.

Subject Code	Subject Name		Credits
ME-ITC203	**Advanced Web Technology**		**04**

Course Objectives:

1 Get familiar with Web Technologies.

2 Gaining a good grasp over Web 2.0 technologies in order to develop responsive web applications

3 Exploring the advantages of emerging web technologies and what environment they are being used in

4 Exploring Web 3.0 and Semantic Web standards

Course Outcomes: Student will be able:

1) To design a responsive web site using HTML5 and CSS.

2) To design RIA using proper choice of Framework

3) To recognize and evaluate website organizational structure and design elements

4) Explain emerging web 3.0 standards

Prerequisite: web programming, C language

DETAILED SYLLABUS:

Sr. No.	Module	Detailed Content	Hours
	Prerequisite	**Introduction to web technologies**: Web system architecture-1,2,3 and n tier architecture, URL, domain name system, overview of HTTP and FTP, Cross browser compatibility issues, W3C Validators **Web Site Design Issues**: Planning a Web Site –Objective and Goals, Audience, Organizing contents. **Publishing of Web Site**. **Function of Web Server** **Basic HTML**: Formatting and fonts, Anchors, images, lists, tables, frames and forms. XML basics.	03
I	Web Technology Basics & HTML 5.0	**HTML 5:** Fundamental Syntax and Semantics, Progressive Markup and Techniques, Forms, Native Audio and Video, Micro data and Custom data, Accessibility, Geo-location, Canvas.	06
II	Responsive web design with HTML5 and CSS3	**Introduction to CSS**: Evolution of CSS, Syntax of CSS, Exploring CSS Selectors, Inserting CSS in an HTML Document, Defining Inheritance in CSS	02
		CSS3 and Responsive Web Design. **CSS3:** Selectors, Typography and color Modes Stunning Aesthetics with CSS3, CSS3 Transitions, Transformations and Animations, Conquer Forms HTML5 and CSS3	06
III	Web Services	**Web Services:** Web services, Evolution and differences with Distributed computing, XML, WSDL, SOAP, UDDI, Transactions, Business Process Execution Language for Web	07

		Services, WS-Security and the Web services security specifications, WS-Reliable Messaging, WS-Policy, WS-Attachments. REST-ful web services, Resource Oriented Architecture, Comparison of REST, SOA, SOAP.	
IV	Rich Internet Application (RIA)	**Introduction to Ajax:** Ajax Design Basics, JavaScript, Blogs, Wikis, RSS feeds **Working with JavaScript Object Notation (JSON):** Create Data in JSON Format, JSON parser, Implement JSON on the Server Side, Implementing Security and Accessibility in AJAX **Applications:** Secure AJAX Applications, Accessible Rich Internet Applications, **Developing RIA using AJAX techniques:** CSS, HTML, DOM, XMLHTTPRequest, JavaScript, PHP, AJAX as REST Client **Open Source Frameworks and CMS for RIA:** Django, Drupal, Joomla introduction and comparison.	08
V	Web Analytics 2.0	Introduction to Web Analytics 2.0 1: State of the Analytics Union, State of the Industry, Rethinking Web Analytics: Meet Web Analytics 2.0, Optimal Strategy for Choosing Your Web Analytics Soul Mate. The Awesome World of Clickstream Analysis: Metrics. The Key to Glory: Measuring Success. Failing Faster: Unleashing the Power of Testing and Experimentation.	08
VI	Web 3.0 and Semantic Web	**Web 3.0 and Semantic Web**: Challenges, Components, Semantic Web Stack: RDF, RDF Schema (RDFS), Simple Knowledge Organization System (SKOS), SPARQL as RDF query language, N-Triples as a format for storing and transmitting data, Turtle (Terse RDF Triple Language), Web Ontology Language (OWL) a family of knowledge representation languages, Rule Interchange Format (RIF), a framework of web rule language dialects supporting rule interchange on the Web.	08

Text Books:

1. HTML 5 Black Book: Kogent Learning solutions
2. Tim O'Reilly, What is Web 2.0? : Design Patterns and Business Models for the Next Generation of Software, O'REILLY
3. John Davies, Rudi Studer, and Paul Warren John , "Semantic Web Technologies: Trends and Research in Ontology-based Systems", Wiley & Son'
4. Web Analytics 2.0: The Art of Online Accountability and Science of Customer Centricity, Web Analytics 2.0: The Art of Online Accountability and Science of Customer Centricity
Avinash Kaushik, ISBN: 978-0-470-52939-3, wiley publication.

References:
1. Grigoris Antoniou and Frank van Harmelen,. A Semantic Web Primer: MIT Press,2004, ISBN 0-262-01210-3
2. Deane Brker, Web Content Management: Systems, Features, and Best Practices, O'Reilly & Associates incorporated, 2016
3. John Domingue, Dieter Fensel, Handbook of Semantic Web Technologies, Springer Reference
4. Liyang Yu, a Developer's Guide to the Semantic Web, Second Edition, Springer
5. An introduction to RDF and Jena RDF API, www.jena.apache.org/tutorials/rdf_api.html.

List of Experiments: based on Laboratory Practical's/ Case studies

1. Design a website with features like login for users and several gadgets, it should atleast have a twitter box, a video, a calendar with events, event announcements and information with a registration form.

2. A mini project based on REST API and web analytics 2.0

3. Apache Jena based RDF and SPRQL based Tutorials

Assessment:

Internal:	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.

Subject Code	Subject Name		Credits
ME-ITDLOC-II2041	**E-Business and Social Network Analysis**		**04**

Course Objectives:

1) To understand e-Business as a significant business segment for the future.

2) To get an overview of technological and strategic aspects of e-Business.

3) To know basics of Social Network Analysis.

4) To visualize, summarize and analyze the effect of Social Networks on e-Business.

Course Outcomes: At the end of the course the students will be able to

1) Develop a complete e-business strategy.

2) Develop and implement complete e-commerce site.

3) Visualize/Analyze real world Social Networks.

4) Analyze the impact of Social Networks on e-Business.

Prerequisite: E-Commerce and E-Business

DETAILED SYLLABUS:

Sr. No.	Module	Detailed Content	Hours
	Prerequisite	Defining e-Business, Framework for understanding e-Business.	3
I	Introduction to e-Business	Fundamental Models of e-Business, Preparing e-Business Plan, and Environmental forces affecting planning & practice, Trends in e-Business.	5
II	e-Business and e-Marketing Strategies	Strategic planning process, SCM, CRM and ERP, Marketing Strategies and Revenue Models.	8
III	e-Payment Systems and Security	Concept of Money, Electronic Payment Systems (EPS), Types of EPS, Smart Card and EPS, Electronic Fund Transfer, Security issues and measures like digital certificate, digital signature, encryption, SSL and SET protocols.	8
IV	Introduction to Social Network Analysis	Concepts: nodes, edges, adjacency matrix, one and two node networks, node degree, Introduction to social network analysis, Network examples, Graph theory basics, Statistical network properties, Degree Distribution, Clustering Coefficients, Frequent patterns, Network motifs, Cliques and k-cores, Node centralities and ranking on Network nodes and edges, Network diameter and average path length.	8
V	Network Communities and	Network Structure, Network Communities, Graph partitioning and cut metrics, Information and Influence of	8

	Visualization	propagation on networks, Network visualization and Graph layouts, Social diffusion.	
VI	SNA in real world	Applications/Case Studies based on the impact of SNA on e-Business, Impact of SNA on consumer behavior.	**8**

Text Books:

1. E-Business: Business, Technology and Society: <u>Kenneth C. Laudon</u> (Author), <u>Carol Traver</u> (Author)

2. E-Business and E-Commerce management Strategy, Implementation and Practice: Dave Chaffey

3. John Scott, "Social network Analysis" Third edition, SAGE Publications

References:

1. E-Commerce : Ninth edition : Gary Schneider, Cengage

2. Christina Prell, "Social Network Analysis: History, Theory and Methodology", SAGE 2011

3. Stephen P Bergatti, Martin G Everett, Jaffery C Johnson, "Analyzing Social Networks", SAGE 2013.

4. Stanley Wasserman, Katherine Faust, "Social Network Analysis: Methods and Applications"

List of Experiments: based on Laboratory Practical's/ Case studies

1. Develop a Business Plan – Identifying the business model, Develop strategic plan, Design Screen Shots, Show few activities (related to CRM, SCM, Marketing, security etc.), organizational structure, s/w & h/w requirements.

2. Create random Networks, Calculate component distribution, average shortest path and evaluate impact of structure on ability of information to diffuse, calculate and interpret node centrality for real world networks.

3. Read recent research based on these services and learn how SNA concepts are applied on e-Business.

Assessment:

Internal: 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.

Subject Code	Subject Name	Credits
ME-ITDLOC-II2042	**AI and Machine Learning**	**04**

Course Objectives:

1 To learn the basic concepts and techniques of AI and machine learning
2. To explore the various mechanism of Knowledge and Reasoning used for building expert
   system.
3. To become familiar with supervised and unsupervised learning models
4. To design and develop AI and machine learning solution using modern tools.

Course Outcomes: Students will able to:

1. Explain the fundamentals of AI and machine learning.
2. Identify an appropriate AI problem solving method and knowledge representation technique.
3. Identify appropriate machine learning models for problem solving.
4. Design and develop the AI applications in real world scenario.

Prerequisite: Probability Theory and Statistics, PROLOG, R Programming

DETAILED SYLLABUS:

Sr. No.	Module	Detailed Content	Hours
	Prerequisite	Basics of AI, Need for AI Basics of ML, Types, need for ML	3
I	Introduction to AI	Definition, Problem, State space representation. Intelligent Systems: Categorization of Intelligent System, Components of AI Program, Foundations of AI, Applications of AI, Current trends in AI, Intelligent Agents: Anatomy, structure, Types	6
II	Problem solving	Solving problem by Searching: Problem Solving Agent, Formulating Problems. Uninformed Search Methods: Breadth First Search (BFS), Depth First Search (DFS), Depth Limited Search, Depth First Iterative Deepening (DFID), Informed Search Methods: Greedy best first Search, A* Search, Memory bounded heuristic Search. Local Search Algorithms and Optimization Problems: Hill climbing search Simulated annealing, Local beam search	8
III	Knowledge and Reasoning	Knowledge based Agents, The Wumpus World, and Propositional logic. First Order Logic: Syntax and Semantic, Inference in FOL, Forward chaining, backward Chaining, Knowledge Engineering in First-Order Logic, Unification, Resolution,	8
IV	Concepts of Machine learning	Supervised, unsupervised, semi-supervised, Rote learning, Reinforcement learning, Issues, steps and applications, Designing a learning System.	3

		Case study: hand written digit recognition, stock price prediction	
V	Learning Models	Decision tree learning. Probabilistic Models: Multivariate Bernoulli Naive Bayes Classifier, Linear and Logistic Regression. Deterministic Models: Support Vector Machine. Hidden Markov Model: Process, Model, Problems of HMM, Viterbi algorithm, Baum- welch algorithm. Reinforcement Learning: Model based learning, Temporal Difference Learning, Generalization, Partially Observable States.	12
VI	Artificial Neural Network	Introduction, neural network representation, Problems for neural network learning, perceptron, multilayer network & Back propagation Algorithm. Deep learning: Definition, relationship between AI, ML, and Deep Learning, Trends in Deep Learning.	8

Text Books:

1. Artificial Intelligence and Machine Learning By Vinod Chandra S.S., Anand Hareendran S

2. Stuart J. Russell and Peter Norvig, "Artificial Intelligence A Modern Approach "Second Edition" Pearson Education

3. Tom M. Mitchell. "Machine Learning" McGraw-Hill, 1997.
4. Ethem Alpaydin "Introduction to machine learning" 2nd ed. The MIT Press, 2010

References:

1. Ivan Bratko "PROLOG Programming for Artificial Intelligence", Pearson Education, Third Edition.
2. Elaine Rich and Kevin Knight "Artificial Intelligence "Third Edition
3. Davis E.Goldberg, "Genetic Algorithms: Search, Optimization and Machine Learning", Addison Wesley, N.Y., 1989.
4. Han Kamber, "Data Mining Concepts and Techniques", Morgann Kaufmann Publishers.

5. "Machine learning with R" by Brett Lantz

List of Experiments : based on Laboratory Practical's/ Case studies

1. Logic programming with **Prolog**

2. Machine Learning with **R**

3. Training and testing using Artificial Neural Network

Assessment:

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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.

Subject Code	Subject Name	Credits
ME-ITDLOC-II2043	**Ethical Hacking and Digital Forensic**	**04**

Course Objectives:

1. Lerner should learn various aspects of network security
2. Lerner should learn different technologies for website security
3. Lerner should learn various aspects of mobile security
4. Lerner should learn various forensic methods for identification of fraud.

Course Outcomes:

1) Explain Knowledge about various aspects of network security.
2) Design and Develop of secure website.
3) Identify various security aspects with respect to mobile technology.
4) Explain solutions for various case studies with the help of forensic techniques.

Prerequisite: Computer Network fundamentals for communication, Static and Dynamic website development, Basics of mobile communications

DETAILED SYLLABUS:

Sr. No.	Module	Detailed Content	Hours
	Prerequisite	**Introduction:** Ethical Hacking terminology, Five stages of hacking, Vulnerability Research, Legal implication of hacking, Impact of hacking.	3
I	Overview of Computer Forensics Technology	Introduction to Computer Forensics, Use of Forensics in Law Enforcement, Employment Proceedings, Computer Forensics services. Types of Computer, Forensics Technology- Military, law, Spyware and Adware, Biometrics security systems.	5
II	Foot Printing & Social Engineering	Information gathering Methodologies, Competitive Intelligence, DNS Enumerations, Social Engineering attacks. **Types of Computer Forensics systems:** Internet security, IDS, Firewall, Public key, Net privacy systems, Vendor and computer Forensics services.	6
III	Incident and Incident Response and Storage	Introduction to Incident, Incident Response Methodology, Steps, Activities in Initial Response Phase after detection of an incident. **Initial Response and Forensic Duplication:** Initial Response & Volatile Data Collection from Windows system, Initial Response & Volatile Data Collection from Unix system, **Forensic Duplication:** Forensic duplication as Admissible Evidence, Forensic Duplication Tool Requirements, Creating a Forensic Duplicate/Qualified Forensic Duplicate of a Hard Drive. **Storage and Evidence Handling:** File Systems: FAT, NTFS, Forensic Analysis of File systems, Storage Fundamentals: Storage Layer, Hard Drives. Evidence Handling: Types of Evidence, Challenges in evidence handling, Overview of evidence handling	10

		procedure.	
		Digital Forensics: Introduction – Evidential potential of digital devices: closed vs. open systems, evaluating digital evidence potential, Device handling: seizure issues, device identification, networked devices and contamination.	
IV	Network Forensics	Collecting Network Based Evidence, Investigating Routers, Network protocols, Email Tracing, Internet Fraud.	**8**
V	Mobile Phone Forensics	Crime and mobile phones, evidences, forensic procedures, files present in SIM card, device data, external memory dump, evidences in memory card, operators systems. Android Forensics: Procedures for handling an android device, imaging android USB mass storage devices, logical and physical techniques.	**8**
VI	Hacking	**Scanning & Enumeration:** Port Scanning, Network Scanning, Vulnerability Scanning, NMAP Scanning tool, OS Fingerprinting, Enumeration. **System Hacking:** Password cracking techniques, Key loggers, Escalating privileges, Hiding Files, Steganography Technologies, Countermeasures. **Sniffers & SQL Injection:** Active and passive sniffing, ARP Poisoning, Session Hijacking, DNS Spoofing, Conduct SQL Injection attack, Countermeasures. **Systems Investigation and Ethical Issues:** Data Analysis Techniques, Investigating Live systems (Windows & Unix), Investigating Hacker Tools, Ethical Issues, Cybercrime. Reconnaissance, Scanning Host discovery, Network devices discovery, service discovery, Backdoors and Trojan horses, Buffer Overflows, Covering Tracks: Networks and systems, Denial of service Attacks, Exploiting system using Netcat, IP address Spoofing, Network Sniffing, Password Attacks, rootkits, Session Hijacking and Defenses.	**8**

Text Books:

1. Kevin Mandia, chirs Proise, "Incident Response and Computer Forensic"

2. Gregory Kipper, "" Wireless Crime and Forensic Investigation", Auerbach publication, 2007

3.Peter Stepheson,"Investigating Computer Crime: A handbook for corporate investigation", Sept 1999

References:

1.Skoudis E. Perlman R. counter hack: A step by step Guide to Computer Attacks and effective Defense, Prentice Hall Professional technical Reference, 2001.

2. John R Vacca "Computer Forensic " Second Edition

 3.Hacker Techniques, Exploits and incident Handling http://www.sans.org

List of Experiments : based on Laboratory Practical's/ Case studies

1. Develop secure web site.

2. Sniffers and SQL Injection.

3. Digital Forensics.

Assessment:

Internal:	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.

Subject Code	Subject Name	Credits
ME-ITDLOC-II2044	**Internet of Things**	**04**

Course Objectives: The course objectives are to:

- Provide an overview of concepts, main trends and challenges of Internet of Things.

- Develop the ability to use Internet of Things related software and hardware technologies.

- Provide the knowledge of data management business processes and analytics of IoT.

- Develop skills to relate the IoT technologies for practical IoT applications such as smart objects.

Course Outcomes: Learner will able to:

- Explain and interpret the Internet of Things concepts and challenges.

- Experiment with the software and hardware IoT Technologies.

- Identify data management and business processes and analytics of IoT

- Design and develop small IoT applications to create smart objects

Perquisite: Web Programming, Microcontroller

DETAILED SYLLABUS:

Sr. No.	Module	Detailed Content	Hours
	Perquisite	Web Programming Concepts, Tools, Framework.	3
I	Introduction to Internet of Things	Definition of Internet of Things (IoT), IoT Paradigm, IoT Architecture – State of the Art, IoT Protocols, IoT Communication Models, IoT in Global Context, Real world scenarios, Different Areas, Examples Trends in the Adaption of the IoT (Cloud Computing, Big Data Analytics, Concepts of Web of Things, Concept of Cloud of Things with emphasis on Mobile Cloud Computing, Smart Objects).	5
II	Open – Source Prototyping Platforms for IoT	Basic Arduino Programming Extended Arduino Libraries, Arduino – Based Internet Communication, Raspberry PI, Sensors and Actuators and Interfacing.	8
III	IoT Protocol & Technology	RFID + NFC, Wireless Networks + WSN, RTLS + GPS, Agents + Multi – Agent Systems, Composition Models for the Web of Things and resources on the Web, Discovery, Search, IoT Mashups and Others. IoT Protocols - M2M, BacNet, ModBus, Bluetooth, Wifi, ZigBee.	8
IV	Wireless Sensor	History and Context, The Node, Connecting Nodes, Networking Nodes, Secured Communication for IoT.	6

	Networks	Networking and the Internet - IP Addressing, Protocols - MQTT, CoAP, REST Transferring data.	
V	Data Analytics for IoT	Introduction, Apache Hadoop, Using Hadoop MapReduce for Batch Data Analysis, Apache Oozie, Apache Spark, Apache Storm, Using Apache Storm for Real-time Data Analysis, Structural Health Monitoring Case Study, Tools for IoT:- Chef, Chef Case Studies, Puppet, Puppet Case Study - Multi-tier Deployment, NETCONF-YANG Case Studies, IoT Code Generator.	10
VI	Application and Use Cases	Concrete Applications and Use – Cases of Web Enabled Things: Energy Management and Smart Homes, Ambient Assisted Living, Intelligent Transport, Etc. Cloud of Things and Big Data. Business Cases and Issues - Agriculture, Music Therapy, Smart Home, Smart Grid Network, Wearable, Healthcare.	8

Text Books:

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

2   The Internet of Things (Connecting objects to the web) by Hakima Chaouchi (Wiley Publications).

3   Internet of Things (A Hands-on-Approach) by Arshdeep Bhaga and Vijay   Madisetti.

Reference Books:

1   The Internet of Things Key applications and Protocols, 2nd Edition, (Wiley Publication) by Olivier Hersent, David Boswarthick and Omar Elloumi.

2   IoT –From Research and Innovation to Market development (River Publication) by Ovidiu Vermesan and Peter Friess.

3   Building Internet of Things with Arduino by Charalampos Doukas.

List of Experiments :

1) Implement A Heterogeneous, Hierarchical Wireless Sensor Network using Cooja/ MSPSim Simulator also add routing protocol, broadcasting message in WSN.
2) Create a smart city and IoT WSN using CupCARBON U-ONE 2.8.5 simulator and senscript.
3) Building machine to machine (M2M) applications such as remote monitoring/Vehicle Tracking, fleet management or smart grid using M2MLabs open source application framework.

Assessment:

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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.

Subject Code	Subject Name	Credits
ME-ITDLOC-II2045	**Advanced Software Quality Assurance**	**04**

Course Objectives: Objectives of this course include:

1. Examining various methods and approaches used to improve the quality of a product or service.

2. Exploring the principles and techniques used to evaluate both functional and non-functional requirements

3. Distinguish between the various activities of quality assurance, quality planning and quality control.

4. Understand the importance of standards in the quality management process and their impact on the final product.

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

1. Explain the established concepts, the fundamental test process, test management principles, test strategies/approaches, risks and principles to support test objectives.

2. Analyze and prioritize both functional and non-functional specifications, such as performance efficiency and usability, design tests using established techniques for functional tests at all test levels for systems of small to medium complexity

3. Interpret and execute tests according to agreed test specifications and analyze and report on the results of tests independently

4. Implement testing tools for various testing activities

Prerequisite: Software engineering.

DETAILED SYLLABUS:

Sr. No.	Module	Detailed Content	Hours
	Prerequisite	Software engineering (or) Experience in software development. Any one programming language and IDE. Knowledge of testing tools is advantageous.	3
I	Fundamentals of software Testing Process: defects, hypotheses, and tests	Basic Definitions, Software Testing Principles , The Role of Process in Software Quality, Testing as a Process , Overview of the Testing Maturity Model , The Tester's Role in a Software Development Organization Origins of Defects, Defect Classes, the Defect Repository, and Test Design. Requirements and Specification Defects. Design Defects. Coding Defects. Testing Defects, Developer/Tester Support for Developing a Defect Repository.	4

II	Strategies and methods for test case design	Test Case Design Strategies - Using the Black Box Approach to Test Case Design, Random Testing, Equivalence Class Partitioning, Boundary Value Analysis , Cause-and-Effect Graphing, State Transition Testing, Error Guessing, Black Box Testing and Commercial Off-the-Shelf Components (COTS). Using the White Box Approach to Test Design, Test Adequacy Criteria, Coverage and Control Flow Graphs, Covering Code Logic, Paths: Their Role in White Box–Based Test Design, Data Flow and White Box Test Design, Loop Testing, Mutation Testing.	11
III	Levels of testing	Levels of Testing and Software Development Paradigms , Unit Test: Functions, Procedures, Classes, and Methods as Units , Unit Test Planning , Designing the Unit Tests , The Class as a Testable Unit, The Test Harness. Integration Test: Integration Strategies for Procedures and Functions, Integration Strategies for Classes, Designing Integration Tests, Integration Test Planning ,System Test: The Different Types, Functional Testing, Performance Testing , Stress Testing, Configuration Testing, Security Testing, Recovery Testing , Regression Testing , Alpha, Beta, and Acceptance Tests .Role of Use Cases.	10
IV	Reviews as a testing activity	Types of Reviews – Inspections, Walkthroughs, Developing a Review Program, The Need for Review Policies, Components of Review Plans, Review Goals, Preconditions and Items to be Reviewed, Review Procedures, Review Checklists. Reporting Review Results, Review, Rework, and Follow-Up , Review Metrics , The Self-Check or Personal Review, software Quality Evaluation	4
V	Evaluating software quality	Quality Costs, Quality Control, Statistical Testing, Software Reliability, Measurements for Software Reliability, Applying Reliability Models, Confidence Levels and Quality Control, Usability Testing and Quality Control , Assessment Usability Testing, Validation Usability Testing. Resource Requirements - Usability Tests and Measurements DEFECT ANALYSIS AND PREVENTION -Processes and Defects, Techniques for Defect Analysis Defect Causal Analysis, Making Process Changes, Monitoring Actions and Process Changes, Benefits of a Defect Prevention Program, Defect Prevention and the Three Critical Views	8
VI	Test driven development	Overview of testing on agile project. What is TDD? TDD and traditional testing, Incremental design, continuous integration, Self-documenting code. TDD and documentation, Scaling TDD via Agile Model-Driven Development (AMDD). Overview of agile TDD tools. Introduction to digital testing	8

Text Books:

1. Ilene Burnstein, "Practical software testing", Springer Professional computing

2. Kshirasagar Naik and Priyadarshi Tripathy (Eds), "Software Testing and Quality Assurance: Theory and Practice", John Wiley, 2008

3. Kent Beck "Test Driven Development", Addison Wesley.

References:

7. Marnie L. Hutcheson, "Software Testing Fundamentals- Methods and Metrics", Wiley

8. Boriz Beizer, "Software Testing Techniques", 2nd Edition, DreamTech, 2009.

9. Aditya P. Mathur, "Foundations of Software Testing", Pearson, 2008
10. Mauro Pezze and Michal Young, "Software Testing and Analysis. Process, Principles, and Techniques", John Wiley, 2008
11. Stephen H. Kan, "Metrics and Models in Software Quality Engineering", 2nd Edition, Pearson, 2003

List of Experiments: Use the following tools in laboratories.

CVS: For the software configuration management repository

Bugzilla: For tracking and reporting bugs and change requests

CheckStyle: To verify the source code conformance to the programming language standard

Eclipse: A development environment with a multitude of plug-ins

Logiscope: Product quality measurement

IBM academic program gives many software tools such as the IBM RequisitePro Traceability tool.

DevOps tools: GitHub, Jenkins and Docker.

Laboratory Practical's/ Case studies –

1. Develop a small application or program additional features into existing software using CVS tool/GitHub

2. Test the software produced using open-source software tools for unit and integration testing. Use IBM RequisitePro/Excel, Bugzilla to update information on defects/changes and inspection,

3. Product quality assessment- Assess source code conformance to customer standards using CheckStyle and software complexity/quality using Logiscope.

4. TDD – Use of DevOps Tools – Jenkins and Docker to build code, create Docker containers, run tests and stage production.

Assessment:

Internal:	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.

Course Code	Course Name	Credits
ME-ITILOCII2051	**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, engaging with all stakeholders of the projects. Team management, communication and project meetings. **5.2 Monitoring and Controlling Projects:** Earned Value Management techniques for measuring value of work completed; Using milestones for measurement; change requests and scope creep. Project audit. **5.3 Project Contracting**	8

	Project procurement management, contracting and outsourcing,	
06	**6.1 Project Leadership and Ethics:** Introduction to project leadership, ethics in projects. Multicultural and virtual projects. **6.2 Closing the Project:** Customer acceptance; Reasons of project termination, Various types of project terminations (Extinction, Addition, Integration, Starvation), Process of project termination, completing a final report; doing a lessons learned analysis; acknowledging successes and failures; Project management templates and other resources; Managing without authority; Areas of further study.	6

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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.

<u>**Assessment:**</u>

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:
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2. All question carry equal marks
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4. Only Four question need to be solved.

Course Code	Course Name	Credits
ME-ITILOCII2052	**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) **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.	10
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.	05

	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	
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:
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4. Only Four question need to be solved.

Course Code	Course Name	Credits
ME-ITILOCII2053	**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

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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
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4. Only Four question need to be solved.

Course Code	Course Name	Credits
ME-ITILOCII2054	**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	6

	& conflicts: Concept of roles; role dynamics; role conflicts and 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

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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
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6. Laurie Mullins, Management & Organizational Behavior, Latest Ed, 2016, Pearson Publications

Assessment:

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End Semester Theory Examination:
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Course Code	Course Name	Credits
ME-ITILOCII2055	**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.

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Course Code	Course Name	Credits
ME-ITILOCII2056	**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** **1.1** Research – Definition; Concept of Construct, Postulate, Proposition, Thesis, Hypothesis, Law, Principle.Research methods vs Methodology **1.2** Need of Research in Business and Social Sciences **1.3** Objectives of Research **1.4 Issues** and Problems in Research **1.5** Characteristics of Research:Systematic, Valid, Verifiable, Empirical and Critical	**09**
02	**Types of Research** **2.1**. Basic Research **2.2**. Applied Research **2.3.** Descriptive Research **2.4.** Analytical Research **2.5**. Empirical Research **2.6** Qualitative and Quantitative Approaches	**07**
03	**Research Design and Sample Design** **3.1** Research Design – Meaning, Types and Significance **3.2** 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 **j.** Preparation of Research Report	**08**
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**	**04**

| | **6.1** Preparation of the report on conclusion reached
6.2 Validity Testing & Ethical Issues
6.3 Suggestions and Recommendation | |

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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, (2[nd]ed), Singapore, Pearson Education

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Course Code	Course Name	Credits
ME-ITILOCII2057	**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 **Patent databases:** Important websites, Searching international databases	07

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
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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
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14. Vivien Irish, 2005, Intellactual Property Rights for Engineers,IET
15. Howard B Rockman, 2004, Intellectual Property Law for Engineers and scientists, Wiley-IEEE Press

Assessment:

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Course Code	Course Name	Credits
ME-ITILOCII 2058	**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:
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4. Only Four question need to be solved.

Course Code	Course Name	Credits
ME-ITILOCII2059	**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.

Subject Code	Subject Name	Credits
ME-ITL101	**Laboratory I (Core Course Lab)**	**01**

Module	Detailed content	Lab. Sessions
1	**Two Laboratory Practical's to be conducted for each of the core subjects as suggested in the subject syllabus.**	24

Modality and Assessment:

1. Each Laboratory assignment will be done in a group of two students. The Faculty teaching each core subject will be required to propose and evaluate the respective Laboratory assignments. These will be essentially hands-on practical and not theory / research review types of assignments.
2. **End Semester Examination:** Practical/Oral examination is to be conducted by pair of internal and external examiners.

Subject Code	Subject Name	Credits
ME-ITL102	**Laboratory II –(DLOC & ILOC Lab)**	**01**

Module	Detailed content	Lab. Sessions
1	**Three Laboratory Practical's to be conducted for each of the DEC & IEC subjects as suggested in the subject syllabus.**	24

Modality and Assessment:

1. Each mini project assignment will be done by individual student. The Faculty teaching elective subject will be required to propose and evaluate the respective mini projects. These will be essentially hands-on practical and not theory / research review types of projects
2. **End Semester Examination:** Practical/Oral examination is to be conducted by pair of internal and external examiners

Subject Code	Subject Name	Credits
ME-ITL201	**Laboratory III-(Core Course Lab)**	**01**

Module	Detailed content	Lab. Sessions
1	**Two Laboratory Practical's to be conducted for each of the core subjects as suggested in the subject syllabus.**	24

Modality and Assessment:

1. Each Laboratory assignment will be done in a group of two students. The Faculty teaching each core subject will be required to propose and evaluate the respective Laboratory assignments. These will be essentially hands-on practical and not theory / research review types of assignments.
2. **End Semester Examination:** Practical/Oral examination is to be conducted by pair of internal and external examiners

Subject Code	Subject Name	Credits
ME-ITL202	**Laboratory IV –(DLOC & ILOC Lab)**	**01**

Module	Detailed content	Lab. Sessions
1	**Three Laboratory Practical's to be conducted for each of the DLOC & ILOC subjects as suggested in the subject syllabus.**	24

Modality and Assessment:

1. Each mini project assignment will be done by individual student. The Faculty teaching elective subject will be required to propose and evaluate the respective mini projects. These will be essentially hands-on practical and not theory / research review types of projects
2. **End Semester Examination:** Practical/Oral examination is to be conducted by pair of internal and external examiners

Subject Code	Subject Name	Credits
ME-ITS301	**Seminar**	**03**

Guidelines for Seminar
- o   Seminar should be based on thrust areas in Information Technology
- o   Students should do literature survey and identify the topic of seminar and finalize in consultation with Guide/Supervisor. Students should use multiple literatures (at least 10 papers from Refereed Journals) and understand the topic and compile the report in standard format and present in front of Panel of Examiners. (pair of Internal and External examiners appointed by the University of Mumbai)
- o   **Seminar should be assessed based on following points**
  - ▪   Quality of Literature survey and Novelty in the topic
  - ▪   Relevance to the specialization
  - ▪   Understanding of the topic
  - ▪   Quality of Written and Oral Presentation

IMPORTANT NOTE :

1. Assessment of Seminar will be carried out by a pair of Internal and External examiner. The external examiner should be selected from approved panel of examiners for Seminar by University of Mumbai, OR faculty from Premier Educational Institutions /Research Organizations such as IIT, NIT, BARC, TIFR, DRDO, etc. OR a person having minimum Post-Graduate qualification with at least five years' experience in Industries.

2. Literature survey in case of seminar is based on the broader area of interest in recent developments and for dissertation it should be focused mainly on identified problem.

3. At least 4-5 hours of course on Research Methodology should be conducted which includes Literature Survey, Problems Identification, Analysis and Interpretation of Results and Technical Paper Writing in the beginning of 3rd Semester.
4. Students should publish at least one paper based on the seminar work in reputed International / National Conference/Journal (desirably in Referred Journal should be ISI/Scopus/SCI indexing)

Subject Code	Subject Name	Credits
ME-ITD301/ **ME-ITD401**	**Dissertation (I and II)**	**12 + 15**

Guidelines for Dissertation

o Students should do literature survey and identify the problem for Dissertation and finalize in consultation with Guide/Supervisor. Students should use multiple literatures and understand the problem. Students should attempt solution to the problem by analytical/simulation/experimental methods. The solution to be validated with proper justification and compile the report in standard format.

Guidelines for Assessment of Dissertation I

o Dissertation I should be assessed based on following points
o
  ▪ Quality of Literature survey and Novelty in the problem
  ▪ Clarity of Problem definition and Feasibility of problem solution
  ▪ Relevance to the specialization
  ▪ Clarity of objective and scope
o Dissertation I should be accessed through a presentation by a panel of Internal examiners appointed by the Head of the Department/Institute of respective Programme.

Guidelines for Assessment of Dissertation II

o Dissertation II should be assessed based on following points
  ▪ Quality of Literature survey and Novelty in the problem
  ▪ Clarity of Problem definition and Feasibility of problem solution
  ▪ Relevance to the specialization or current Research / Industrial trends
  ▪ Clarity of objective and scope
  ▪ Quality of work attempted
  ▪ Validation of results
  ▪ Quality of Written and Oral Presentation
o Dissertation II should be accessed through a presentation jointly by Internal and External Examiners appointed by the University of Mumbai
o Students should publish at least one or two paper based on the work in reputed International / National Conference/Journal (desirably in Referred Journal should be ISI/Scopus/SCI indexing) (desirably in Referred Journal)