UNIVERSITY OF MUMBAI
No. UG/2.5-A of 2016-17

CIRCULAR:-

A reference is invited to the syllabus relating to the Master of Engineering (M. E) degree course vide this office Circular No. UG/24 of 2013-14, dated 21st July, 2013 and the Principals of affiliated Colleges in Engineering, hereby informed that the recommendation made by Ad-hoc Board of Studies in Information Technology 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. 4.28 and that in accordance therewith, the revised syllabus as per Choice Based Credit System for Master of Engineering (Information Technology with Specialization in Information & Cyber Warfare) (Sem. I to IV), 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 2016-117.

MUMBAI – 400 032
5th January, 2017

To,
The Principals of affiliated Colleges in Engineering.

A.C/4.28/14/07/2016.

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

No. UG/2.5-A of 2016-17 MUMBAI-400 032 5th January, 2017

Copy forwarded with compliments for information to:-

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

(Dr.M.A.Khan)
REGISTRAR

PTO
Syllabus for the
M. E. in Information Technology with
specialization in Information and Cyber
Warfare
Revised 2016

Choice Based Credit and Grading System

(As per Choice Based Semester 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 multifaceted 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 in Information Technology with specialization in Information and Cyber Warfare**
**Mumbai University**

(With effect from 2016-2017)

## Semester I

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Name</th>
<th>Teaching Scheme (Contact Hours)</th>
<th>Credits Assigned</th>
</tr>
</thead>
<tbody>
<tr>
<td>ME-IT-ICW 101</td>
<td>IT Infrastructure Design</td>
<td>4</td>
<td>--</td>
</tr>
<tr>
<td>ME-IT-ICW 102</td>
<td>Advanced Computer Forensic Analysis</td>
<td>4</td>
<td>--</td>
</tr>
<tr>
<td>ME-IT-ICW 103</td>
<td>Internet of Things</td>
<td>4</td>
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</tr>
<tr>
<td>ME-IT-ICW--DLOC 104</td>
<td>Department Level Optional Course-I</td>
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<tr>
<td>ME-IT-ICW--ILOC 105</td>
<td>Institute Level Optional Course-I</td>
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<tr>
<td>ME-IT-ICW 101L</td>
<td>Laboratory I</td>
<td>--</td>
<td>2</td>
</tr>
<tr>
<td>ME-IT-ICW 102L</td>
<td>Laboratory II</td>
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</table>

## Examination Scheme

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Name</th>
<th>Theory</th>
<th>Internal Assessment</th>
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<tbody>
<tr>
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<td></td>
<td>Test1</td>
<td>Test 2</td>
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<tr>
<td>ME-IT-ICW 101</td>
<td>IT Infrastructure Design</td>
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<td>ME-IT-ICW 102</td>
<td>Advanced Computer Forensic Analysis</td>
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<tr>
<td>ME-IT-ICW 103</td>
<td>Internet of Things</td>
<td>20</td>
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</tbody>
</table>
# Department Level Optional Course (DLOC)

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

# Institute Level Optional Course (ILOC)

Every student is required to take one Institute Level Optional Course for Semester I and Semester II, which is not closely allied to their disciplines. Different sets of courses will run in the both the semesters.
<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-IT ICW DLOC-I-1041</td>
<td>Cyber Law</td>
<td>ME-IT -ICW ILOC-I-1051</td>
<td>Product Lifecycle Management</td>
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<tr>
<td>ME-IT ICW DLOC-I-1042</td>
<td>Social Networks Analysis</td>
<td>ME-IT -ICW ILOC-I-1052</td>
<td>Reliability Engineering</td>
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<tr>
<td>ME-IT ICW DLOC-I-1043</td>
<td>Data Science</td>
<td>ME-IT -ICW ILOC-I-1053</td>
<td>Management Information System</td>
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<td>ME-IT -ICW ILOC-I-1055</td>
<td>Operation Research</td>
</tr>
<tr>
<td></td>
<td></td>
<td>ME-IT -ICW ILOC-I-1056</td>
<td>Cyber Security and Laws</td>
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<tr>
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<td>ME-IT -ICW ILOC-I-1057</td>
<td>Disaster Management and Mitigation Measures</td>
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<td></td>
<td>ME-IT -ICW ILOC-I-1058</td>
<td>Energy Audit and Management</td>
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<tr>
<td>Course Code</td>
<td>Course Name</td>
<td>Teaching Scheme (Contact Hours)</td>
<td>Credits Assigned</td>
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<tr>
<td>ME-IT-ICW 201</td>
<td>Network Security</td>
<td>4</td>
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<tr>
<td>ME-IT-ICW 202</td>
<td>Cryptography and PKI</td>
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<td>ME-IT-ICW 203</td>
<td>Web Application Hacking</td>
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<td>ME-IT-ICW– DLOC 204X</td>
<td>Department Level Optional Course-II</td>
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<td>Institute Level Optional Course-II</td>
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<td>ME-IT-ICW 203L</td>
<td>Laboratory III</td>
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<tr>
<td>ME-IT-ICW 204L</td>
<td>Laboratory IV</td>
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<tr>
<th>Course Code</th>
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<tr>
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<tr>
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<td>Cryptography and PKI</td>
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<td>ME-IT-ICW 204L</td>
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<tr>
<td>ME-IT–ICW DLOC-II-2041</td>
<td>Cloud and IOT Security</td>
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<td>ME-IT ICW ILOC-II-2051</td>
<td>Project Management</td>
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<td>ME-IT–ICW DLOC-II-2042</td>
<td>Global Cyber Warfare</td>
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<td>ME-IT ICW ILOC-II-2052</td>
<td>Finance Management</td>
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<td>ME-IT–ICW DLOC-II-2043</td>
<td>Botnets</td>
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<td>ME-IT ICW ILOC-II-2053</td>
<td>Entrepreneurship Development and Management</td>
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<td>ME-IT ICW ILOC-II-2055</td>
<td>Professional Ethics and CSR</td>
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<td>ME-IT ICW ILOC-II-2056</td>
<td>Research Methodology</td>
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<td>ME-IT ICW ILOC-II-2057</td>
<td>IPR and Patenting</td>
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<td>ME-IT ICW ILOC-II-2058</td>
<td>Digital Business Management</td>
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<td>ME-IT ICW ILOC-II-2059</td>
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### Semester III

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<td>ME IT – ICW-S301</td>
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<td>ME IT – ICW-D301</td>
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<tbody>
<tr>
<td></td>
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<td>Theory</td>
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<tr>
<td></td>
<td></td>
<td>Test1</td>
</tr>
<tr>
<td>ME IT – ICW-S301</td>
<td>Seminar</td>
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</tr>
<tr>
<td>ME IT – ICW-D301</td>
<td>Dissertation I</td>
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### Semester IV

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<tbody>
<tr>
<td>ME-IT-ICW-D401</td>
<td>Dissertation II</td>
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</thead>
<tbody>
<tr>
<td></td>
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<td>Theory</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Internal Assessment</td>
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<td>Test1</td>
<td>Test 2</td>
<td>Avg.</td>
</tr>
<tr>
<td>ME-IT-ICW-D401</td>
<td>Dissertation II</td>
<td>--</td>
</tr>
<tr>
<td>Total</td>
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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>
<th>Subject Name</th>
<th>Credits</th>
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</thead>
<tbody>
<tr>
<td>ME-IT-ICW 101</td>
<td>IT Infrastructure Design</td>
<td>04</td>
</tr>
</tbody>
</table>

**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 | 6     |
<table>
<thead>
<tr>
<th>Section</th>
<th>Content</th>
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</thead>
</table>
| 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, NSI/NECA/BICSI-002 Data Center Design and Implementation Best Practices  
Relationship of Spaces, Data Center Topology Data Center Tiers Basic Data Center Design Example. |
| IV.     | Enterprise Wireless LAN Architecture: Components of Centralize Architecture: understanding 802.11X standards, LWAPP WLAN Controller. WLAN technologies (Narrow Band, Spread Spectrum, FHSS, DSS) and topologies, Wireless Network Components: Access Point and NICs, Router etc; WLAN enterprise design, WLAN performance, WLAN monitoring and troubleshooting, WLAN security. Intra and inter controller roaming. |

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-IT-ICW 102 | Advanced Computer Forensic Analysis | 04

**Course Objectives:**

- Student will be able to understand the basic terminology of computer forensics
- Student will be able to extract and handle digital data that will be processed
- Student will be tackle micro threats and various methods of information warfare.
- Student will be understand surveillance tools and civilian casualties which may result in the case of attack.

**Course Outcomes: The Learner will:**

- Become aware of basic terminology of computer forensics
- Be able to extract and handle digital data
- Be able to tackle micro threats
- Handle surveillance tools and avoid civilian casualties.

**Prerequisite:**

1. Learner should be aware of current on-going technology related to cybercrime.

<table>
<thead>
<tr>
<th>Sr. No.</th>
<th>Module</th>
<th>Detailed Content</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>Overview of computer Forensics Technology</td>
<td>Introduction to computer forensics, use of forensics in law enforcement, employment proceedings, computer Forensics services. Types of computer Forensics Technology- Military, law, spyware and Adware, Biometrics security systems.</td>
<td>4</td>
</tr>
<tr>
<td>II</td>
<td>Types of Computer Forensics systems</td>
<td>Internet security, IDS, Firewall, Public key, net privacy systems, vendor and computer Forensics services</td>
<td>8</td>
</tr>
<tr>
<td>III</td>
<td>Computer Forensics evidence and capture</td>
<td>Data recovery, evidence collection and data seizure, duplication and preservation of digital evidence, computer image verification and authentication</td>
<td>8</td>
</tr>
<tr>
<td>IV</td>
<td>Computer Forensics Analysis</td>
<td>Discovery of electronic evidence, identification of data, Reconstructing past events, network: network forensic scenario, approach, email destruction, system testing</td>
<td>8</td>
</tr>
</tbody>
</table>
Counter Measures

**Fight against Macro Threats:** government preparations, industrial support, role of international organizations, super cyber protection agencies

**Information Warfare Arsenal & Tactics of the Military:** Overview, Information warfare tools and tactics for: offensive ruinous, containment, defensive prevention, defensive ruinous and defensive response containment

Surveillance Tools and Civilian Casualties

Monitoring, Cyber Surveillance, implications of cookies and integrated platforms
Loss to Cyber Mass, destruction of personal assets.
Privacy violation, uncovering secret identities, monitoring of private affairs in cyber space.

**Text Books:**

2. By John R. Vacca Computer forensics: computer crime scene investigation, Volume 1

**References:**

1. EnCase Computer Forensics . Sybex
3. Computer Forensics & Privacy, Michael Caloyannides
Course Objective:

- Vision and Introduction to IoT.
- Understand IoT Market perspective.
- Data and Knowledge Management and use of Devices in IoT Technology.
- Real World IoT Design Constraints, Industrial Automation and Commercial Building Automation in IoT.

Course Outcome: Students should be able to

- Understand the vision of IoT from a global context.
- Determine the Market perspective of IoT.
- Use of Devices, Gateways and Data Management in IoT.
- Building state of the art architecture in IoT.
- Application of IoT in Industrial and Commercial Building Automation and Real World Design Constraints

Prerequisite: Student should have knowledge of wireless networks, network protocols

<table>
<thead>
<tr>
<th>Sr. No.</th>
<th>Module</th>
<th>Detailed Content</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>M2M to IoT</td>
<td>The Vision-Introduction, From M2M to IoT, M2M towards IoT-the global context, A use case example, Differing Characteristics.</td>
<td>6</td>
</tr>
<tr>
<td>II</td>
<td>M2M to IoT – A Market Perspective</td>
<td>Introduction, Some Definitions, M2M Value Chains, IoT Value Chains, An emerging industrial structure for IoT, The international driven global value chain and global information monopolies. M2M to IoT-An Architectural Overview– Building an architecture, Main design principles and needed capabilities, An IoT architecture outline, standards considerations.</td>
<td>10</td>
</tr>
<tr>
<td>III</td>
<td>M2M and IoT Technology Fundamentals</td>
<td>Devices and gateways, Local and wide area networking, Data management, Business processes in IoT, Everything as a Service(XaaS), M2M and IoT Analytics, Knowledge Management</td>
<td>8</td>
</tr>
</tbody>
</table>
### Text Books:


### References:

Course Objectives: The objective of this course is to

1) Equip students with basic concepts of technology and law, digital contracts, rights of netizens and E-governance and provide knowledge of cyber crime and Policies of internet law.

2) Impart knowledge of Information Technology Act and legal frame work of Right to Privacy, Data Security and Data Protection, Forensic analysis, inner investigation models for overcoming cyber crimes.

3) To identify the processes involved in collecting and presenting electronic evidence.

4) Develop competencies for dealing with frauds and deceptions (confidence tricks, scams) and other cyber crimes for example, child pornography etc. that are taking place via the Internet;

5) Emphases upon studying cyber space and various aspects of cyber laws and regulating them through relevant Acts.

6) Understand the range of options which may be available for dealing with online disputes, and how to choose amongst them

Course Outcomes: Students will be able to

1) Learn law and legal policies associated with the internet.

2) Understand IT security Policies, Business law and contracting for data security.

3) Apply law to emerging dangers.

4) Carry out investigations so that they will be judged as ethical and credible.

5) Bridge gaps between security professionals, law enforcement and prosecutors.

6) Evaluate the role and meaning of contracts for technology, including services, software and outsourcing.

Prerequisite: System and Web Security
<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>Indian IT Act, ISP and Intellectual property issues, Cyber squatters and Copy Right Protection, Patents, Data privacy and protection, Domain Name, Software piracy, Plagiarism, Issues in ethical hacking</td>
<td></td>
</tr>
<tr>
<td>III</td>
<td>Electronic Records and Signature</td>
<td>Vicarious Liability, E-Discovery, Records Retention, Destruction, Email Retention, Forensics, Privacy Policies, Evidence Law, Signatures</td>
<td>6</td>
</tr>
<tr>
<td>IV</td>
<td>Contracts and formal legal documents in the Infotech World</td>
<td>Click Through Agreements, Contract Formation, Battle of the Forms, Liability, Breach, Bonds, Assent, Warranty, Remedies, Liens, Ownership Issues, Subpoenas, Documentation, Audits, Exceptions, Maintenance, Termination, Escrow, Competition, Disputes, Non-Disclosure</td>
<td>8</td>
</tr>
<tr>
<td>V</td>
<td>Investigation and Ethics</td>
<td>Cooperation with investigations, Live Vs Post mortem investigation, Numerous Examples of Fraud (Post-Mordems), Sarbanes-Oxley Act, Securities Fraud, Federal Sentencing Guidelines, IT Codes of Ethics, Hotlines, Reporting, Whistleblowing, Employee Monitoring, Entrapment, Raids &amp; Seizures</td>
<td>8</td>
</tr>
<tr>
<td>VI</td>
<td>Cyber Defence</td>
<td>Sony Root Kit Case Study, Crisis Communications, Choicepoint Case Study, Relationship with Law Enforcement, TJX Case Study, Publicity, Safely Monitoring Threats w/o Incurring Liability, Factors Mitigating Legal Risk, Public Accountability, Political Diplomacy, Strategic Legal Procedures, Competitive Boundaries</td>
<td>8</td>
</tr>
</tbody>
</table>

**Text Books:**


References:

Subject Code | Subject Name | Credits
----------|-------------|-------
ME-IT DLOC-I-1042 | Social Networks Analysis | 04

Course Objectives:
1. To understand the components of the social network
2. To model and visualize the social network
3. To mine the users in the social network
4. Understand human behaviour in social web and related communities

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

- Represent knowledge using ontology
- Predict human behaviour in social web and related communities
- Visualize social networks.
- Develop semantic web related applications

Prerequisite: 1) Networking 2) Graph Theory 3) Data Mining Techniques

<table>
<thead>
<tr>
<th>Sr. No.</th>
<th>Module</th>
<th>Detailed Content</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>III</td>
<td>MINING COMMUNITIES</td>
<td>Aggregating and reasoning with social network data, Advanced Representations - Extracting evolution of Web Community from a Series of Web Archive - Detecting Communities in Social Networks - Evaluating Communities – Core Methods for Community Detection &amp; Mining - Applications of Community Mining Algorithms - Node Classification in Social Networks.</td>
<td></td>
</tr>
<tr>
<td>VI</td>
<td>Visualization And Applications Of Social Networks</td>
<td>Graph theory - Centrality - Clustering - Node-Edge Diagrams - Matrix representation - Visualizing online social networks, Visualizing social networks with matrix-based representations - Matrix and Node-Link Diagrams - Hybrid representations - Applications - Cover networks - Community welfare - Collaboration networks - Co-Citation networks</td>
<td></td>
</tr>
</tbody>
</table>

**REFERENCES:**


### Course Objectives:

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

### Course Outcomes:

The student should be able:

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

### Prerequisite: fundamentals of data base, basic programming skills

<table>
<thead>
<tr>
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<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>
</tr>
<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>
<td>4</td>
</tr>
<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>
</tr>
</tbody>
</table>
### III. Learning Algorithms
- k-nearest neighbor, Simple and multiple Linear Regression, Logistic Regression, Support vector machine, Model-Based Clustering, Clustering High-Dimensional Data.

### IV. Data Visualization
- Data Visualization basics, techniques, types, applications, tools, Data Journalism, Interactive dashboards.

### V. Advance Analytical Methods
- Text Analysis - Text analysis steps, A text analysis example, Collecting raw text and representing text, TF and TFIDF, Categorizing documents by topics, determining 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.

### 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.
ME-IT–ICW
DLOC-I-1044
Intrusion Detection System
04

Course Objectives:

1. To make students aware of Internal Contents of Packets in Hexadecimal.
2. Students will become aware of different Intrusion Detection Systems & Techniques
3. Students will learn about methodologies used to detect intrusions.

Course Outcome:

1. The students will demonstrate knowledge about different techniques in Intrusions.
2. Identify and analyse the stages in UDP, TCP packets data conversion from hexadecimal to decimal.
3. Demonstrate systematic understanding of the concepts of Intrusion Detection Systems.

DETAILED SYLLABUS :

<table>
<thead>
<tr>
<th>Sr. No.</th>
<th>Module</th>
<th>Detailed Content</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>Intrusion Detection Systems      :</td>
<td>IDS Introduction, Types of IDS : Host IDS, Network IDS, Target Based Assembly Detection, Signature and Anomaly Based Detection, Signature Writing Techniques.</td>
<td>06</td>
</tr>
<tr>
<td>II</td>
<td>Traffic Analysis :</td>
<td>Packet Dissection Using TCPdump, Dissecting the Whole Packet, Freeware Tools for Packet Dissection, Examining IP Header Fields, Introduction to Snort and Rules.</td>
<td>08</td>
</tr>
<tr>
<td>IV</td>
<td>Wireless IDS/IPS :</td>
<td>Types , Wireless IDS Events, Intrusion Prevention Techniques , Honeypot, Other Wireless Threats.</td>
<td>06</td>
</tr>
<tr>
<td>V</td>
<td>Physical and Geospatial Intrusion Detection for IT :</td>
<td>Common Physical Access Control Components , Geographic Information System , Spatial Point Pattern Analysis , Point Intensity , Geocoding Techniques , Limitations.</td>
<td>08</td>
</tr>
<tr>
<td>VI</td>
<td>Visual Data Communications :</td>
<td>Visualization , Statistical Graphing Techniques , Technological Considerations ,Security Event Visualization</td>
<td>08</td>
</tr>
</tbody>
</table>
Text Book:
1. Practical Intrusion Analysis: Prevention and Detection for the Twenty-First Century, Ryan Trost, Addison-Wesley Professional; 1 edition

Reference books

1. Rebecca Gurley Base “Intrusion Detection” MacMillan Technology Series (MTP Series)
   ISBN 1578701856, 9781578701858

2. Rafeeq Rehman “Intrusion Detection with SNORT, Apache, MySQL, PHP and ACID”
<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  |
<p>| 03     | <strong>Product Data Management (PDM):</strong> 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     | <strong>Virtual Product Development Tools:</strong> For components, machines, and manufacturing plants, 3D CAD systems and realistic rendering techniques, Digital mock-up, Model | 05  |</p>
<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
</tr>
</thead>
</table>

**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.

**REFERENCES:**

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
**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.

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

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4. Only Four question need to be solved.

**REFERENCES:**

### Course Code | Course Name | Credits
--- | --- | ---
ME-IT-ICW | Management Information System | 03
ILOC-I-1053

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

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

<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>

**Assessment:**

Mumbai University Revised 2016 syllabus of ME – IT I&CW
**Internal:**
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**End Semester Theory Examination:**
Some guidelines for setting up the question paper. Minimum 80% syllabus should be covered in question papers of end semester examination. **In question paper weightage of each module will be proportional to number of respective lecture hours as mention in the syllabus.**

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

**REFERENCES:**

1. Kelly Rainer, Brad Prince, Management Information Systems, Wiley
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>
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</tr>
</thead>
<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>
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<td></td>
<td>1.2 Typical Applications of Experimental Design</td>
<td></td>
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<td></td>
<td>1.3 Guidelines for Designing Experiments</td>
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<td></td>
<td>1.4 Response Surface Methodology</td>
<td>06</td>
</tr>
<tr>
<td>02</td>
<td><strong>Fitting Regression Models</strong></td>
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<tr>
<td></td>
<td>2.1 Linear Regression Models</td>
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<td>2.2 Estimation of the Parameters in Linear Regression Models</td>
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<td></td>
<td>2.3 Hypothesis Testing in Multiple Regression</td>
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<td></td>
<td>2.4 Confidence Intervals in Multiple Regression</td>
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<td></td>
<td>2.5 Prediction of new response observation</td>
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<td>2.6 Regression model diagnostics</td>
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<td>2.7 Testing for lack of fit</td>
<td>08</td>
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<tr>
<td>03</td>
<td><strong>Two-Level Factorial Designs</strong></td>
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<tr>
<td></td>
<td>3.1 The $2^2$ Design</td>
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<td></td>
<td>3.2 The $2^3$ Design</td>
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<td></td>
<td>3.3 The General $2^k$ Design</td>
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<td></td>
<td>3.4 A Single Replicate of the $2^k$ Design</td>
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<tr>
<td></td>
<td>3.5 The Addition of Center Points to the $2^k$ Design,</td>
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<tr>
<td></td>
<td>3.6 Blocking in the $2^k$ Factorial Design</td>
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<tr>
<td></td>
<td>3.7 Split-Plot Designs</td>
<td>07</td>
</tr>
<tr>
<td>04</td>
<td><strong>Two-Level Fractional Factorial Designs</strong></td>
<td></td>
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<tr>
<td></td>
<td>4.1 The One-Half Fraction of the $2^k$ Design</td>
<td></td>
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<tr>
<td></td>
<td>4.2 The One-Quarter Fraction of the $2^k$ Design</td>
<td>07</td>
</tr>
</tbody>
</table>
4.3 The General $2^{k-p}$ Fractional Factorial Design
4.4 Resolution III Designs
4.5 Resolution IV and V Designs
4.6 Fractional Factorial Split-Plot Designs

Response Surface Methods and Designs
5.1 Introduction to Response Surface Methodology
5.2 The Method of Steepest Ascent
5.3 Analysis of a Second-Order Response Surface
5.4 Experimental Designs for Fitting Response Surfaces

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

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.

REFERENCES:

5. Design and Analysis of Experiments (Springer text in Statistics), Springer by A.M. Dean, and D. T.Voss
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. | 14 |
Introduction to Decomposition algorithms.

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

Assessment:

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

End Semester Theory Examination:
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<th>Course Name</th>
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</tr>
</thead>
<tbody>
<tr>
<td>ME-IT-ICW</td>
<td>Cyber Security and Laws</td>
<td>03</td>
</tr>
<tr>
<td>ILOC-I--1056</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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

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

<table>
<thead>
<tr>
<th>Module</th>
<th>Detailed Contents</th>
<th>Hrs</th>
</tr>
</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</td>
<td>6</td>
</tr>
</tbody>
</table>
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.

REFERENCES:

1. Nina Godbole, Sunit Belapure, **Cyber Security**, Wiley India, New Delhi
2. The Indian Cyber Law by Suresh T. Vishwanathan; Bharat Law House New Delhi
3. The Information technology Act, 2000; Bare Act- Professional Book Publishers, New Delhi.
4. Cyber Law & Cyber Crimes By Advocate Prashant Mali; Snow White Publications, Mumbai
5. Nina Godbole, **Information Systems Security**, Wiley India, New Delhi
7. William Stallings, **Cryptography and Network Security**, Pearson Publication
8. Websites for more information is available on : The Information Technology ACT, 2008- TIFR : https://www.tifrh.res.in
9. Website for more information , A Compliance Primer for IT professional : https://www.sans.org/reading-room/whitepapers/compliance/compliance-primer-professionals-33538
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.

<table>
<thead>
<tr>
<th>Module</th>
<th>Detailed Contents</th>
<th>Hrs</th>
</tr>
</thead>
<tbody>
<tr>
<td>01</td>
<td>Introduction</td>
<td></td>
</tr>
<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>
<tr>
<td>02</td>
<td>Natural Disaster and Manmade disasters:</td>
<td></td>
</tr>
<tr>
<td></td>
<td>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</td>
<td>09</td>
</tr>
<tr>
<td></td>
<td>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.</td>
<td></td>
</tr>
<tr>
<td>03</td>
<td>Disaster Management, Policy and Administration</td>
<td></td>
</tr>
<tr>
<td></td>
<td>3.1 Disaster management: meaning, concept, importance, objective of disaster management policy, disaster risks in India, Paradigm shift in disaster management.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>3.2 Policy and administration: Importance and principles of disaster management policies, command and co-ordination of in disaster management, rescue operations-how to</td>
<td>06</td>
</tr>
</tbody>
</table>
start with and how to proceed in due course of time, study of flowchart showing the entire process.

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.

Financing Relief Measures:
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.

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.

Assessment:

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

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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.

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)
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.

<table>
<thead>
<tr>
<th>Module</th>
<th>Detailed Contents</th>
<th>Hrs</th>
</tr>
</thead>
<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.</td>
<td>10</td>
</tr>
<tr>
<td></td>
<td>Energy conservation opportunities in: water pumps, industrial drives, induction motors, motor retrofitting, soft starters, variable speed drives.</td>
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<td></td>
</tr>
</tbody>
</table>
| 04 | **Energy Management and Energy Conservation in Thermal Systems:**  
Review of different thermal loads; Energy conservation opportunities in: Steam distribution system, Assessment of steam distribution losses, Steam trapping, Condensate and flash steam recovery system.  
General fuel economy measures in Boilers and furnaces, Waste heat recovery, use of insulation- types and application.  
HVAC system: Coefficient of performance, Capacity, factors affecting Refrigeration and Air Conditioning system performance and savings opportunities. | 10 |
| 05 | **Energy Performance Assessment:**  
On site Performance evaluation techniques, Case studies based on: Motors and variable speed drive, pumps, HVAC system calculations; Lighting System: Installed Load Efficacy Ratio (ILER) method, Financial Analysis. | 04 |
| 06 | **Energy conservation in Buildings:**  
Energy Conservation Building Codes (ECBC): Green Building, LEED rating, Application of Non-Conventional and Renewable Energy Sources | 03 |

**Assessment:**

**Internal:**  
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**End Semester Theory Examination:**

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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.

**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
Semester II

<table>
<thead>
<tr>
<th>Subject Code</th>
<th>Subject Name</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>ME-IT-ICW 201</td>
<td>Network Security</td>
<td>04</td>
</tr>
</tbody>
</table>

Course Objectives:

1. To provide students with contemporary knowledge in Network Security.
2. To equip students with skills to analyze different routing Algorithm Vulnerabilities.
3. To provide knowledge of secure network infrastructure services.
4. To equip students with skills to analyze security at Application layer.

Course Outcomes:

3. Analyze different OS Security Issues.
4. Appreciate different technique of hacking wireless network.

Prerequisite: Computer Network.

DETAILED SYLLABUS:

<table>
<thead>
<tr>
<th>Sr. No.</th>
<th>Module</th>
<th>Detailed Content</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>IV</td>
<td>Security at Application Layer</td>
<td>Security at Application Layer: PGP, S/MIME E-mail security, PGP, PEM, S/MIME, Secure binding of multimedia streams, Secure RTP. Secure RSVP.</td>
<td></td>
</tr>
</tbody>
</table>

**Text Books:**


2. Charles P. Pfleeger “Security in computing”, Pearson Education

**References:**

2. Garfinkel S., Spafford G., “Practical Unix and Internet Security”, O'Reilly
Course Objectives:

1. Students should be able to gain of firsthand experience public key encryption, public key certification, authentication based on PKI.

2. To provide solid foundation of the principal of Cryptographic algorithms including secret key cryptography, hashes and message digests, and public key algorithm.

3. Students should be able appreciate the core techniques of cryptography and how they can be applied to meet various security objectives.

4. Students should be able to understand both the importance of cryptographic key management, and the different key management requirements and practices associated with the use of different security techniques.

Course Outcomes:

- Student will able to used tolls and write programs to create secure channel using PKI.

- Students will be able to appreciate how the techniques described are employed in practice in a variety of security applications, from SSL enabled websites through to disk encryption.

- Compare and contrast a range of different cryptosystems from an applied viewpoint.

- List and elaborate the differences between secret key and public key cryptosystems.

DETAILED SYLLABUS:

<table>
<thead>
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</table>

Mumbai University Revised 2016 syllabus of ME – IT I&CW
Attacks

II Symmetric Key Algorithms

| DES, 3DES, AES, IDEA, RC4, RC5, Confidentiality using symmetric encryption |

III Introduction to Number Theory:

| Prime Numbers, Fermat’s and Euler’s Theorems, Testing for Primality, The Chinese Remainder Theorem, Discrete Logarithms |
| Cryptography and RSA |

IV Message Authentication and Hash Functions:

| Authentication Requirements, Authentication Functions, MAC, Hash Functions, Security of Hash Functions and MACs, SHA, HMAC |

V Digital Signatures and Public Key Infrastructure (PKI):

| Digital Signatures and Public Key Infrastructure (PKI): |
| Digital Signatures, Elliptic Curve Digital Signature Algorithm Authentication Protocols, DSS, Authentication Elliptic Curve Digital Signature Algorithm |
| Digital Certificates, Private Key Management, PKI Trust Models, Public Key Cryptography Standards, Revocation, Directories and PKI, PKIX and Security. |

VI User Authentication and Kerberos

| User authentication Principles, Authentication Tokens, Certificate based authentication, Biometric authentication, Kerberos, Key Distribution Centre(KDC), Security Handshake Pitfalls |

Text Books:

1. Information Security Principal and Practice: Mark stamp, Wiley
2. Cryptography and security, wiley, Shyamala, harini

References:

2. Introduction to Cryptography with coding Theory, Pearson, WadenTrappe
List of Experiments: Six Experiments based on each module. Laboratory Practical's/ Case studies
<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>Web Application Technologies &amp; Mapping</td>
<td>Introduction, HTTP Protocol, Web Functionality, Encoding Schemes, Discovering Hidden Content, Analyzing the Application.</td>
<td>06</td>
</tr>
<tr>
<td>3</td>
<td>Attacking Data Stores</td>
<td>Injecting into SQL, Injecting into NoSQL, Injecting into Xpath.</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Attacking Back-End Components</td>
<td>Injecting OS Commands, Injecting into XML Interpreters, Injecting into Back-end HTTP Requests, Injecting into Mail Services.</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Attacking Users</td>
<td>Inducing User Actions, Capturing Data Cross-Domain, Client-Side Injection Attacks, Local Privacy Attacks,</td>
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</tr>
<tr>
<td></td>
<td>Attacking the Browser.</td>
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<tr>
<td>6</td>
<td>Web Application Hacker’s Toolkit &amp; Methodology</td>
<td>Web Browsers, Other Tools, Map the Application’s Content, Analyze the Application, Test Client-Side Controls, Test the Authentication Mechanism, Test for Input-Based Vulnerabilities, Test for Application Server Vulnerabilities.</td>
<td></td>
</tr>
</tbody>
</table>

**Text Books:**

1. **Botnet : The Killer Web App.** Syngress Publications, Authors : Craig A. Schiller, Jim Binkley, David Harley, Gadi Evron, Tony Bradley, Carsten Willems, Michael Cross.
Course Objectives to learn:

1. The types of services offered through cloud computing, virtualization & IT infrastructure security capabilities
2. The current state of data security and the storage of data in the cloud, security management frameworks and the standards, privacy aspects to consider within the context of cloud computing.
3. All types of attacks and threats, privacy preservation in IOT, Trust model in IoT infrastructure.
4. Security issues in IoT data computations and social context based privacy in IoT platforms.

Course Outcomes: At the end of course student should be able to:

1. Understand IT infrastructure security capabilities and services offered through cloud computing.
2. Understand privacy aspect, data storage and security management frameworks and standards.
3. Understand to attacks threats and privacy preservation in IoT and trust model in IoT infrastructure.
4. Understand social context based privacy in IoT and data computations security issues in IoT.

Prerequisite: Student should have knowledge of cloud computing, IoT, Network security.

DETAILED SYLLABUS:

<table>
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<th>Module</th>
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</tr>
</thead>
<tbody>
<tr>
<td>II</td>
<td>Cloud Security</td>
<td>INFRASTRUCTURE SECURITY:</td>
<td>8</td>
</tr>
</tbody>
</table>
III Security Management & Privacy In Cloud


IV IOT Threats, Attacks & Privacy Preservation

Internet of Things (IoT) as Interconnection of Threats (IoT), Attack, Defense, and Network Robustness of Internet of Things, Privacy Preservation Data Dissemination, Privacy Preservation for IoT Used in Smart Buildings.

V IOT Trust And Authentication

Trust and Trust Models for the IoT, Authentication in IoT.

VI IOT Data Security And Social Awareness


Text Books:

1. Cloud Security and Privacy An Enterprise perspective on Risk and Compliance, Tim Mather, Subra Kumaraswamy, and Shahed Latif, O’Reilly
3. Cloud Security by Ronald Krutz and Russell Dean Vines, Wiley-India
Course Objectives:

1. This course addresses some of the unique and emerging policy, doctrine, strategy, and operational requirements of conducting cyber warfare at the nation-state level.

2. It provides students with a unified battle-space perspective and enhances their ability to manage and develop operational systems and concepts in a manner that results in the integrated, controlled, and effective use of cyber assets in warfare.

Course Outcomes:

On completion of this course, students should be able to:

- explain the theory of data, information and knowledge as they pertain to information warfare
- apply strategies of using information as a weapon and a target
- apply the principles of offensive and defensive information warfare for a given context
- discuss the social, legal and ethical implications of information warfare

Prerequisite: Student should have knowledge of cyber security and Information security.

DETAILED SYLLABUS:

<table>
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<th>Module</th>
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<tbody>
<tr>
<td>II</td>
<td>Responding to International Cyber Attacks Law of War, Nonstate actors and Law of War ,Analysing Cyber Attacks , Technological Limitations , Issues , Intelligence Component of Cyber Warfare ,Korean DDOS Attacks,One year after RU-GE War,Ingushetia Conflict , Predictive Role of Intelligence ,Nonstate Hackers and Social Web ,Dark side of Social Networks, TwitterGate , Automating Process, False Identities,Components of Bulletproof Networks,SORM-2, Kremlin and Russian</td>
<td>8</td>
<td></td>
</tr>
</tbody>
</table>
### III  Organized Crime in Cyber space:

Subtle Threat, Atrivo/Interchange, EST Domains, McColo, Russian Organized Crime and Kremlin

Investigating Attribution: Using Open Source Internet Data, Autonomous System Network, Team Cymru and It’s Darknet Report, Using WHOIS

### IV  Weaponizing Malware

New Threat Landscape, StopGeogia.ru Malware Discussions, Twitter as DDoS Command Post against Iran, Social Engineering, Channel Consolidation, Adversary’s Look at LinkedIn, BIOS Based Rootkit Attack, Malware for Hire, Targeted Attacks Against Military Brass and Government Executives.

### V  Role of Cyber in Military Doctrine

Russian Federation, FEP, Information wars, RF Military Policy, Art of Misdirection China Military Doctrine, Anti-access Strategies, 36 Stratagems, US Military Doctrine

### VI  Russian Federation: Information Warfare Framework


### VII  Active Defence for Cyber

Covert Action, Cyber Active Defence Under International Law, Cyber Active Defences as Covert Action Under International Law, Cyber Attacks Under International Law: Nonstate Actors

**Text Books:**

1. Inside Cyber Warfare: Mapping the Cyber Underworld by Jeffrey Carr, 2nd edition, O'Reilly
2. Cyber deterrence and Cyberwar by Martin C. Libicki.
Course Objectives

1. To make students aware of Structure of Botnets.
2. Students will become aware of Command to Command & Peer to Peer Working.
3. Students will learn about methodologies used to detect Botnets.

Course Outcome:

1. The students will demonstrate knowledge about different techniques in Botnets.
2. Identify and analyse the stages in different types of Small scale & large attacks.
3. Demonstrate systematic understanding of the concepts of Botnets.

DETAILED SYLLABUS:

<table>
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</thead>
<tbody>
<tr>
<td>II</td>
<td>Common Botnets</td>
<td>Common Botnets : SDBot, Rbot, Agobot, Spybot, Mytob</td>
<td>8</td>
</tr>
<tr>
<td>III</td>
<td>Botnet Detection</td>
<td>Tools and Techniques : Network Infrastructure, Intrusion Detection, Forensics Techniques and Tools for Botnet Detection</td>
<td>8</td>
</tr>
<tr>
<td>IV</td>
<td>Anomaly Detection Tools</td>
<td>Anomaly Detection Tools : TCP Anomaly Detection, UDP Anomaly Detection</td>
<td>8</td>
</tr>
<tr>
<td>V</td>
<td>IRC and Botnets</td>
<td>IRC and Botnets : Understanding IRC Protocol, Detecting IRC Botnet Client, Detecting an IRC Botnet Server, Sniffing IRC Messages, Sandbox Tools.</td>
<td>8</td>
</tr>
<tr>
<td>VI</td>
<td>Intelligence Resources &amp; Responding to</td>
<td>Disassemblers, Confidentiality Agreements, Role of Intelligence Sources, Law Enforcement Issues,</td>
<td>8</td>
</tr>
<tr>
<td>Botnets</td>
<td>Effective Practices, Reporting Botnets, Fighting Back.</td>
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<tbody>
<tr>
<td>II</td>
<td>Project Definition</td>
<td>Ensuring Project Success, Project Description</td>
<td>6</td>
</tr>
<tr>
<td>III</td>
<td>Project Preparation</td>
<td>Introduce the Team, Review Business Mission, Identify Critical Systems, Identify Assets, Asset Valuation, Identifying Threats, Determine Expected Controls</td>
<td>8</td>
</tr>
<tr>
<td>IV</td>
<td>Data Gathering</td>
<td>Sampling, The RIIOT Method of Data Gathering, Administrative Data Gathering, Technical Data Gathering., Physical Data Gathering.</td>
<td>10</td>
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</tr>
<tr>
<td>VI</td>
<td>Security Risk Assessment Approaches.</td>
<td>Quantitative vs. Qualitative Analysis, Qualitative Analysis, Tools, Security Risk Assessment Methods, Relevant Standards and Regulations.</td>
<td>10</td>
</tr>
</tbody>
</table>

**Text Books:**


**References:**

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>
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<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>04</td>
<td><strong>Planning Projects:</strong></td>
<td>6</td>
</tr>
</tbody>
</table>
Assessment:

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4. Only Four question need to be solved.

REFERENCES:

1. Jack Meredith & Samuel Mantel, Project Management: A managerrial approach, Wiley India, 7th Ed.
4. Gopalan, Project Management, , Wiley India
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>
</table>
| 01     | **Overview of Indian Financial System:** Characteristics, Components and Functions of Financial System.  
**Financial Instruments:** Meaning, Characteristics and Classification of Basic Financial Instruments — Equity Shares, Preference Shares, Bonds-Debentures, Certificates of Deposit, and Treasury Bills.  
**Financial Markets:** Meaning, Characteristics and Classification of Financial Markets — Capital Market, Money Market and Foreign Currency Market  
**Financial Institutions:** Meaning, Characteristics and Classification of Financial Institutions — Commercial Banks, Investment-Merchant Banks and Stock Exchanges | 06  |
| 02     | **Concepts of Returns and Risks:** Measurement of Historical Returns and Expected Returns of a Single Security and a Two-security Portfolio; Measurement of Historical Risk and Expected Risk of a Single Security and a Two-security Portfolio.  
**Time Value of Money:** Future Value of a Lump Sum, Ordinary Annuity, and Annuity Due; Present Value of a Lump Sum, Ordinary Annuity, and Annuity Due; Continuous Compounding and Continuous Discounting. | 06  |
| 03     | **Overview of Corporate Finance:** Objectives of Corporate Finance; Functions of Corporate Finance—Investment Decision, Financing Decision, and Dividend Decision.  
**Financial Ratio Analysis:** Overview of Financial Statements—Balance Sheet, Profit and Loss Account, and Cash Flow Statement; Purpose of Financial Ratio Analysis; Liquidity Ratios; Efficiency or Activity Ratios; Profitability Ratios; Capital Structure Ratios; Stock Market Ratios; Limitations of Ratio Analysis. | 09  |
Capital Budgeting: Meaning and Importance of Capital Budgeting; Inputs for Capital Budgeting Decisions; Investment Appraisal Criterion—Accounting Rate of Return, Payback Period, Discounted Payback Period, Net Present Value (NPV), Profitability Index, Internal Rate of Return (IRR), and Modified Internal Rate of Return (MIRR)


Sources of Finance: Long Term Sources—Equity, Debt, and Hybrids; Mezzanine Finance; Sources of Short Term Finance—Trade Credit, Bank Finance, Commercial Paper; Project Finance.


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

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<tbody>
<tr>
<td>01</td>
<td><strong>Overview Of Entrepreneurship:</strong> Definitions, Roles and Functions/Values of</td>
<td>04</td>
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<td>Entrepreneurship, History of Entrepreneurship Development, Role of</td>
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<td></td>
<td>Entrepreneurship in the National Economy, Functions of an Entrepreneur,</td>
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<td>Entrepreneurship and Forms of Business Ownership</td>
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<td>Role of Money and Capital Markets in Entrepreneurial Development:</td>
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<td>Contribution of Government Agencies in Sourcing information for</td>
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<td>Entrepreneurship</td>
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<td>02</td>
<td><strong>Business Plans And Importance Of Capital To Entrepreneurship:</strong> Preliminary</td>
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<td>and Marketing Plans, Management and Personnel, Start-up Costs and Financing as</td>
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<td></td>
<td>well as Projected Financial Statements, Legal Section,</td>
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<td></td>
<td>Insurance, Suppliers and Risks, Assumptions and Conclusion, Capital and its</td>
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<td>Importance to the Entrepreneur</td>
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<td><strong>Entrepreneurship And Business Development:</strong> Starting a New Business, Buying</td>
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<td>an Existing Business, New Product Development, Business Growth and the</td>
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<td>Entrepreneur Law and its Relevance to Business Operations</td>
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<td>03</td>
<td>Women’s Entrepreneurship Development, Social entrepreneurship-role and need,</td>
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<td></td>
<td>EDP cell, role of sustainability and sustainable development for SMEs, case</td>
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<td>studies, exercises</td>
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<td>04</td>
<td><strong>Indian Environment for Entrepreneurship:</strong> key regulations and legal aspects,</td>
<td>08</td>
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<td></td>
<td>MSMED Act 2006 and its implications, schemes and policies of the Ministry of</td>
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<td>MSME, role and responsibilities of various government organisations, departments,</td>
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<td>banks etc., Role of State governments in terms of infrastructure developments and</td>
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<td>support etc., Public private partnerships, National Skill development Mission,</td>
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<td>Credit Guarantee Fund, PMEGP, discussions, group exercises etc</td>
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<td>05</td>
<td><strong>Effective Management of Business:</strong> Issues and problems faced by micro and</td>
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<td>small enterprises and effective management of M and S enterprises (risk management,</td>
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<tr>
<td></td>
<td>credit availability, technology innovation, supply chain management, linkage with</td>
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<tr>
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<td>large industries), exercises, e-Marketing</td>
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</tbody>
</table>
Achieving Success In The Small Business: Stages of the small business life cycle, four types of firm-level growth strategies, Options – harvesting or closing small business Critical Success factors of small business

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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
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.

<table>
<thead>
<tr>
<th>Module</th>
<th>Detailed Contents</th>
<th>Hrs</th>
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</thead>
</table>
| 01     | Introduction to HR  
Human Resource Management- Concept, Scope and Importance, Interdisciplinary Approach Relationship with other Sciences, Competencies of HR Manager, HRM functions.  
Human resource development (HRD): changing role of HRM – Human resource Planning, Technological change, Restructuring and rightsizing, Empowerment, TQM, Managing ethical issues. | 5   |
| 02     | Organizational Behavior (OB)  
Introduction to OB Origin, Nature and Scope of Organizational Behavior, Relevance to Organizational Effectiveness and Contemporary issues  
Personality: Meaning and Determinants of Personality, Personality development, Personality Types, Assessment of Personality Traits for Increasing Self Awareness | 7   |
<table>
<thead>
<tr>
<th>Chapter</th>
<th>Topic</th>
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</tr>
</thead>
<tbody>
<tr>
<td>03</td>
<td>Perception: Attitude and Value, Effect of perception on Individual Decision-making, Attitude and Behavior.</td>
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<tr>
<td></td>
<td>Motivation: Theories of Motivation and their Applications for Behavioral Change (Maslow, Herzberg, McGregor);</td>
<td></td>
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<tr>
<td></td>
<td>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.</td>
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<td></td>
<td>Case study</td>
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</tr>
<tr>
<td>03</td>
<td>Organizational Structure &amp; Design</td>
<td>Structure, size, technology, Environment of organization; Organizational Roles &amp; conflicts: Concept of roles; role dynamics; role conflicts and stress.</td>
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<td></td>
<td>Leadership: Concepts and skills of leadership, Leadership and managerial roles, Leadership styles and contemporary issues in leadership.</td>
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<tr>
<td></td>
<td>Power and Politics: Sources and uses of power; Politics at workplace, Tactics and strategies.</td>
<td>6</td>
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<tr>
<td>04</td>
<td>Human resource Planning</td>
<td>Recruitment and Selection process, Job-enrichment, Empowerment - Job-Satisfaction, employee morale.</td>
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<td></td>
<td>Performance Appraisal Systems: Traditional &amp; modern methods, Performance Counseling, Career Planning.</td>
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<td></td>
<td>Training &amp; Development: Identification of Training Needs, Training Methods</td>
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<tr>
<td>05</td>
<td>Emerging Trends in HR</td>
<td>Organizational development; 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></td>
<td>Cross Cultural Leadership and Decision Making: Cross Cultural Communication and diversity at work, Causes of diversity, managing diversity with special reference to handicapped, women and ageing people, intra company cultural difference in employee motivation.</td>
<td>6</td>
</tr>
<tr>
<td>06</td>
<td>HR &amp; MIS</td>
<td>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</td>
</tr>
<tr>
<td></td>
<td>Strategic HRM</td>
<td>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></td>
<td>Labor Laws &amp; Industrial Relations</td>
<td>Evolution of IR, IR issues in organizations, Overview of Labor Laws in India; Industrial Disputes Act, Trade Unions Act, Shops and Establishments Act</td>
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<tbody>
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<td>ME-IT ICW</td>
<td>Professional Ethics and Corporate Social Responsibility (CSR)</td>
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<tr>
<td>ILOC-II-2055</td>
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</table>

**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

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<tr>
<th>Module</th>
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<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>
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<tr>
<td>02</td>
<td><strong>Professional Ethics in the Marketplace:</strong> Perfect Competition; Monopoly Competition; Oligopolistic Competition; Oligopolies and Public Policy <strong>Professional Ethics and the Environment:</strong> Dimensions of Pollution and Resource Depletion; Ethics of Pollution Control; Ethics of Conserving Depletable Resources</td>
<td>08</td>
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<tr>
<td>03</td>
<td><strong>Professional Ethics of Consumer Protection:</strong> Markets and Consumer Protection; Contract View of Business Firm’s Duties to Consumers; Due Care Theory; Advertising Ethics; Consumer Privacy <strong>Professional Ethics of Job Discrimination:</strong> Nature of Job Discrimination; Extent of Discrimination; Reservation of Jobs.</td>
<td>06</td>
</tr>
<tr>
<td>04</td>
<td><strong>Introduction to Corporate Social Responsibility:</strong> 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</td>
<td>05</td>
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<tr>
<td>05</td>
<td><strong>Corporate Social Responsibility:</strong> Articulation of Gandhian Trusteeship Corporate Social Responsibility and Small and Medium Enterprises (SMEs) in India, Corporate Social Responsibility and Public-Private Partnership (PPP) in</td>
<td>08</td>
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REFERENCES:

1. Business Ethics: Texts and Cases from the Indian Perspective (2013) by Ananda Das Gupta; Publisher: Springer.
**Course Code** | **Course Name** | **Credits**
---|---|---
ME-IT ICW ILOC-II-2056 | Research Methodology | 03

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

**Outcomes:** Learner will be able to…
1. Prepare a preliminary research design for projects in their subject matter areas
2. Accurately collect, analyze and report data
3. Present complex data or situations clearly
4. Review and analyze research findings

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<tr>
<td>01</td>
<td><strong>Introduction and Basic Research Concepts</strong>&lt;br&gt; 1.1 Research – Definition; Concept of Construct, Postulate, Proposition, Thesis, Hypothesis, Law, Principle. Research methods vs Methodology&lt;br&gt; 1.2 Need of Research in Business and Social Sciences&lt;br&gt; 1.3 Objectives of Research&lt;br&gt; 1.4 Issues and Problems in Research&lt;br&gt; 1.5 Characteristics of Research: Systematic, Valid, Verifiable, Empirical and Critical</td>
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<tr>
<td>02</td>
<td><strong>Types of Research</strong>&lt;br&gt; 2.1. Basic Research&lt;br&gt; 2.2. Applied Research&lt;br&gt; 2.3. Descriptive Research&lt;br&gt; 2.4. Analytical Research&lt;br&gt; 2.5. Empirical Research&lt;br&gt; 2.6. Qualitative and Quantitative Approaches</td>
<td>07</td>
</tr>
<tr>
<td>03</td>
<td><strong>Research Design and Sample Design</strong>&lt;br&gt; 3.1 Research Design – Meaning, Types and Significance&lt;br&gt; 3.2 Sample Design – Meaning and Significance Essentials of a good sampling Stages in Sample Design Sampling methods/techniques Sampling Errors</td>
<td>07</td>
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</table>
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

05  
**Formulating Research Problem**  
5.1 Considerations: Relevance, Interest, Data Availability, Choice of data, Analysis of data, Generalization and Interpretation of analysis  

06  
**Outcome of Research**  
6.1 Preparation of the report on conclusion reached  
6.2 Validity Testing & Ethical Issues  
6.3 Suggestions and Recommendation

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<td>ME-IT-ICW</td>
<td>IPR and Patenting</td>
<td>03</td>
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<tr>
<td>ILOC-II-2057</td>
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**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

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<thead>
<tr>
<th>Module</th>
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<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.</td>
<td>05</td>
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<tr>
<td>02</td>
<td><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>07</td>
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<tr>
<td>03</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</td>
<td>07</td>
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<tr>
<td>04</td>
<td><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>
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<td>05</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>
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<td>06</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>
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<td>07</td>
<td><strong>Patent Rules:</strong> Indian patent act, European scenario, US scenario, Australia</td>
<td>08</td>
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scenario, Japan scenario, Chinese scenario, Multilateral treaties where India is a member (TRIPS agreement, Paris convention etc.)


**Patent databases:** Important websites, Searching international databases

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<td>Digital Business Management</td>
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<td>ILOC-II-2058</td>
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**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>
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</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 | 06    |
| 3 | **Digital Business Support services:** ERP as e–business backbone, knowledge Tope Apps, Information and referral system  
**Application Development:** Building Digital business Applications and Infrastructure | 06 |
|---|---|---|
| 4 | **Managing E-Business**-Managing Knowledge, Management skills for e-business, Managing Risks in e–business  
| 5 | **E-Business Strategy**-E-business Strategic formulation- Analysis of Company’s Internal and external environment, Selection of strategy, E-business strategy into Action, challenges and E-Transition  
(Process of Digital Transformation) | 04 |
| 6 | **Materializing e-business: From Idea to Realization**-Business plan preparation  
**Case Studies and presentations** | 08 |

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4. Only Four question need to be solved.

**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
8. E-Governance-Challenges and Opportunities in : Proceedings in 2nd International Conference theory and practice of Electronic Governance
# Course Details

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Name</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>ME-IT-ICW ILOC-II-2059</td>
<td>Environmental Management</td>
<td>03</td>
</tr>
</tbody>
</table>

## 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

## Detailed Contents

<table>
<thead>
<tr>
<th>Module</th>
<th>Detailed Contents</th>
<th>Hrs</th>
</tr>
</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/Man-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>

## 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.

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, Maclllan India, 2000
6. Introduction to Environmental Management, Mary K Theodore and Louise Theodore, CRC Press
<table>
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<tr>
<th>Subject Code</th>
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<tbody>
<tr>
<td>ME-IT-ICW</td>
<td>Laboratory I (Core Course Lab)</td>
<td>01</td>
</tr>
<tr>
<td>101L</td>
<td></td>
<td></td>
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</tbody>
</table>

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<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.
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<tr>
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<td>Laboratory II –(DLOC &amp; ILOC Lab)</td>
<td>01</td>
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<tr>
<td>102L</td>
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<tbody>
<tr>
<td>1</td>
<td>Three Laboratory Practical’s to be conducted for each of the DLOC &amp; ILOC 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
### 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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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).
### 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 assessed 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 assessed 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)