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
7 November, 2016

To,

The Principals of affiliated Colleges in Engineering.

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

***************

No. UG/149A of 2016 MUMBAI-400 032 7 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.

(Shri M.A. Khan)
REGISTRAR

PTO
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

<table>
<thead>
<tr>
<th>Subject Code</th>
<th>Subject Name</th>
<th>Teaching Scheme (Contact Hours)</th>
<th>Credits Assigned</th>
</tr>
</thead>
<tbody>
<tr>
<td>ME-ITC101</td>
<td>Data Science</td>
<td>04</td>
<td>--</td>
</tr>
<tr>
<td>ME-ITC102</td>
<td>IT Infrastructure Design</td>
<td>04</td>
<td>--</td>
</tr>
<tr>
<td>ME-ITC103</td>
<td>Advances in Software Engineering</td>
<td>04</td>
<td>--</td>
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<tr>
<td>ME-ITDLOC-I104</td>
<td>Department Level Optional Course-I</td>
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<td>ME-ITILOC-I105</td>
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<td>ME-ITL101</td>
<td>Laboratory-I</td>
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<td>02</td>
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<tr>
<td>ME-ITL102</td>
<td>Laboratory-II</td>
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<thead>
<tr>
<th>Subject Code</th>
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<tr>
<td></td>
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<td>Theory Internal Assessment</td>
</tr>
<tr>
<td>ME-ITC101</td>
<td>Data Science</td>
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<td>ME-ITC102</td>
<td>IT Infrastructure Design</td>
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<tr>
<td>ME-ITC103</td>
<td>Advances in Software Engineering</td>
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<tr>
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<td>ME-ITL102</td>
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</table>
# 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.

<table>
<thead>
<tr>
<th>Subject Code</th>
<th>Department Level Optional Course (DLOC)</th>
<th>Subject Code</th>
<th>Institute Level Optional Course (ILOC)</th>
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<tbody>
<tr>
<td>ME-ITDLOC-I11041</td>
<td>User Experience Engineering</td>
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<td>ME-ITILOC-I11052</td>
<td>Reliability Engineering</td>
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<td>ME-ITDLOC-I11043</td>
<td>Cloud Computing</td>
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<td>Management Information System</td>
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<tr>
<td>ME-ITDLOC-I11044</td>
<td>IT Strategy</td>
<td>ME-ITILOC-I11054</td>
<td>Design of Experiments</td>
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<tr>
<td>ME-ITDLOC-I11045</td>
<td>Knowledge Management</td>
<td>ME-ITILOC-I11055</td>
<td>Operation Research</td>
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<td>ME-ITILOC-I11056</td>
<td>Cyber Security and Laws</td>
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<td></td>
<td>ME-ITILOC-I11057</td>
<td>Disaster Management and Mitigation Measures</td>
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<td>Energy Audit and Management</td>
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### Semester II

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<tbody>
<tr>
<td>ME-ITC201</td>
<td>Security &amp; Risk Management</td>
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<td>ME-ITC202</td>
<td>High Performance Computing</td>
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<tr>
<td>ME-ITC203</td>
<td>Advance web technology</td>
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<td>ME-ITL202</td>
<td>Laboratory-IV</td>
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<td><strong>Test1</strong></td>
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</thead>
<tbody>
<tr>
<td>ME-ITDLOC-II2041</td>
<td>E-Business &amp; Social Network Analysis</td>
<td>ME-ITILOC-II2051</td>
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<td>ME-ITDLOC-II2042</td>
<td>AI &amp; Machine Learning</td>
<td>ME-ITILOC-II2052</td>
<td>Finance Management</td>
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<td>ME-ITDLOC-II2043</td>
<td>Ethical Hacking &amp; Forensic</td>
<td>ME-ITILOC-II2053</td>
<td>Entrepreneurship Development and Management</td>
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<td>ME-ITDLOC-II2044</td>
<td>Internet of Things</td>
<td>ME-ITILOC-II2054</td>
<td>Human Resource Management</td>
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<td>ME-ITDLOC-II2045</td>
<td>Advanced Software Quality Assurance</td>
<td>ME-ITILOC-II2055</td>
<td>Professional Ethics and CSR</td>
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<td>ME-ITILOC-II2057</td>
<td>IPR and Patenting</td>
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<td>ME-ITILOC-II2058</td>
<td>Digital Business Management</td>
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<td>ME-ITILOC-II2059</td>
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### Semester III

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<tr>
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<td>Seminar</td>
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<tr>
<td>ME-ITD301</td>
<td>Dissertation</td>
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<tbody>
<tr>
<td></td>
<td></td>
<td>Theory</td>
</tr>
<tr>
<td></td>
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<td>Internal Assessment</td>
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<td>Term Work</td>
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<td>Oral Work</td>
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<td>Oral Work</td>
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| ME-ITS301    | Seminar      | -- | -- | -- | -- | 50 | 50 | 100 |
| ME-ITD301    | Dissertation | -- | -- | -- | -- | 100 | -- | 100 |
| Total        |              | -- | -- | -- | -- | 150 | 50 | 200 |
### Semester IV

<table>
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<th>Subject Name</th>
<th>Teaching Scheme (Contact Hours)</th>
<th>Credits Assigned</th>
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<tbody>
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<th>Subject Code</th>
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<tbody>
<tr>
<td></td>
<td></td>
<td>Theory</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Test</td>
</tr>
<tr>
<td>ME-ITD401</td>
<td>Dissertation II</td>
<td>--</td>
</tr>
<tr>
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</table>

* 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.
Semester I

<table>
<thead>
<tr>
<th>Subject Code</th>
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<tbody>
<tr>
<td>ME-ITC101</td>
<td>Data Science</td>
<td>04</td>
</tr>
</tbody>
</table>

**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 database, basic programming skills

<table>
<thead>
<tr>
<th>Sr. No.</th>
<th>Module</th>
<th>Detailed Content</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Prerequisite</td>
<td>Relational database, KDD process, Introduction to BIG data, What is Hadoop, Core components of Hadoop, Hadoop ecosystem.</td>
<td>3</td>
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<tr>
<td>I</td>
<td>An Introduction to Data Science</td>
<td>Definition, working, benefits and uses of Data Science, Data science vs BI, The data science process, Role of a Data Scientist,</td>
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<tr>
<td>II</td>
<td>Statistical Data Analysis &amp; Inference</td>
<td>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.</td>
<td>8</td>
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<tr>
<td>III</td>
<td>Learning Algorithms</td>
<td>k-nearest neighbor, Simple and multiple Linear Regression, Logistic Regression, Support vector machine, Model-Based Clustering, Clustering High-Dimensional Data,</td>
<td>12</td>
</tr>
<tr>
<td>IV</td>
<td>Data Visualization</td>
<td>Data Visualization basics, techniques, types, applications, tools, Data Journalism, Interactive dashboards,</td>
<td>8</td>
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<tr>
<td>V</td>
<td>Advance Analytical Methods</td>
<td>Text Analysis- Text analysis steps, A text analysis example, Collecting raw text and representing text, TF and TFIDF, Categorizing documents by topics, determining</td>
<td>8</td>
</tr>
</tbody>
</table>
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  

**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.

<table>
<thead>
<tr>
<th>Module</th>
<th>Detailed content</th>
<th>Hours</th>
</tr>
</thead>
</table>
| 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  
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 |
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.


References:

2. CCDA Cisco official Guide
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:

<table>
<thead>
<tr>
<th>Sr. No.</th>
<th>Module</th>
<th>Detailed Content</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Nature of Software, Software Definition, Software characteristics, Software Application Domains, Software Myths, Software Engineering Practice</td>
<td>03</td>
</tr>
<tr>
<td>Section</td>
<td>Topic</td>
<td>Notes</td>
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<td>---------</td>
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<td></td>
</tr>
</tbody>
</table>

Text Books:

References:


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


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.
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 techniques 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)” describes 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:

<table>
<thead>
<tr>
<th>Sr. No.</th>
<th>Module</th>
<th>Detailed Content</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Pre-requisites</td>
<td>HCI and Usability, Usability Paradigms and Usability Principles, User Interface Design Tools.</td>
<td>3</td>
</tr>
<tr>
<td>I</td>
<td>Introduction</td>
<td>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.</td>
<td>6</td>
</tr>
<tr>
<td>II</td>
<td>The Wheel: A Lifecycle Template</td>
<td>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.</td>
<td>6</td>
</tr>
<tr>
<td>V</td>
<td>UX Evaluation, The Interaction</td>
<td>UX Goals, Metrics and Targets, UX Evaluation Techniques.- Formative vs summative, Analysis.</td>
<td>8</td>
</tr>
</tbody>
</table>
Cycle and the User Action Framework

<table>
<thead>
<tr>
<th>VI</th>
<th>UX Design Guidelines</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Introduction, Using and interpreting design guidelines, Human memory limitations, Selected UX design guidelines and examples, Planning, Translation, Physical actions, Outcomes, Assessment, Overall.</td>
</tr>
</tbody>
</table>

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
4. Human Computer Interaction by Alan Dix

Lab Practical's: For any Case Study perform following practicals:-

Sr.No. Description

1. Identify 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
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:**

<table>
<thead>
<tr>
<th>Sr. No.</th>
<th>Module</th>
<th>Detailed Content</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>II</td>
<td><strong>Medium access protocols</strong></td>
<td>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</td>
<td>8</td>
</tr>
<tr>
<td>IV</td>
<td>Multicast routing in ad-hoc networks</td>
<td></td>
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<table>
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<tr>
<th>V</th>
<th>Transport layer-security protocols</th>
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<table>
<thead>
<tr>
<th>VI</th>
<th>Mobile/vehicular Ad-hoc Networks</th>
</tr>
</thead>
</table>

**Text book**


**References**


**Practical**

1. Implement Ad-hoc network using BlueHoc Simulator.
2. Implement MANET using DARS Simulator.
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.
<table>
<thead>
<tr>
<th>Subject Code</th>
<th>Subject Name</th>
<th>Credits</th>
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<tbody>
<tr>
<td>ME-DDLOC-11043</td>
<td>Cloud Computing</td>
<td>04</td>
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</tbody>
</table>

**Course Objectives:**

1. Introduce the broad perception 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:**

<table>
<thead>
<tr>
<th>Sr. No.</th>
<th>Module</th>
<th>Detailed Content</th>
<th>Hours</th>
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</thead>
</table>
### Computing Environment

<table>
<thead>
<tr>
<th>IV</th>
<th>Green Mobile Cloud Computing</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>V</th>
<th>Resource Allocation and Business Aspects of Mobile Cloud Computing</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>VI</th>
<th>Application of Mobile Cloud Computing and Future Research Scope of Mobile Cloud Computing</th>
</tr>
</thead>
</table>

### Text Books:


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 by Ishwarya Chandrasekaran 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.
**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:**

<table>
<thead>
<tr>
<th>Sr. No.</th>
<th>Module</th>
<th>Detailed Content</th>
<th>Hours</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>Prerequisite</td>
<td>Basic of IT infrastructure and Internet Technology.</td>
<td>3</td>
</tr>
<tr>
<td>II</td>
<td>Technology Intelligence</td>
<td>Signals of New Technology, What is Technology Intelligence, Importance of Technology Intelligence, Levels of Technology Intelligence, External versus Internal Technology Intelligence. Mapping the Technology</td>
<td>8</td>
</tr>
</tbody>
</table>
### Environment
- Steps in Mapping
- Mapping the Macro level Environment
- Mechanisms for Data Collection
- Challenges, Organizational Arrangements and Key Principles for Data Collection

### Business Strategy and Technology Strategy
- Business Strategy

### 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.

### 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

### 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

### 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

### References:
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


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-I11045 | 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:

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<tr>
<th>Sr. No.</th>
<th>Module</th>
<th>Detailed Content</th>
<th>Hours</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>Prerequisite</td>
<td>Meaning of data, information, knowledge and expertise. Meaning of epistemology. Types of Knowledge - Subjective &amp; Objective views of knowledge, procedural Vs. Declarative, tacit Vs. explicit, general Vs. specific.</td>
<td>3</td>
</tr>
<tr>
<td>I</td>
<td>Introduction to Knowledge Management</td>
<td>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 &amp; their role Relevance of KM in today’s dynamic &amp; complex environment Future of Knowledge Management</td>
<td>5</td>
</tr>
</tbody>
</table>

**Text Books:**


**References:**


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

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


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**: ME-ITILOCI1051  
**Course Name**: Product Life Cycle Management  
**Credits**: 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

<table>
<thead>
<tr>
<th>Module</th>
<th>Detailed Contents</th>
<th>Hrs</th>
</tr>
</thead>
</table>
| 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 |
| 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 |
Product Design


REFERENCES:


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: ME-ITILOCI1052
### Course Name: Reliability Engineering
### Credits: 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

<table>
<thead>
<tr>
<th>Module</th>
<th>Detailed Contents</th>
<th>Hrs</th>
</tr>
</thead>
</table>
| 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, Fault tree analysis and Event tree Analysis | 05  |

### REFERENCES:
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.
Objectives:
1. The course is a 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.
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.

<table>
<thead>
<tr>
<th>Module</th>
<th>Detailed Contents</th>
<th>Hrs</th>
</tr>
</thead>
<tbody>
<tr>
<td>01</td>
<td>Introduction To Information Systems (IS): Computer Based Information Systems, Impact of IT on organizations, Importance of IS to Society. Organizational Strategy, Competitive Advantages and IS.</td>
<td>4</td>
</tr>
<tr>
<td>02</td>
<td>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</td>
<td>7</td>
</tr>
<tr>
<td>03</td>
<td>Ethical issues and Privacy: Information Security. Threat to IS, and Security Controls</td>
<td>7</td>
</tr>
<tr>
<td>05</td>
<td>Computer Networks Wired and Wireless technology, Pervasive computing, Cloud computing model.</td>
<td>6</td>
</tr>
</tbody>
</table>

REFERENCES:
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.
<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Name</th>
<th>Credits</th>
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<tbody>
<tr>
<td>ME-ITILOC11054</td>
<td>Design of Experiments</td>
<td>03</td>
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</table>

**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

<table>
<thead>
<tr>
<th>Module</th>
<th>Detailed Contents</th>
<th>Hrs</th>
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<tbody>
<tr>
<td>01</td>
<td><strong>Introduction</strong></td>
<td></td>
</tr>
<tr>
<td></td>
<td>1.1 Strategy of Experimentation</td>
<td></td>
</tr>
<tr>
<td></td>
<td>1.2 Typical Applications of Experimental Design</td>
<td></td>
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<tr>
<td></td>
<td>1.3 Guidelines for Designing Experiments</td>
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<td>04</td>
<td><strong>Two-Level Fractional Factorial Designs</strong></td>
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<td>4.1 The One-Half Fraction of the $2^k$ Design</td>
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<td>4.2 The One-Quarter Fraction of the $2^k$ Design</td>
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<td>4.3 The General $2^{k-p}$ Fractional Factorial Design</td>
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<td>4.4 Resolution III Designs</td>
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<td>4.6 Fractional Factorial Split-Plot Designs</td>
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<td>05</td>
<td><strong>Response Surface Methods and Designs</strong></td>
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<td>5.1 Introduction to Response Surface Methodology</td>
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<td>6.1 Crossed Array Designs and Signal-to-Noise Ratios</td>
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<tr>
<td>6.2 Analysis Methods</td>
<td></td>
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</tr>
<tr>
<td>6.3 Robust design examples</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

REFERENCES:

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

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-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

<table>
<thead>
<tr>
<th>Module</th>
<th>Detailed Contents</th>
<th>Hrs</th>
</tr>
</thead>
</table>
| 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  
**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 $2 \times 2$ games. | 05 |
| 06 | **Inventory Models:** Classical EOQ Models, EOQ Model with Price Breaks, EOQ with Shortage, Probabilistic EOQ Model, | 05 |

**REFERENCES:**


**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-ITILOCI1056 | Cyber Security and Laws | 03

Objectives:
1. To understand and identify different types of cybercrime and cyber law
2. To recognize 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

<table>
<thead>
<tr>
<th>Module</th>
<th>Detailed Contents</th>
<th>Hrs</th>
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</thead>
<tbody>
<tr>
<td>01</td>
<td><strong>Introduction to Cybercrime:</strong> Cybercrime definition and origins of the world, Cybercrime and information security, Classifications of cybercrime, Cybercrime and the Indian ITA 2000, A global Perspective on cybercrimes.</td>
<td>4</td>
</tr>
<tr>
<td>03</td>
<td><strong>Tools and Methods Used in Cyberline</strong> 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)</td>
<td>6</td>
</tr>
<tr>
<td>05</td>
<td><strong>Indian IT Act.</strong> Cyber Crime and Criminal Justice : Penalties, Adjudication and Appeals Under the IT Act, 2000, IT Act. 2008 and its Amendments</td>
<td>6</td>
</tr>
<tr>
<td>06</td>
<td><strong>Information Security Standard compliances</strong> SOX, GLBA, HIPAA, ISO, FISMA, NERC, PCI.</td>
<td>6</td>
</tr>
</tbody>
</table>

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
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: ME-ITILOCI1057  
**Course Name:** Disaster Management and Mitigation Measures  
**Credits:** 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

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<thead>
<tr>
<th>Module</th>
<th>Detailed Contents</th>
<th>Hrs</th>
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</thead>
<tbody>
<tr>
<td>01</td>
<td><strong>Introduction</strong></td>
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<tr>
<td></td>
<td>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.</td>
<td>03</td>
</tr>
</tbody>
</table>
| 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 coordination 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.

REFERENCES:
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

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

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-ITILOC11058 | 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.

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<tr>
<th>Module</th>
<th>Detailed Contents</th>
<th>Hrs</th>
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<tbody>
<tr>
<td>02</td>
<td><strong>Energy Audit Principles:</strong> 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&amp; targeting; Energy audit Instruments; Data and information-analysis. Financial analysis techniques: Simple payback period, NPV, Return on investment (ROI), Internal rate of return (IRR)</td>
<td>08</td>
</tr>
<tr>
<td>03</td>
<td><strong>Energy Management and Energy Conservation in Electrical System:</strong> Electricity billing, Electrical load management and maximum demand Control; Power factor improvement, Energy efficient equipments and appliances, star ratings. <strong>Energy efficiency measures in lighting system, Lighting control:</strong> 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.</td>
<td>10</td>
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<tr>
<td>04</td>
<td><strong>Energy Management and Energy Conservation in Thermal Systems:</strong> 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.</td>
<td>10</td>
</tr>
</tbody>
</table>
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
8. www.energymanagertraining.com
9. www.bee-india.nic.in

Assessment:

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

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

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

<table>
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<tr>
<th>Subject Code</th>
<th>Subject Name</th>
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<tbody>
<tr>
<td>ME-ITC201</td>
<td>Security &amp; Risk Management</td>
<td>04</td>
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</tbody>
</table>

## 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:

<table>
<thead>
<tr>
<th>Module</th>
<th>Detailed content</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>Prerequisite</td>
<td>Overview of Information Security Management</td>
<td>3</td>
</tr>
<tr>
<td>I</td>
<td>Introduction to Information Security</td>
<td>5</td>
</tr>
<tr>
<td>II</td>
<td>Information Security Risk Assessment Basics</td>
<td>8</td>
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<tr>
<td>III</td>
<td>Risk Assessment Methodology</td>
<td>8</td>
</tr>
<tr>
<td>IV</td>
<td>Performing the Assessment</td>
<td>10</td>
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</tbody>
</table>

### Module Details:

- **Overview of Information Security Management**

- **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.

- **Information Security Risk Assessment Basics**

- **Risk Assessment Methodology**

- **Performing the Assessment**
  - Vulnerability scan and Exploitation: Internet Host and network enumeration, IP

| 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. | 8 |
|   | 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. |   |

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

**References**

5. Network Security Assessment, Chris McNab, O’reilly
6. Inside Security Assessment, Micheal Gregg, Pearson

**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
attempted by students. Minimum 80% syllabus should be covered in question papers of end semester examination.

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<tr>
<th>Subject Code</th>
<th>Subject Name</th>
<th>Credits</th>
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<tbody>
<tr>
<td>ME-ITC202</td>
<td>High Performance Computing</td>
<td>04</td>
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</tbody>
</table>

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:

<table>
<thead>
<tr>
<th>Sr. No.</th>
<th>Module</th>
<th>Detailed Content</th>
<th>Hours</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>Pre-requisite</td>
<td>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.</td>
<td>3</td>
</tr>
</tbody>
</table>
| 1       | 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     |
| 2       | 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 |

**Text Books:**


5. CUDA C PROGRAMMING GUIDE, September 2015.

**Reference Books:**


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 configurations.
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:**

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:

<table>
<thead>
<tr>
<th>Sr. No.</th>
<th>Module</th>
<th>Detailed Content</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>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</td>
<td>03</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Basic HTML: Formatting and fonts, Anchors, images, lists, tables, frames and forms. XML basics.</td>
<td></td>
</tr>
<tr>
<td>I</td>
<td>Web Technology Basics &amp; HTML 5.0</td>
<td>HTML 5: Fundamental Syntax and Semantics, Progressive Markup and Techniques, Forms, Native Audio and Video, Micro data and Custom data, Accessibility, Geo-location, Canvas.</td>
<td>06</td>
</tr>
<tr>
<td>II</td>
<td>Responsive web design with HTML5 and CSS3</td>
<td>Introduction to CSS: Evolution of CSS, Syntax of CSS, Exploring CSS Selectors, Inserting CSS in an HTML Document, Defining Inheritance in CSS</td>
<td>02</td>
</tr>
<tr>
<td></td>
<td></td>
<td>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</td>
<td>06</td>
</tr>
<tr>
<td>III</td>
<td>Web Services</td>
<td>Web Services: Web services, Evolution and differences with Distributed computing, XML, WSDL, SOAP, UDDI, Transactions, Business Process Execution Language for Web</td>
<td>07</td>
</tr>
<tr>
<td>IV</td>
<td>Rich Internet Application (RIA)</td>
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<td></td>
<td>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.</td>
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</tr>
</tbody>
</table>
|    | **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. |

<table>
<thead>
<tr>
<th>V</th>
<th>Web Analytics 2.0</th>
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<thead>
<tr>
<th>VI</th>
<th>Web 3.0 and Semantic Web</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>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.</td>
</tr>
</tbody>
</table>

**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  

**References:**

**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 at least 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.
### 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:

<table>
<thead>
<tr>
<th>Sr. No.</th>
<th>Module</th>
<th>Detailed Content</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Defining e-Business, Framework for understanding e-Business.</td>
<td>3</td>
</tr>
<tr>
<td>II</td>
<td>e-Business and e-Marketing Strategies</td>
<td>Strategic planning process, SCM, CRM and ERP, Marketing Strategies and Revenue Models.</td>
<td>8</td>
</tr>
<tr>
<td>III</td>
<td>e-Payment Systems and Security</td>
<td>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.</td>
<td>8</td>
</tr>
<tr>
<td>IV</td>
<td>Introduction to Social Network Analysis</td>
<td>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.</td>
<td>8</td>
</tr>
<tr>
<td>V</td>
<td>Network Communities and Network Structure, Network Communities, Graph partitioning and cut metrics, Information and Influence of</td>
<td>8</td>
<td></td>
</tr>
<tr>
<td>VI</td>
<td>SNA in real world</td>
<td>Applications/Case Studies based on the impact of SNA on e-Business, Impact of SNA on consumer behavior.</td>
<td>8</td>
</tr>
</tbody>
</table>

Text Books:

1. E-Business: Business, Technology and Society: Kenneth C. Laudon (Author), Carol Traver (Author)
2. E-Business and E-Commerce management Strategy, Implementation and Practice: Dave Chaffey

References:

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

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:**

<table>
<thead>
<tr>
<th>Sr. No.</th>
<th>Module</th>
<th>Detailed Content</th>
<th>Hours</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>Prerequisite</td>
<td>Basics of AI, Need for AI</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Basics of ML, Types, need for ML</td>
<td></td>
</tr>
<tr>
<td>I</td>
<td>Introduction to AI</td>
<td>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</td>
<td>6</td>
</tr>
<tr>
<td>IV</td>
<td>Concepts of Machine learning</td>
<td>Supervised, unsupervised, semi-supervised, Rote learning, Reinforcement learning, Issues, steps and applications, Designing a learning System.</td>
<td>3</td>
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</table>
Case study: hand written digit recognition, stock price prediction

<table>
<thead>
<tr>
<th>V</th>
<th>Learning Models</th>
<th>Decision tree learning.</th>
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<tbody>
<tr>
<td></td>
<td></td>
<td>Reinforcement Learning: Model based learning, Temporal Difference Learning, Generalization, Partially Observable States.</td>
</tr>
</tbody>
</table>

|------|---------------------------|-------------------------------------------------------------------------------------------------|

Text Books:

1. Artificial Intelligence and Machine Learning By Vinod Chandra S.S., Anand Hareendran S
4. Ethem Alpaydin "Introduction to machine learning” 2nd ed. The MIT Press, 2010

References:

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:

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.
<table>
<thead>
<tr>
<th>Subject Code</th>
<th>Subject Name</th>
<th>Credits</th>
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</thead>
<tbody>
<tr>
<td>ME-ITDLOC-II2043</td>
<td>Ethical Hacking and Digital Forensic</td>
<td>04</td>
</tr>
</tbody>
</table>

**Course Objectives:**

1. Learner should learn various aspects of network security
2. Learner should learn different technologies for website security
3. Learner should learn various aspects of mobile security
4. Learner 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:**

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<tr>
<th>Sr. No.</th>
<th>Module</th>
<th>Detailed Content</th>
<th>Hours</th>
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<tbody>
<tr>
<td></td>
<td>Prerequisite</td>
<td>Introduction: Ethical Hacking terminology, Five stages of hacking, Vulnerability Research, Legal implication of hacking.</td>
<td>3</td>
</tr>
<tr>
<td>II</td>
<td>Foot Printing &amp; Social Engineering</td>
<td>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.</td>
<td>6</td>
</tr>
</tbody>
</table>
procedure.


### IV Network Forensics
- Collecting Network Based Evidence, Investigating Routers, Network protocols, Email Tracing, Internet Fraud.

### 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.

### 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.

### Text Books:
1. Kevin Mandia, chirs Proise, “Incident Response and Computer Forensic”

### References:
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** ME-ITDLOC-II2044  
**Subject Name** Internet of Things  
**Credits** 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:

<table>
<thead>
<tr>
<th>Sr. No.</th>
<th>Module</th>
<th>Detailed Content</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Perquisite</td>
<td>Web Programming Concepts, Tools, Framework.</td>
<td>3</td>
</tr>
<tr>
<td>3</td>
<td>Open – Source Prototyping Platforms for IoT</td>
<td>Basic Arduino Programming Extended Arduino Libraries, Arduino – Based Internet Communication, Raspberry PI, Sensors and Actuators and Interfacing.</td>
<td>8</td>
</tr>
<tr>
<td>4</td>
<td>IoT Protocol &amp; Technology</td>
<td>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.</td>
<td>8</td>
</tr>
<tr>
<td>Networks</td>
<td>Networking and the Internet - IP Addressing, Protocols - MQTT, CoAP, REST Transferring data.</td>
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</tbody>
</table>

**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:**
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:**

**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: ME-ITDLOC-II2045
### Subject Name: Advanced Software Quality Assurance
### Credits: 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. Distinguishing between the various activities of quality assurance, quality planning and quality control.
4. Understanding 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:

<table>
<thead>
<tr>
<th>Sr. No.</th>
<th>Module</th>
<th>Detailed Content</th>
<th>Hours</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>Prerequisite</td>
<td>Software engineering (or) Experience in software development. Any one programming language and IDE. Knowledge of testing tools is advantageous.</td>
<td>3</td>
</tr>
</tbody>
</table>
II Strategies and methods for test case design


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.


IV Reviews as a testing activity


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


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

Text Books:

1. Ilene Burnstein, “Practical software testing”, Springer Professional computing


References:


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,


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

<table>
<thead>
<tr>
<th>Module</th>
<th>Detailed Contents</th>
<th>Hrs</th>
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</thead>
<tbody>
<tr>
<td>01</td>
<td><strong>Project Management Foundation:</strong> Definition of a project, Project Vs Operations, Necessity of project management, Triple constraints, Project life cycles (typical &amp; 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).</td>
<td>5</td>
</tr>
<tr>
<td>02</td>
<td><strong>Initiating Projects:</strong> 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 &amp; growth (forming, storming, norming &amp; performing), team dynamics.</td>
<td>6</td>
</tr>
<tr>
<td>03</td>
<td><strong>Project Planning and Scheduling:</strong> 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).</td>
<td>8</td>
</tr>
<tr>
<td>05</td>
<td><strong>5.1 Executing Projects:</strong> Planning monitoring and controlling cycle. Information needs and reporting, engaging with all stakeholders of the projects. Team management, communication and project meetings. <strong>5.2 Monitoring and Controlling Projects:</strong> Earned Value Management techniques for measuring value of work completed; Using milestones for measurement; change requests and scope creep. Project audit. <strong>5.3 Project Contracting</strong></td>
<td>8</td>
</tr>
<tr>
<td>06</td>
<td>Project procurement management, contracting and outsourcing.</td>
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<tr>
<td><strong>6.1 Project Leadership and Ethics:</strong></td>
<td>Introduction to project leadership, ethics in projects. Multicultural and virtual projects.</td>
<td></td>
</tr>
<tr>
<td><strong>6.2 Closing the Project:</strong></td>
<td>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.</td>
<td></td>
</tr>
</tbody>
</table>

**REFERENCES:**

1. Jack Meredith & Samuel Mantel, Project Management: A managerial approach, Wiley India, 7th Ed.
4. Gopalan, Project Management, Wiley India

**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.
<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Name</th>
<th>Credits</th>
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</thead>
<tbody>
<tr>
<td>ME-ITILOCII2052</td>
<td>Finance Management</td>
<td>03</td>
</tr>
</tbody>
</table>

**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

<table>
<thead>
<tr>
<th>Module</th>
<th>Detailed Contents</th>
<th>Hrs</th>
</tr>
</thead>
<tbody>
<tr>
<td>01</td>
<td><strong>Overview of Indian Financial System:</strong> Characteristics, Components and Functions of Financial System.</td>
<td>06</td>
</tr>
<tr>
<td></td>
<td><strong>Financial Instruments:</strong> Meaning, Characteristics and Classification of Basic Financial Instruments — Equity Shares, Preference Shares, Bonds-Debentures, Certificates of Deposit, and Treasury Bills.</td>
<td></td>
</tr>
<tr>
<td></td>
<td><strong>Financial Markets:</strong> Meaning, Characteristics and Classification of Financial Markets — Capital Market, Money Market and Foreign Currency Market</td>
<td></td>
</tr>
<tr>
<td></td>
<td><strong>Financial Institutions:</strong> Meaning, Characteristics and Classification of Financial Institutions — Commercial Banks, Investment-Merchant Banks and Stock Exchanges</td>
<td></td>
</tr>
<tr>
<td>02</td>
<td><strong>Concepts of Returns and Risks:</strong> 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.</td>
<td>06</td>
</tr>
<tr>
<td></td>
<td><strong>Time Value of Money:</strong> 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.</td>
<td></td>
</tr>
<tr>
<td>03</td>
<td><strong>Overview of Corporate Finance:</strong> Objectives of Corporate Finance; Functions of Corporate Finance—Investment Decision, Financing Decision, and Dividend Decision.</td>
<td>09</td>
</tr>
<tr>
<td></td>
<td><strong>Financial Ratio Analysis:</strong> 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.</td>
<td></td>
</tr>
<tr>
<td>04</td>
<td><strong>Capital Budgeting:</strong> 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)</td>
<td>10</td>
</tr>
<tr>
<td></td>
<td><strong>Working Capital Management:</strong> 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.</td>
<td></td>
</tr>
<tr>
<td>05</td>
<td><strong>Sources of Finance:</strong> Long Term Sources—Equity, Debt, and Hybrids; Mezzanine Finance; Sources of Short Term Finance—Trade Credit, Bank Finance, Commercial Paper; Project Finance.</td>
<td>05</td>
</tr>
</tbody>
</table>
**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:**


**Assessment:**

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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-ITILOCII2053 | Entrepreneurship 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

<table>
<thead>
<tr>
<th>Module</th>
<th>Detailed Contents</th>
<th>Hrs</th>
</tr>
</thead>
<tbody>
<tr>
<td>01</td>
<td><strong>Overview Of Entrepreneurship:</strong> 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</td>
<td>04</td>
</tr>
<tr>
<td>02</td>
<td><strong>Business Plans And Importance Of Capital To Entrepreneurship:</strong> 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 <strong>Entrepreneurship And Business Development:</strong> Starting a New Business, Buying an Existing Business, New Product Development, Business Growth and the Entrepreneur Law and its Relevance to Business Operations</td>
<td>09</td>
</tr>
<tr>
<td>03</td>
<td>Women’s Entrepreneurship Development, Social entrepreneurship-role and need, EDP cell, role of sustainability and sustainable development for SMEs, case studies, exercises</td>
<td>05</td>
</tr>
<tr>
<td>04</td>
<td><strong>Indian Environment for Entrepreneurship:</strong> 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</td>
<td>08</td>
</tr>
<tr>
<td>05</td>
<td><strong>Effective Management of Business:</strong> 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</td>
<td>08</td>
</tr>
<tr>
<td>06</td>
<td><strong>Achieving Success In The Small Business:</strong> 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</td>
<td>05</td>
</tr>
</tbody>
</table>

REFERENCES:
1. Poornima Charantimath, Entrepreneurship development- Small Business Enterprise, Pearson
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.
10. Laghu Udyog Samachar
11. www.msme.gov.in
12. www.dcmesme.gov.in
13. www.msmetraining.gov.in

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4. Only Four question need to be solved.
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.

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<thead>
<tr>
<th>Module</th>
<th>Detailed Contents</th>
<th>Hrs</th>
</tr>
</thead>
<tbody>
<tr>
<td>01 Introduction to HR</td>
<td>• 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.</td>
<td>5</td>
</tr>
<tr>
<td>02 Organizational Behavior (OB)</td>
<td>• 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</td>
<td>7</td>
</tr>
<tr>
<td>03 Organizational Structure &amp;Design</td>
<td>• Structure, size, technology, Environment of organization: Organizational Roles</td>
<td>6</td>
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<tr>
<td>Human resource Planning</td>
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<tr>
<td><strong>Leadership:</strong> Concepts and skills of leadership, Leadership and managerial roles, Leadership styles and contemporary issues in leadership.</td>
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<tr>
<td><strong>Power and Politics:</strong> Sources and uses of power; Politics at workplace, Tactics and strategies.</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Emerging Trends in HR</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Organizational development:</strong> Business Process Re-engineering (BPR), BPR as a tool for organizational development, managing processes &amp; transformation in HR, Organizational Change, Culture, Environment.</td>
</tr>
<tr>
<td><strong>Cross Cultural Leadership and Decision Making:</strong> 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.</td>
</tr>
</tbody>
</table>

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<thead>
<tr>
<th>HR &amp; MIS</th>
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</thead>
<tbody>
<tr>
<td><strong>Need, purpose, objective and role of information system in HR, Applications in HRD in various industries (e.g. manufacturing R&amp;D, Public Transport, Hospitals, Hotels and service industries.</strong></td>
</tr>
<tr>
<td><strong>Strategic HRM:</strong> 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</td>
</tr>
<tr>
<td><strong>Labor Laws &amp; Industrial Relations:</strong> Evolution of IR, IR issues in organizations, Overview of Labor Laws in India; Industrial Disputes Act, Trade Unions Act, Shops and Establishments Act</td>
</tr>
</tbody>
</table>

**REFERENCES:**


**Assessment:**

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4. Only four questions need to be solved.
Course Code | Course Name | Credits
---------- | ----------- | ------
ME-ITILOCII2055 | Professional Ethics and Corporate Social Responsibility (CSR) | 03

Objectives:
1. To understand professional ethics in business
2. To recognize 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

<table>
<thead>
<tr>
<th>Module</th>
<th>Detailed Contents</th>
<th>Hrs</th>
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</thead>
<tbody>
<tr>
<td>01</td>
<td><strong>Professional Ethics and Business:</strong> The Nature of Business Ethics; Ethical Issues in Business; Moral Responsibility and Blame; Utilitarianism: Weighing Social Costs and Benefits; Rights and Duties of Business</td>
<td>04</td>
</tr>
</tbody>
</table>
| 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.

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<th>Course Name</th>
<th>Credits</th>
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<tbody>
<tr>
<td>ME-ITILOCII2056</td>
<td>Research Methodology</td>
<td>03</td>
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</tbody>
</table>

**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

REFERENCES:


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4. Only Four question need to be solved.
Course Code: ME-ITILOCII2057
Course Name: IPR and Patenting
Credits: 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

<table>
<thead>
<tr>
<th>Module</th>
<th>Detailed Contents</th>
<th>Hr</th>
</tr>
</thead>
<tbody>
<tr>
<td>01</td>
<td><strong>Introduction to Intellectual Property Rights (IPR):</strong> Meaning of IPR, Different category of IPR instruments - Patents, Trademarks, Copyrights, Industrial Designs, Plant variety protection, Geographical indications, Transfer of technology etc. <strong>Importance of IPR in Modern Global Economic Environment:</strong> Theories of IPR, Philosophical aspects of IPR laws, Need for IPR, IPR as an instrument of development</td>
<td>05</td>
</tr>
<tr>
<td>02</td>
<td><strong>Enforcement of Intellectual Property Rights:</strong> Introduction, Magnitude of problem, Factors that create and sustain counterfeiting/piracy, International agreements, International organizations (e.g. WIPO, WTO) active in IPR enforcement <strong>Indian Scenario of IPR:</strong> 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.</td>
<td>07</td>
</tr>
<tr>
<td>03</td>
<td><strong>Emerging Issues in IPR:</strong> Challenges for IP in digital economy, e-commerce, human genome, biodiversity and traditional knowledge etc.</td>
<td>05</td>
</tr>
<tr>
<td>04</td>
<td><strong>Basics of Patents:</strong> 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</td>
<td>07</td>
</tr>
<tr>
<td>05</td>
<td><strong>Patent Rules:</strong> 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.)</td>
<td>08</td>
</tr>
</tbody>
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4. Only Four question need to be solved.
Course Code | Course Name | Credits
---|---|---
ME-ITLOCI | 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

<table>
<thead>
<tr>
<th>Module</th>
<th>Detailed content</th>
<th>Hours</th>
</tr>
</thead>
</table>
| 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  
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 Topo Apps, Information and referral system  
**Application Development**: Building Digital business Applications and Infrastructure | 06 |


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<tbody>
<tr>
<td>4</td>
<td>Managing E-Business - Managing Knowledge, Management skills for e-business, Managing Risks in e-business</td>
<td>06</td>
</tr>
<tr>
<td>6</td>
<td>Materializing e-business: From Idea to Realization - Business plan preparation</td>
<td>08</td>
</tr>
</tbody>
</table>

References:

2. E-commerce from vision to fulfilment, Elias M. Awad, PHI-Restricted, 2002
6. Trend and Challenges in Digital Business Innovation, Vinocenzo Morabito, Springer
7. Digital Business Discourse Erika Darics, April 2015, Palgrave Macmillan

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4. Only Four question need to be solved.
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

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

REFERENCES:
2. A Handbook of Environmental Management Edited by Jon C. Lovett and David G. Ockwell, Edward Elgar Publishing
5. Environmental Management: An Indian Perspective, S N Chary and Vinod Vyasulu, Macmillan India, 2000
6. Introduction to Environmental Management, Mary K Theodore and Louise Theodore, CRC Press
Assessment:

Internal:
Assessment consists of two tests out of which; one should be compulsory class test and the other is either a class test or 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     

<table>
<thead>
<tr>
<th>Module</th>
<th>Detailed content</th>
<th>Lab. Sessions</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Two Laboratory Practical’s to be conducted for each of the core subjects as suggested in the subject syllabus.</td>
<td>24</td>
</tr>
</tbody>
</table>

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.
<table>
<thead>
<tr>
<th>Subject Code</th>
<th>Subject Name</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>ME-ITL102</td>
<td>Laboratory II –(DLOC &amp; ILOC Lab)</td>
<td>01</td>
</tr>
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<tbody>
<tr>
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<td>Three Laboratory Practical’s to be conducted for each of the DEC &amp; IEC subjects as suggested in the subject syllabus.</td>
<td>24</td>
</tr>
</tbody>
</table>

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
<table>
<thead>
<tr>
<th>Subject Code</th>
<th>Subject Name</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>ME-ITL201</td>
<td>Laboratory III-(Core Course Lab)</td>
<td>01</td>
</tr>
</tbody>
</table>

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**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
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</tbody>
</table>

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
## Guidelines for Seminar

- Seminar should be based on thrust areas in Information Technology
- 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)

- **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**

- 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**

- Dissertation I 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
  - Clarity of objective and scope
- 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**

- 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
- Dissertation II should be accessed through a presentation jointly by Internal and External Examiners appointed by the University of Mumbai
- 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)