# <u>UNIVERSITYOFMUMBAI</u>



Revised syllabus (Rev- 2016) from Academic Year 2016 -17 Under

# FACULTY OF TECHNOLOGY

# **Information Technology**

**Second Year** with Effect from **AY 2017-18**

**Third Year** with Effect from **AY 2018-19**

**Final Year** with Effect from **AY 2019-20**

As per **Choice Based Credit and Grading System**

with effect from the AY 2016–17

**Program Structure B.E. Information Technology, (Rev. 2016)**

**B. E. Information Technology (Semester-VII)**

| Course Code | Course Name | Teaching Scheme (Contact Hours) | | | Credits Assigned | | | |
|---|---|---|---|---|---|---|---|---|
| | | Theory | Pract | Tut | Theory | TW/ Pract | Tut | Total |
| ITC701 | Enterprise Network Design | 4 | - | - | 4 | - | - | 4 |
| ITC702 | Infrastructure Security | 4 | - | - | 4 | - | - | 4 |
| ITC703 | Artificial Intelligence | 4 | - | - | 4 | - | - | 4 |
| ITDLO-II | Department Level Optional Course -III | 4 | - | - | 4 | - | - | 4 |
| ILO-I | Institute Level Optional Course-I | 3 | - | - | 3 | - | - | 3 |
| ITL701 | Network Design Lab | - | 2 | - | - | 1 | | 1 |
| ITL702 | Advanced Security Lab | - | 2 | - | - | 1 | | 1 |
| ITL703 | Intelligence System Lab | - | 2 | - | | 1 | | 1 |
| ITL704 | Android Apps Development Lab | - | 2 | | | 1 | | 1 |
| ITM705 | Project-I | - | 6/8 | | | 3 | - | 3 |
| | **Total** | **19** | **14** | **-** | **19** | **7** | **-** | **26** |

| Course Code | Course Name | Examination Scheme | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | Theory | | | | | TW | Oral | Oral & Pract | Total |
| | | Internal Assessment | | | End Sem. Exam | Exam Duration ( in Hrs) | | | | |
| | | Test 1 | Test 2 | Avg. | | | | | | |
| ITC701 | Enterprise Network Design | 20 | 20 | 20 | 80 | 3 | - | | - | 100 |
| ITC702 | Infrastructure Security | 20 | 20 | 20 | 80 | 3 | - | | - | 100 |
| ITC703 | Artificial Intelligence | 20 | 20 | 20 | 80 | 3 | - | | - | 100 |
| ITDLO-II | Department Level Optional Course -III | 20 | 20 | 20 | 80 | 3 | - | | - | 100 |
| ILO-I | Institute Level Optional Course-I | 20 | 20 | 20 | 80 | 3 | -- | | - | 100 |
| ITL701 | Network Design Lab | - | - | - | - | - | 25 | 25 | -- | 50 |
| ITL702 | Advanced Security Lab | - | - | - | - | - | 25 | 25 | -- | 50 |
| ITL703 | Intelligence System Lab | -- | - | - | - | -- | 25 | 25 | -- | 50 |
| ITL704 | Android Apps Development Lab | | | | | | 25 | 25 | -- | 25 |
| ITM705 | Project-I | - | - | - | - | - | 50 | 25 | -- | 75 |
| **Total** | | 100 | 100 | 100 | 400 | | 150 | 125 | -- | 750 |

# Department Level Optional Course (DLO)

Every student is required to take one Department Elective Course for Semester VII. 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.

(DLO-I subjects will have no Labs only Theory)

# Institute Level Optional Course (ILO)

Every student is required to take one Institute Elective Course for Semester VII, which is

not closely allied to their disciplines. Different sets of courses will run in the both the semesters.

| Subject Code | Department Level Optional Course (DLO) | Subject Code | Institute Level Optional Course (ILO) |
|---|---|---|---|
| | Semester VII | | |
| ITDLO7031 | Storage Area Networks | ILO7011 | Product Lifecycle Management |
| ITDLO7032 | Mobile Application Development | ILO7012 | Reliability Engineering |
| ITDLO7033 | High Performance Computing | ILO7013 | Management Information System |
| ITDLO7034 | Software Testing and Quality Assurance | ILO7014 | Design of Experiments |
| ITDLO7035 | Soft Computing | ILO7015 | Operation Research |
| | | ILO7016 | Cyber Security and Laws |
| | | ILO7017 | Disaster Management and Mitigation Measures |
| | | ILO7018 | Energy Audit and Management |
| | | ILO7019 | Development Engineering |

| Course Code | Course Name | Theory | Practical | Tutorial | Theory | Practical /Oral | Tutorial | Total |
|---|---|---|---|---|---|---|---|---|
| ITC701 | Enterprise Network Design | 04 | -- | | 04 | -- | -- | 04 |

| Course Code | Course Name | Examination Scheme | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | Theory Marks | | | | Term Work | Oral & Practical | Total |
| | | Internal assessment | | | End Sem. Exam | | | |
| | | Test1 | Test2 | Avg. of two Tests | | | | |
| ITC701 | Enterprise Network Design | 20 | 20 | 20 | 80 | -- | -- | 100 |

**Course Objectives:** Students will try:

1.  To be familiarized with the methodologies and approaches of the network design for an enterprise network.
2.  To understand the network hierarchy and use modular approach to network design for an enterprise network.
3.  To understand the campus design and data center design considerations for designing an enterprise campus.
4.  To study Enterprise Edge WAN Technologies and design a WAN using them
5.  Designing an IP addressing plan and selecting a Route protocol for an enterprise network.
6.  To design enterprise network for given user requirements in  an application.

**Course Outcomes: S**tudent should be able to:

1.  Understand the customer requirements and Apply a Methodology to Network Design
2.  Structure and Modularize the Network
3.  Design Basic Campus and Data Center Network.
4.  Design Remote Connectivity
5.  Design IP Addressing and Select suitable Routing Protocols for the Network
6.  Compare Openflow controllers and switches with other enterprise networks.

**Pre-requisite:** Computer Networks

**Detailed syllabus:**
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| Sr. No. | Module | Detailed Content | Hours | CO Mapping |
|---|---|---|---|---|
| 0 | Prerequisite | 1. OSI Reference Model and TCP/IP Protocol Suite<br>2. Routing IP Addresses<br>3. Internetworking Devices | 02 | |
| I | Applying a Methodology to Network Design: | The Cisco Service Oriented Network Architecture, Network Design Methodology, Identifying Customer Requirements, Characterizing the Existing Network and Sites, Using the Top-Down Approach to Network Design, The Design Implementation Process. | 08 | CO1, CO6 |
| II | Structuring and Modularizing the Network: | Network Hierarchy, Using a Modular Approach to Network Design, *Services Within Modular Networks, Network Management Protocols and Features* | 09 | CO2, CO6 |
| III | Designing Basic Campus and Data Center Networks | Campus Design Considerations, Enterprise Campus Design, Enterprise Data Center Design Considerations | 09 | CO3, CO6 |
| IV | Designing Remote Connectivity | Enterprise Edge WAN Technologies, WAN Design, Using WAN Technologies, Enterprise Edge WAN and MAN Architecture, Selecting Enterprise Edge Components, Enterprise Branch and Teleworker Design. | 09 | CO4, CO6 |
| V | Designing IP Addressing in the Network & Selecting Routing Protocols | Designing an IP Addressing Plan, Introduction to IPv6, Routing Protocol Features, Routing Protocols for the Enterprise, Routing Protocol Deployment, *Route* Redistribution, Route Filtering, Redistributing and Filtering with BGP, Route Summarization | 10 | CO5 |
| VI | Software Defined | Understanding SDN and Open Flow : SDN – SDN Building | | CO6 |

| | | | | |
|---|---|---|---|---|
| | Network | Blocks, OpenFlow messages – Controller to Switch, Symmetric and Asynchronous messages,<br><br>Implementing OpenFlow Switch, OpenFlow controllers , POX and NOX, Open Flow in Cloud Computing, Case study: how SDN changed Traditional Enterprise network Design | 05 | |

**Text Books:**

1. Authorized Self-Study Guide, Designing for Cisco Internetwork Solutions (DESGN), Second Edition, Cisco Press-Diane Teare.
2. Network Analysis, Architecture, and Design 3rd Edition, Morgan Kaufman, James D.
3. CCDA Cisco official Guide
4. Software Defined Networking with Open Flow : PACKT Publishing Siamak Azodolmolky

**References:**

1. Top-Down Network Design (Networking Technology) 3rd Edition, Priscilla Oppenheimer ,Cisco Press Book
2. Network Planning and Design Guide Paperback – 2000, Shaun Hummel

**Assessment:**

**Internal Assessment for 20 marks:**
Consisting of **Two Compulsory Class Tests**
Approximately 40% to 50% of syllabus content must be covered in First test and remaining 40% to 50% of syllabus contents must be covered in second test.

**End Semester Examination:** Some guidelines for setting the question papers are as:
- Weightage of each module in end semester examination is expected to be/will be proportional to number of respective lecture hours mentioned in the syllabus.
- Question paper will comprise of total **six questions**, **each carrying 20 marks.**
- **Q.1** will be **compulsory** and should **cover maximum contents of the syllabus**.
- **Remaining question will be mixed in nature** (for example if Q.2 has part (a) from module 3 then part (b) will be from any other module. (Randomly selected from all the modules.)
- Total **four questions** need to be solved.

| Course Code | Course Name | Theory | Practical | Tutorial | Theory | Practical/Oral | Tutorial | Total |
|---|---|---|---|---|---|---|---|---|
| ITC702 | Infrastructure Security | 04 | -- | - | 04 | -- | - | 04 |

| Course Code | Course Name | Examination Scheme | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | Theory Marks | | | | Term Work | Oral & Practical | Total |
| | | Internal assessment | | | End Sem. Exam | | | |
| | | Test1 | Test2 | Avg. of two Tests | | | | |
| ITC702 | Infrastructure Security | 20 | 20 | 20 | 80 | -- | -- | 100 |

**Course Objectives:** Students will try :
1. To understand underlying principles of infrastructure security
2. To explore software vulnerabilities, attacks and protection mechanisms
   To learn security aspects of wireless network infrastructure and protocols
3. To investigate web server vulnerabilities and their countermeasures
4. To develop policies for security management and mitigate security related risks in the organization
5. To Learn the different attacks on Open Web Applications and Web services.
6. To Learn the different security policies.

**Course Outcomes:** Students will be able to:
1. Understand the concept of vulnerabilities, attacks and protection mechanisms
2. Analyze and evaluate software vulnerabilities and attacks on databases and operating systems
3. Explain the need for security protocols in the context of wireless communication
4. Understand and explain various security solutions for Web and Cloud infrastructure
5. Understand, and evaluate different attacks on Open Web Applications and Web services
6. Design appropriate security policies to protect infrastructure components

**Prerequisite:** Computer Networks, Cryptography and Network Security

**Detail Syllabus:**

| Sr. No. | Module | Detailed Content | Hours | CO Mapping |
|---|---|---|---|---|
| I | Introduction | Cyber-attacks, Vulnerabilities, Defense Strategies and Techniques, Authentication Methods- Password, Token and Biometric, Access Control Policies and Models (DAC,MAC, RBAC, ABAC, BIBA, Bell La Padula), Authentication and Access Control Services- RADIUS, TACACS, and TACACS+ | 6 | CO1 |

| | | | | |
|---|---|---|---|---|
| II | Software Security | **Software Vulnerabilities:**<br><br>Buffer overflow, Format String, Cross-Site Scripting, SQL Injection, Malware: Viruses, Worms, Trojans, Logic Bomb, Bots, Rootkits<br><br>**Operating System Security:**<br><br>Memory and Address Protection, File Protection Mechanism, User Authentication.<br><br>Linux and Windows: Vulnerabilities, File System Security<br><br>**Database Security:**<br><br>Database Security Requirements, Reliability and Integrity, Sensitive Data, Inference Attacks, Multilevel Database Security | 12 | CO2 |
| III | Wireless Security | Mobile Device Security- Security Threats, Device Security, GSM, UMTS and 4G Security, IEEE 802.11xWireless LAN Security, VPN Security, Wireless Intrusion Detection System (WIDS) | 9 | CO3 |
| IV | Cloud Security | Cloud Security Risks and Countermeasures, Data Protection in Cloud, Cloud Application Security, Cloud Identity and Access Management, Cloud Security as a Service, SAML, OAuth | 8 | CO4 |
| V | Web Security | Web Security Considerations, User Authentication and Session Management, Cookies, SSL, HTTPS, SSH, Privacy on Web, Web Browser Attacks, Account Harvesting, Web Bugs, Clickjacking, Cross-Site Request Forgery, Session Hijacking and Management, Phishing and Pharming Techniques, DNS Attacks, Web Service Security, Secure Electronic Transaction, Email Attacks, Web Server Security as per OWASP, Firewalls, Penetration Testing | 12 | CO4, CO5 |
| VI | Information Security and Risk Management | Security Policies, Business Continuity Plan, Risk Analysis, Incident Management, Legal System and Cybercrime, Ethical Issues in Security Management. | 5 | CO6 |

**Text Books:**
1. Computer Security Principles and Practice, William Stallings, Sixth Edition, Pearson Education
2. Security in Computing, Charles P. Pfleeger, Fifth Edition, Pearson Education
3. Network Security and Cryptography, Bernard Menezes, Cengage Learning
4. Network Security Bible, Eric Cole, Second Edition, Wiley

**Reference Books:**
1. Web Application Hackers Handbook by Wiley.
2. Computer Security, Dieter Gollman, Third Edition, Wiley
3. CCNA Security Study Guide, Tim Boyle, Wiley
4. Introduction to Computer Security, Matt Bishop, Pearson.
5. Cloud Security and Privacy, Tim Mather, Subra Kumaraswamy, Shahed Latif , O'Riely

**Assessment:**

**Internal Assessment for 20 marks:**
Consisting of **Two Compulsory Class Tests**
Approximately 40% to 50% of syllabus content must be covered in First test and remaining 40% to 50% of syllabus contents must be covered in second test.

**End Semester Examination:** Some guidelines for setting the question papers are as:
- Weightage of each module in end semester examination is expected to be/will be proportional to number of respective lecture hours mentioned in the syllabus.
- Question paper will comprise of total **six questions**, **each carrying 20 marks.**
- **Q.1** will be **compulsory** and should **cover maximum contents of the syllabus**.
- **Remaining question will be mixed in nature** (for example if Q.2 has part (a) from module 3 then part (b) will be from any other module. (Randomly selected from all the modules.)
- Total **four questions** need to be solved.

| Course Code | Course Name | Theory | Practical | Tutorial | Theory | Practical /Oral | Tutorial | Total |
|---|---|---|---|---|---|---|---|---|
| ITC703 | Artificial Intelligence | 04 Hr/Week | | -- | 04 | -- | -- | 04 |

| Course Code | Course Name | Examination Scheme | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | Theory Marks | | | | Term Work | Oral & Practical | Total |
| | | Internal assessment | | | End Sem. Exam | | | |
| | | Test1 | Test2 | Avg. of two Tests | | | | |
| ITC703 | Artificial Intelligence | 20 | 20 | 20 | 80 | -- | -- | 100 |

**Course Objectives:** Students will try:

1. To create appreciation and understanding of both the achievements of AI and the theory underlying those achievements.
2. To introduce the concepts of a Rational Intelligent Agent and the different types of Agents that can be designed to solve problems
3. To review the different stages of development of the AI field from human like behavior to Rational Agents.
4. To impart basic proficiency in representing difficult real life problems in a state space representation so as to solve them using AI techniques like searching and game playing.
5. To create an understanding of the basic issues of knowledge representation and Logic and blind and heuristic search, as well as an understanding of other topics such as minimal, resolution, etc. that play an important role in AI programs.
6. To introduce advanced topics of AI such as planning, Bayes networks, natural language processing and Cognitive Computing.

**Course Outcomes:** Students will be able to:

1. Demonstrate knowledge of the building blocks of AI as presented in terms of intelligent agents.
2. Analyze and formalize the problem as a state space, graph, design heuristics and select amongst different search or game based techniques to solve them.
3. Develop intelligent algorithms for constraint satisfaction problems and also design intelligent systems for Game Playing
4. Attain the capability to represent various real life problem domains using logic based techniques and use this to perform inference or planning.
5. Formulate and solve problems with uncertain information using Bayesian approaches.
6. Apply concept Natural Language processing to problems leading to understanding of cognitive computing. .

**Prerequisite:** Programming, Data Structures.

**Detailed syllabus:**

| Sr. No. | Module | Detailed Content | Hours | CO Mapping |
|---|---|---|---|---|
| 0 | **Prerequisites** | Knowledge of any programming language, Data structures. | **2** | -- |
| I | Introduction to Intelligent Systems and Intelligent Agents | Introduction to AI, AI Problems and AI techniques, Solving problems by searching, Problem Formulation. State Space Representation<br><br>Structure of Intelligent agents, Types of Agents, Agent Environments PEAS representation for an Agent. | 07 | CO 1<br><br>CO 2 |
| II | Search Techniques | **Uninformed Search**: DFS, BFS, Uniform cost search, Depth Limited Search, Iterative Deepening.<br>**Informed Search:** Heuristic functions, Hill Climbing, Simulated Annealing, Best First Search, A*,<br>**Constraint Satisfaction Programming**: Crypto Arithmetic, Map Coloring, N-Queens.<br><br>**Adversarial Search:** Game Playing, Min-Max Search, Alpha Beta Pruning | 11 | **CO 2**<br><br>**CO 3** |
| III | Knowledge and Reasoning | A Knowledge Based Agent, Overview of Propositional Logic, First Order Predicate Logic, Inference in First Order Predicate Logic: Forward and Backward Chaining, Resolution. | 10 | **CO 4** |
| IV | Planning | Introduction to Planning, Planning with State Space Search, Partial Ordered planning, Hierarchical Planning, Conditional Planning. | 06 | **CO 4** |
| V | Uncertain Knowledge and Reasoning | Uncertainly, Representing Knowledge in an Uncertain Domain, Conditional Probability, Joint Probability, Bayes' theorem, Belief Networks, Simple Inference in Belief Networks. | 06 | **CO 5** |
| VI | Natural Language | Language Models, Natural Language for Communication: | 10 | **CO 6** |

| | | Processing | Syntactic Analysis, Augmented Grammars and Semantic Interpretation, Machine Translation.<br><br>**Overview of Cognitive Computing:** Foundation of Cognitive Computing, List of Design Principles for Cognitive Systems, Natural Language Processing in Support of a Cognitive System **(First three chapters from Text book 3)** | | |

## Text Books:

1. Stuart Russell and Peter Norvig, Artificial Intelligence: A Modern Approach, 2nd Edition, Pearson Education.
2. Elaine Rich, Kevin Knight, Shivshankar B Nair, Artificial Intelligence, McGraw Hill, 3rd Edition
3. Judith S. Hurwitz, Marcia Kaufman, Adrian Bowles, Cognitive Computing and Big Data Analytics, Wiley India

## References:

1. George Lugar, .AI-Structures and Strategies for Complex Problem Solving., 4/e, 2002, Pearson Education.
2. Nils J. Nilsson, Principles of Artificial Intelligence, Narosa Publication.
3. Patrick H. Winston, Artificial Intelligence, 3rd edition, Pearson Education.
4. Deepak Khemani, A First Course in Artificial Intelligence, McGraw Hill Publication
5. John Kelly , Steve Hamm, Smart Machines - IBM′s Watson and the Era of Cognitive Computing, Columbia Business School Publishing

## Assessment:

**Internal Assessment for 20 marks:**
Consisting of **Two Compulsory Class Tests**
Approximately 40% to 50% of syllabus content must be covered in First test and remaining 40% to 50% of syllabus contents must be covered in second test.

**End Semester Examination:**   Some guidelines for setting the question papers are as:
- Weightage of each module in end semester examination is expected to be/will be proportional to number of respective lecture hours mentioned in the syllabus.
- Question paper will comprise of total **six questions**, **each carrying 20 marks.**
- **Q.1** will be **compulsory** and should **cover maximum contents of the syllabus**.
- **Remaining question will be mixed in nature** (for example if Q.2 has part (a) from module 3 then part (b) will be from any other module. (Randomly selected from all the modules.)
- Total **four questions** need to be solved.

| Course Code | Course Name | Theory | Practical | Tutorial | Theory | Practical & Oral | Tutorial | Total |
|---|---|---|---|---|---|---|---|---|
| ITL701 | Network Design Lab | -- | 2 | -- | -- | 2 | -- | 02 |

| Course Code | Course Name | Examination Scheme | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | Theory Marks | | | | Term Work | Oral | Practical & Oral | Total |
| | | Internal assessment | | | End Sem. Exam | | | | |
| | | Test1 | Test2 | Avg. of two Tests | | | | | |
| ITL701 | Network Design Lab | -- | -- | -- | -- | 25 | 25 | -- | 50 |

**Lab Objectives:** Students will try:

1. To be familiarized with the requirements of an enterprise and address its major design areas
2. To recognize the hierarchical network model for the enterprise
3. Identify the networking devices and their configurations required for the design and also prepare a bill of materials
4. Propose a design for the Server Farm of an enterprise network and discuss up gradations if needed.
5. Provide suitable IP addressing plan and best possible routing protocol for an enterprise network.
6. Construct a suitable design for an enterprise network and test it using a tool.

**Lab Outcomes:** Students will be able to:

1. Understand the requirements of an enterprise and outline its major design areas
2. Identify functional areas to construct high level modules for enterprise architecture and analyze them.
3. Identify the networking devices, prepare a bill of materials and configure the devices as per the Core, Acess and Distribution layers
4. Design the Server Farm for an enterprise network and discuss up gradations if needed.
5. Identify and select the technology for Remote site Connectivity**,** suitable IP addressing plan and routing protocol for an enterprise network.
6. Test and monitor the enterprise network using a tool

**Prerequisite:** Computer Networks.

**Guidelines**

1. The case study of College Campus Network must be designed as a mini project work which is to be conducted by a group of three students

2. Each group will be associated with a subject Incharge/ mini project mentor. The group should meet with the concerned faculty during Laboratory hours and the progress of work discussed must be documented.

3. The students must understand the requirements of a College campus enterprise network.

4. The students must outline the major design areas of a College campus enterprise network.

5. The students must identify the functional areas and construct high level modules for the College campus enterprise architecture.

6. The students must analyze the existing College campus enterprise network and propose up gradations to existing infrastructure.

7. The students must identify the network devices required and their locations to design a College campus enterprise network.

8. The students must configure the network devices required as per the Core Layer, Access Layer and Distribution Layer.

9. The students must Design the Server Farm for enterprise network using a configuration tool and also discuss if any other improvement is required.

10. The students must Prepare a bill of materials of all the networking devices. Develop a Request for Proposal-RFP for the enterprise network

11. The students must identify the technology for Remote Site connectivity and evaluate it as per the application requirements of the college campus enterprise network.

12. Propose a suitable IP addressing plan for the enterprise network.

13. Determine a suitable routing protocol for the enterprise network.

14. Create and Test the designed college campus enterprise network using a tool.

15. Use Nagios tool for enterprise infrastructure monitoring tool

16. Each group may present their work in various project competitions and paper presentations.

17. A detailed report is to be prepared as per guidelines given by the concerned faculty.

**Text Books:**

1. Authorized Self-Study Guide, Designing for Cisco Internetwork Solutions (DESGN), Second Edition, Cisco Press-Diane Teare.
2. Designing and Supporting Computer Networks, CCNA Discovery Learning Guide (Cisco Systems Networking Academy Program) Paperback – 2008, Kenneth Stewart , Aubrey Adams, Allan Reid , Jim Lorenz.

**References:**

1. 1. Top-Down Network Design (Networking Technology) 3rd Edition, Priscilla Oppenheimer ,Cisco Press Book
2. Network Planning and Design Guide Paperback – 2000, Shaun Hummel

**Term Work:**

Term Work shall consist of full Mini Project on above guidelines/syllabus. Also Term work Journal must include at least 2 assignments.

**Term Work Marks:** 25 Marks (Total marks) = 15 Marks (Mini Project) + 5 Marks (Assignments) + 5 Marks (Attendance)

**Oral Exam:** An Oral exam will be held based on the Mini Project and Presentation.

| Course Code | Course Name | Theory | Practical | Tutorial | Theory | Practical/Oral | Tutorial | Total |
|---|---|---|---|---|---|---|---|---|
| ITL702 | Advance Security Lab | -- | 02 | - | -- | 01 | - | 01 |

| Course Code | Course Name | Examination Scheme | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | Theory Marks | | | | Term Work | Oral & Practical | Oral | Total |
| | | Internal assessment | | | End Sem. Exam | | | | |
| | | Test1 | Test2 | Avg. of two Tests | | | | | |
| ITL702 | Advance Security Lab | -- | -- | -- | -- | 25 | -- | 25 | 50 |

**Lab Objective:** Students will try to:

1. Implement and analyze program and database vulnerabilities Buffer overflow and SQL Injection.
2. Explore and analyze different security tools to secure mobile devices, web browser, wireless network and router
3. Explore reconnaissance, attack and forensics tools in Kali Linux
4. Learn security of system using personal firewall installation
5. Understand AAA using RADUIS
6. Understand AAA using TACACS

**Lab Outcome:** Students will able to:

1. Implement and analyze program and database vulnerabilities Buffer overflow and SQL Injection.
2. Explore and analyze different security tools to secure mobile devices, web browser, wireless network and router
3. Explore reconnaissance, attack and forensics tools in Kali Linux
4. Learn security of system using personal firewall installation
5. Understand AAA using RADUIS
6. Understand AAA using TACACS

**Prerequisite:** Computer Networks, Cryptography and Network Security.

| Hardware | Software |
|---|---|
| PC i3 or above configuration. | Kali Linux, Java, Snort, Kismet, Metasploit, Wireshark, Droidcrypt |

**Detail Syllabus:**

| Sr. No | Description | Hours | CO mapping |
|--------|-------------|-------|------------|
| 1 | Exploring Kali Linux and the inbuilt tools for reconnaissance and ethical hacking. | 2 | LO3 |
| 2 | Implementation and analysis of SQL injection Attack | 4 | LO1 |
| 3 | Implementation of Buffer overflow attack and its analysis using Splint, Cppcheck etc. | 2 | LO1 |
| 4 | Setting up personal Firewall using Iptables | 2 | LO4 |
| 5 | Exploring wireless security tools like Kismet, NetStumbler etc. | 2 | LO2 |
| 6 | Performing a penetration testing using Metasploit | 2 | LO3 |
| 7 | Exploring Router security, access lists using packet tracer | 2 | LO2 |
| 8 | Exploring VPN security using Packet tracer | 2 | LO2 |
| 9 | Exploring Authentication and access control using RADIUS, TACACS and TACACS+ | 2 | LO5 |

| | | | |
|---|---|---|---|
| | | | |
| 10 | Install and use a security app on an Android mobile (e.g. Droidcrypt) | 2 | LO2 |
| 11 | Explore forensics tools in Kali Linux for acquiring, analyzing and duplicating data | 2 | LO3 |
| 12 | Configuration of mod Security, core rule set on apache server. | 2 | LO2 |

**Text Books:**

1. Build your own Security Lab, Michael Gregg, Wiley India
2. CCNA Security, Study Guide, TIm Boyles, Sybex

**Reference Books:**

1. Network Security Bible, Eric Cole, Wiley India

**Term Work:**
Term Work shall consist of at least 10 to 12 practical's based on the above list. Also Term work Journal must include at least 2 assignments.
**Term Work Marks:** 25 Marks (Total marks) = 15 Marks (Experiment) + 5 Marks (Assignments) + 5 Marks (Attendance)

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

| Course Code | Course Name | Theory | Practical | Tutorial | Theory | Practical /Oral | Tutorial | Total |
|---|---|---|---|---|---|---|---|---|
| ITL703 | Intelligence System Lab | -- | 2 | -- | -- | 1 | -- | 01 |

| Course Code | Course Name | Examination Scheme | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | Theory Marks | | | | Term Work | Oral & Practical | Oral | Total |
| | | Internal assessment | | | End Sem. Exam | | | | |
| | | Test1 | Test2 | Avg. of two Tests | | | | | |
| ITL703 | Intelligence System Lab | -- | -- | -- | -- | 25 | -- | 25 | 50 |

**Course Objectives:** Students will try:

1. To introduce the concepts of a Rational Intelligent Agent and the different types of Agents that can be designed to solve problems
2. To impart basic proficiency in representing difficult real life problems in a state space representation so as to solve them using AI techniques.
3. To make students understand various AI methods like searching and game playing and how to apply them to solve real applications
4. To explain to students the basic issues of knowledge representation and Logic so as to build inference engines
5. To impart a basic understanding of some of the more advanced topics of AI such as planning.
6. To understand Bayes networks, natural language processing and introduce concept of cognitive computing.

**Course Outcomes:** Students will be able to:

1. Design the building blocks of an Intelligent Agent using PEAS representation .
2. Analyze and formalize the problem as a state space, graph, design heuristics and select amongst different search or game based techniques to solve them.
3. Develop intelligent algorithms for constraint satisfaction problems and also design intelligent systems for Game Playing
4. Attain the capability to represent various real life problem domains using logic based techniques and use this to perform inference or planning.
5. Formulate and solve problems with uncertain information using Bayesian approaches.
6. Apply concept Natural Language processing and cognitive computing for creation of domain specific ChatBots.

| Hardware | Software |
|---|---|
| PC i3 or above configuration. | Java Python |

**Detailed syllabus:**

| Module No. | Detailed Content | Hours | LO Mapping |
|---|---|---|---|
| 1 | Tutorial exercise for <br> a) Design of Intelligent System using PEAS. <br> b) Problem Definition with State Space Representation | 2 | LO 1, LO 2 |
| 11 | Implementation of Uninformed and Informed Search Algorithms. | 6 | LO 2 |
| 111 | Implementation of CSP and Game playing algorithms . | 4 | LO 3 |
| 1V | a) Assignment on Predicate Logic, for forward and backward reasoning and resolution. <br><br> b) Design of a Planning system using STRIPS. | 4 | LO 4 |
| V | Implementation of Bayes' Belief Network. | 2 | LO 5 |
| VI | **Mini project** <br><br> Construction of a domain specific ChatBot using Natural Language Processing techniques. <br><br> ( Applications can include : Medical Diagnosis, Personal Shopping Assistant, Travel Agent , Trouble shooting etc.) | 8 | LO6 |

**Text Books:**

1. Stuart Russell and Peter Norvig, Artificial Intelligence: A Modern Approach, 2nd Edition, Pearson Education.

2. Judith S. Hurwitz, Marcia Kaufman, Adrian Bowles, Cognitive Computing and Big Data Analytics, Wiley India

**References:**

1. George Lugar, .AI-Structures and Strategies for Complex Problem Solving., 4/e, 2002, Pearson Education.

2. John Kelly , Steve Hamm, Smart Machines - IBM′s Watson and the Era of Cognitive Computing, Columbia Business School Publishing

**Term Work:**
Term Work shall consist of at least 10 to 12 practical's based on the above list. Also Term work Journal must include at least 2 assignments.
**Term Work Marks:** 25 Marks (Total marks) = 20 Marks (Experiment + Mini-Project) + 5 Marks (Attendance) **Oral Exam:** An Oral exam will be held based on the above syllabus.

| Course Code | Course Name | Theory | Practical | Tutorial | Theory | Practical & Oral | Tutorial | Total |
|---|---|---|---|---|---|---|---|---|
| ITL704 | Android Apps Development Lab | | 2 | | | 1 | | 1 |

| Course Code | Course Name | Examination Scheme | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | Theory Marks | | | | Term Work | Practical & Oral | Oral | Total |
| | | Internal assessment | | | End Sem. Exam | | | | |
| | | Test1 | Test2 | Avg. of twoTests | | | | | |
| ITL704 | Android Apps Development Lab | -- | -- | -- | -- | 25 | -- | 25 | 50 |

| Hardware | Software |
|---|---|
| PC i3 or above configuration. | Java<br>Android SDK |

**Lab Objectives:** Students will try:

1. To gain knowledge of installing Android Studio and Cross Platform Integrated Development Environment.
2. To learn designing of User Interface and Layouts for Android App.
3. To learn how to use intents to broadcast data within and between Applications.
4. To use Content providers and Handle Databases using SQLite.
5. To introduce Android APIs for Camera and Location Based Service.
6. To discuss various security issues with Android Platform.

**Lab Outcomes:** Students will be able to:

1. Experiment on Integrated Development Environment for Android Application Development.
2. Design and Implement User Interfaces and Layouts of Android App.
3. Use Intents for activity and broadcasting data in Android App.
4. Design and Implement Database Application and Content Providers.
5. Experiment with Camera and Location Based service.
6. Develop Android App with Security features.

**Prerequisite:** Java Programming, Internet Programming**.**

**Guidelines**

**1.** The mini project work is to be conducted by a group of three students

2. Each group will be associated with a subject Incharge/ mini project mentor. The group should meet with the concerned faculty during Laboratory hours and the progress of work discussed must be documented.

3. The students may do survey for different application which they can create Apps using Android.

4. Students will do Installation, configuration of Android Studio & to create AVD and also try for Cross platform Integrated Development Environment (Any Open Source Tool).

5. Students will try to Design and implement following points in their Mini Project (Android Apps)

   a. Widget box for Android phone.

   b. Use Layouts

   c. Use Intents

   d. Use Activity

   e. Use SQLite

   f. Use Camera

   g. Use Location API

   h. Generate APK file

6. Each group along with the concerned faculty shall identify a potential problem statement for Apps development, on which the study and implementation is to be conducted.

7. Each group may present their work in various project competitions and paper presentations.

8. A detailed report is to be prepared as per guidelines given by the concerned faculty.


**Text Books:**

1.Professional Android 4 Application Development by wrox publication
2**.**Android Cookbook by o'reilly
3. Beginning Android Development Wrox Press


**References:**

1. Android Application Development For Dummies, 2nd Edition by MichaelBurton, DonnFelker
2. Android Security –attack and defenses, AbhishekDubey and AnmolMisra by CRC Press

**Term Work:**
   Term Work shall consist of full Mini Project on above guidelines/syllabus. Also Term work Journal must include at least 2 assignments.
   **Term Work Marks:** 25 Marks (Total marks) = 15 Marks (Mini Project) + 5 Marks (Assignments) + 5 Marks (Attendance)

   **Oral Exam:** An Oral exam will be held based on the Mini Project and Presentation.

| Course Code | Course Name | Theory | Practical | Tutorial | Theory | Practical / Oral | Tutorial | Total |
|---|---|---|---|---|---|---|---|---|
| ITM705 | Project-I | -- | 06 | -- | -- | 3 | -- | 3 |

| Course Code | Course Name | Examination Scheme | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | Theory Marks | | | | Term Work | Practical & Oral | Oral | Total |
| | | Internal assessment | | | End Sem. Exam | | | | |
| | | Test1 | Test2 | Avg. of two Tests | | | | | |
| ITM705 | Project-I | -- | -- | -- | -- | 50 | -- | 25 | 75 |

**Lab Objectives:** Students will try:

1. To offer students a glimpse into real world problems and challenges that need IT based solutions
2. To enable students to create very precise specifications of the IT solution to be designed.
3. To introduce students to the vast array of literature available of the various research challenges in the field of IT
4. To create awareness among the students of the characteristics of several domain areas where IT can be effectively used.
5. To enable students to use all concepts of IT in creating a solution for a problem
6. To improve the team building, communication and management skills of the students.

**Lab Outcomes:** Student will be able to:

1. Discover potential research areas in the field of IT
2. Conduct a survey of several available literature in the preferred field of study
3. Compare and contrast the several existing solutions for research challenge
4. Demonstrate an ability to work in teams and manage the conduct of the research study.
5. Formulate and propose a plan for creating a solution for the research plan identified
6. To report and present the findings of the study conducted in the preferred domain

**Guidelines**

1. The project work is to be conducted by a group of three students

2. Each group will be associated with a project mentor/guide. The group should meet with the project mentor/guide periodically and record of the meetings and work discussed must be documented.

3. Department has to allocate 1 day in VII semester and 2 day in VIII semester every week.

4. Students will do literature survey in Sem VI or Sem VII.

5. Students will do design, implementation and coding in Sem VII.

6. Each group along with its guide/mentor shall identify a potential research area/problem domain, on which the study is to be conducted.

7. Each team will do a rigorous literature survey of the problem domain by reading and understanding at least 3-5 research papers from current good quality national/international journals/conferences. (Papers selected must be indexed by Scopus/IEEE/Springer/ACM etc.). The list of papers surveyed must be clearly documented.

8. The project assessment for term work will be done at least two times at department level by giving presentation to panel members which consist of at least three (3) members as Internal examiners (including the project guide/mentor) appointed by the Head of the department of respective Programme.

9. A report is to be prepared summarizing the findings of the literature survey. A comparative evaluation of the different techniques surveyed is also to be done.

10. Students will do testing and analyze in Sem VIII

11. Teams must analyze all the results obtained by comparing with other standard techniques.

12. Every team must publish their work in national / international conference/journals (if possible publish in Scopus indexed journals).

**Evaluation**

1. Each team has to give presentation/demo to the Internal Panel and External examiner.

2. Each team will prepare a report that will summarize the results of the literature survey and implementation and coding as project proposal in SEM VII. The list of papers surveyed must be clearly documented.

3. Each group will be jointly evaluated by a team of Internal and External Examiners approved by the University of Mumbai.

4. Oral exam will be conduct on the project done by the students.

**Term Work:**
Term Work shall consist of full Project-I on above guidelines/syllabus.

**Term Work Marks:** 50 Marks (Total marks) = 45 Marks (Project-I) + 5 Marks (Attendance)

**Oral Exam:** An Oral exam will be held based on the Project-I and Presentation.

| Course Code | Course Name | Theory | Practical | Tutorial | Theory | Practical /Oral | Tutorial | Total |
|---|---|---|---|---|---|---|---|---|
| ITDLO7031 | Storage Area Network | 04 | -- | -- | 04 | -- | 01 | 05 |

| Course Code | Course Name | Examination Scheme | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | Theory Marks | | | | Term Work | Practical & Oral | Oral | Total |
| | | Internal assessment | | | End Sem. Exam | | | | |
| | | Test1 | Test2 | Avg. of two Tests | | | | | |
| ITDLO7031 | Storage Area Network | 20 | 20 | 20 | 80 | -- | -- | -- | 100 |

**Course Objectives:** Students will try to:

1. Understand the need for Storage Area Network and Data protection to satisfy the information explosion requirements
2. Study storage technologies: SAN, NAS, IP storage etc., which will bridge the gap between the emerging trends in industry and academics.
3. To get an insight of Storage area network architecture, protocols and its infrastructure.
4. To study and discuss the applications of SAN to fulfill the needs of the storage management in the heterogeneous environment..
5. Study and understand the management of Storage area Networks.
6. To understand and analyze case studies on the storage area network technology

**Course Outcomes:** Students will able to:

1. Students will analyze the limitations of the client-server architecture and evaluate the need for data protection and storage centric architectures such as Intelligent storage system..
2. Students will understand, interpret and examine various SAN technologies.
3. Students will describe and sketch the SAN architecture and its uses.
4. Students will classify the applications as per their requirements and select relevant SAN solutions.
5. Students will understand and evaluate different SAN management strategies to fulfill business continuity requirements.
6. Students will design case studies on NAS, SAN and SAN/ NAS

**Prerequisite:** Computer Networks, Operating System

**Detailed syllabus:**

| Sr. No. | Module | Detailed Content | Hours | CO Mapping |
|---------|--------|------------------|-------|------------|
| 0 | Prerequisite | Networking Protocols, File system and Memory management | 02 | |
| I | Introduction to Storage System | Introduction: Storage oriented architecture, Storage Systems, Data center Infrastructure, Challenges in managing information, Information life cycle; Basics of Storage System: Components of Storage System, Disk Drive components and Performance, Components of Host; Data Protection: Raid Components and types, RAID technologies and RAID levels, RAID impact on disk performance; Intelligent Storage System" Components of ISS, Storage Provisioning and types of ISS | 09 | CO1 |
| II | Network Attached Storage | Storage on Network: NAS hardware and software architecture, NAS connectivity, NAS as a Storage System; NAS Hardware devices; NAS software components; NAS connectivity options: NAS connectivity hardware and Software Architecture. | 07 | CO2 |
| III | Storage Area Networks | Architecture Overview: Creating Network for storage; Hardware devices: Fibre Channel Switch, Host Bus Adaptors, Putting the Storage in SANs, Fabric Operation from a hardware perspective, SAN hardware considerations ; Software Components: The switch's operating system, device drivers, the supporting components, considerations for SAN software ; Configuration options for SANs: Connecting into the data center, the evolving network and device connections, SAN configuration guidelines | 10 | CO3 |

| IV | Applications-Putting it together | Defining the I/O workload: Storage planning and capacity planning, the definition and characterization of workloads, the business application, I/O content and workloads, Considerations for I/O workloads in storage networking ; Applying SAN solution: SAN workload characterization, applying SAN to OLTP workloads, transactional workloads; Applying NAS solution: NAS workload characterization, applying NAS to departmental workloads, enterprise web workloads and specialized workloads; Considerations when integrating SN and NAS: Differences and similarities, the need to integrate, future storage connectivity and integration | 10 | CO4 |
|---|---|---|---|---|
| V | Management | Planning business continuity: Defining the environment, the role of storage networking in business continuity, storage design and implementation of the business continuity planning ; Managing availability: Availability Metrics, Implementing the plan ; Maintaining Serviceability: Tracking the configurations, Investigating the changes and closing the loop on serviceability; Capacity Planning: Storage Analysis, developing and implementing plan for storage, Modelling performance and capacity requirements ; Security considerations: Overview of Information security, Security methods, Storage Security challenges, FC SAN security, NAS security | 09 | CO5 |
| VI | Case studies | Case studies on NAS, SAN, SAN/NAS | 05 | CO6 |

**Text Books:**

1. Storage Networks: The Complete Reference. Spalding, Robert ,Tata McGraw-Hill Education, 2003
2. "Storage Network Management and Retrieval", Vaishali Khairnar, Nilima Dongre. Wiley

**References:**

1. Richard Barker, Paul Massiglia, "Storage Area Network Essentials: A Complete Guide to Understanding and Implementing SANs", Wiley India
2. Ulf Troppens,Wolfgang Muller-Friedt,Rainer Wolafka, "Storage Networks Explained" Wiley Publication
3. G. Somasundaram, Alok Shrivastava, "Information Storage and Management", EMC Education services", Wiley Publication

**Assessment:**

**Internal Assessment for 20 marks:**
Consisting of **Two Compulsory Class Tests**
Approximately 40% to 50% of syllabus content must be covered in First test and remaining 40% to 50% of syllabus contents must be covered in second test.

**End Semester Examination:** Some guidelines for setting the question papers are as:

- Weightage of each module in end semester examination is expected to be/will be proportional to number of respective lecture hours mentioned in the syllabus.
- Question paper will comprise of total **six questions**, **each carrying 20 marks.**
- **Q.1** will be **compulsory** and should **cover maximum contents of the syllabus**.
- **Remaining question will be mixed in nature** (for example if Q.2 has part (a) from module 3 then part (b) will be from any other module. (Randomly selected from all the modules.)
- Total **four questions** need to be solved.

| Course Code | Course Name | Theory | Practical | Tutorial | Theory | Practical & Oral | Tutorial | Total |
|---|---|---|---|---|---|---|---|---|
| ITDLO7032 | Mobile Application Development | 04 | - | - | 04 | - | - | 04 |

| Course Code | Course Name | Examination Scheme | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | Theory Marks | | | | Term Work | Practical & Oral | Oral | Total |
| | | Internal assessment | | | End Sem. Exam | | | | |
| | | Test1 | Test2 | Avg. of two Tests | | | | | |
| ITDLO7032 | Mobile Application Development | 20 | 20 | 20 | 80 | - | - | -- | 100 |

**Course Objectives:** Students will try:

1. To introduce Android platform and its architecture.
2. To learn activity creation and Android UI designing.
3. To be familiarized with Intent, Broadcast receivers and Internet services.
4. To work with SQLite Database and content providers.
5. To integrate multimedia, camera and Location based services in Android Application.
6. To explore Mobile security issues.

**Course Outcomes:** Students will be able to:

1. Describe Android platform, Architecture and features.
2. Design User Interface and develop activity for Android App.
3. Use Intent , Broadcast receivers and Internet services in Android App.
4. Design and implement Database Application and Content providers.
5. Use multimedia, camera and Location based services in Android App.
6. Discuss various security issues in Android platform.

**Prerequisite:** Internet Programming, Database Management System.

**Detailed syllabus:**

| Sr. No. | Module | Detailed Content | Hours | CO Mapping |
|---|---|---|---|---|
| 0 | Prerequisite | Basics of HTML5,CSS3 & XML | 02 | - |
| I | Introduction to Android and Architecture of | Introduction of Android platform, Android features ,Android Marketplace, Evolution of Android OS, Android | 07 | CO1 |

| | | Android | Application Architecture, Developing for Android, Developing for Mobile and Embedded Devices, Android Development Tools | | |
|---|---|---|---|---|---|
| II | Applications, Activities and Building User Interface | Application: Application Manifest File,Externalizing Resources,Android Application Lifecycle and Android Application Class. Android Activity: Creating activities, Activity lifecycle and Android Activity classes. User Interface:Fundamental Android UI Design, Layouts, Fragments, Designing UI with views, Creating new views, widget toolbox, Adapters. | | 09 | CO2 |
| III | Intents, Broad cast receiver and Internet Resources | Introducing Intents, Linking Activities Using intents , Calling Built-in Applications Using intents , Displaying notifications, Creating Intent Filters and Broadcast Receivers,Downloading and Parsing Internet Resources,Using the Download Manager,Internet Services, Connecting to Google App Engine, Downloading Data Without Draining the Battery | | 09 | CO3 |
| IV | Data Persistence and Content Providers | Introducing Android Databases,Introducing SQLite, Content Values and Cursors,Working with SQLite Databases,Parsing an XMLdocument ,Parsing JSON data . Creating Content Providers, Using Content Providers,Adding Search to Your Application,Native Android Content Providers | | 09 | CO4 |
| V | Audio, Video ,Camera, Maps, Geocoding and Location Based services | Playing Audio and Video,Manipulating Raw Audio,Using Audio , Using the Camera for Taking Pictures,Recording Video,Using Media Effects ,Adding Media to the Media Store. Using Location-Based Services ,Using the Emulator with Location-Based Services,Selecting a Location Provider,Finding Your Current Location, Location Updates,Proximity Alerts,Geocoder, Map-Based Activities,Displaying Maps | | 08 | CO5 |
| VI | Securing and Publishing Android Application | Android Security Model,Android's Manifest Permissions,Mobile Security Issues,Recent Android Attacks,Pen Testing Android. Preparing for Publishing, Deploying | | 08 | CO6 |

| | | APK Files | | |
|---|---|---|---|---|

**Text Books:**

1. Professional Android 4 Application Development,Retomeier, by wrox publication,
**2.** Android Security –attack and defenses, AbhishekDubey and AnmolMisra by CRC Press
3. Beginning Android Application Development, Wei-meng lee, by wrox publication

**References:**

1. Android Application Development For Dummies, 2nd Edition by Michael Burton, DonnFelker
2. Android Cookbook by o'reilly

**Assessment:**

**Internal Assessment for 20 marks:**
Consisting of **Two Compulsory Class Tests**
Approximately 40% to 50% of syllabus content must be covered in First test and remaining 40% to 50% of syllabus contents must be covered in second test.

**End Semester Examination:** Some guidelines for setting the question papers are as:
- Weightage of each module in end semester examination is expected to be/will be proportional to number of respective lecture hours mentioned in the syllabus.
- Question paper will comprise of total **six questions**, **each carrying 20 marks.**
- **Q.1** will be **compulsory** and should **cover maximum contents of the syllabus**.
- **Remaining question will be mixed in nature** (for example if Q.2 has part (a) from module 3 then part (b) will be from any other module. (Randomly selected from all the modules.)
- Total **four questions** need to be solved.

| Course Code | Course Name | Theory | Practical | Tutorial | Theory | Practical/ Oral | Tutorial | Total |
|---|---|---|---|---|---|---|---|---|
| ITDLO7033 | High Performance Computing | 04 | -- | - | 04 | -- | - | 04 |

| Course Code | Course Name | Examination Scheme | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | Theory Marks | | | | Term Work | Practical & oral | Oral | Total |
| | | Internal assessment | | | End Sem. Exam | | | | |
| | | Test1 | Test2 | Avg. of two Tests | | | | | |
| ITDLO7033 | High Performance Computing | 20 | 20 | 20 | 80 | -- | -- | -- | 100 |

**Course Objectives:** Students will try to:

1. Learn the concepts of parallel processing as it pertains to high-performance computing.
2. Learn to design parallel programs on high performance computing.
3. Discuss issues of parallel programming.
4. Learn the concepts of message passing paradigm using open source APIs.
5. Learn different open source tools.
6. Learn the concepts of Multi-core processor.

**Course Outcomes:** Students will be able to:

1. Memorize parallel processing approaches
2. Describe different parallel processing platforms involved in achieving High Performance Computing.
3. Discuss different design issues in parallel programming
4. Develop efficient and high performance parallel programming
5. Learn parallel programming using message passing paradigm using open source APIs.
6. Design algorithms suited for Multicore processor and GPU systems using   OpenMP and CUDA

**Prerequisite:** Computer Organization

**Detail Syllabus:**

| Sr. No. | Module | Detailed Content | Hours | CO mapping |
|---|---|---|---|---|
| 1 | Introduction | Introduction to Parallel Computing: Motivating Parallelism, Scope of Parallel Computing, Levels of parallelism (instruction, transaction, task, thread, memory, function), Models (SIMD, MIMD, SIMT, SPMD, Dataflow Models, Demand-driven Computation), Parallel Architectures: Interconnection network, Processor Array, Multiprocessor | 7 | CO1 |
| 2 | Parallel Programming Platforms | Parallel Programming Platforms: Implicit Parallelism: Trends in Microprocessor & Architectures, Limitations of Memory System Performance, Dichotomy of Parallel Computing Platforms, Physical Organization of Parallel Platforms, Communication Costs in Parallel Machines | 7 | CO2 |
| 3 | Parallel Algorithm Design | Principles of Parallel Algorithm Design: Preliminaries, Decomposition Techniques, Characteristics of Tasks and Interactions, Mapping Techniques for Load Balancing, Methods for Containing Interaction Overheads, Parallel Algorithm Models, Basic Communication operations: Broadcast and Reduction Communication types | 12 | CO3 |
| 4 | Performance Measures | Performance Measures : Speedup, execution time, efficiency, cost, scalability, Effect of granularity on performance, Scalability of Parallel Systems, Amdahl's Law, Gustavson's Law, Performance Bottlenecks | 5 | CO4 |
| 5 | Fundamental Design Issues in HPC | Programming Using the Message-Passing Paradigm: Principles of Message Passing Programming, The Building Blocks: Send and Receive Operations, MPI: the Message Passing Interface, Topology and Embedding, Overlapping Communication with Computation, Collective Communication and Computation Operations, | 12 | CO5 |

| | | One-Dimensional Matrix-Vector Multiplication, Single-Source Shortest-Path, Sample Sort, Groups and Communicators, Two-Dimensional Matrix-Vector Multiplication, Introduction to OpenMP, | | |
|---|---|---|---|---|
| 6 | General Purpose Graphics Processing Unit(GPGPU) | CUDA enabled GPGPU, GPGPU architecture, GPGPU programming using CUDA, Introduction to CUDA Programming | 9 | CO6 |

**Text Books:**

1. AnanthGrama, Anshul Gupta, George Karypis, Vipin Kumar , "Introduction to Parallel Computing", Pearson Education, Second Edition, 2007.
2. Kai Hwang, Naresh Jotwani, "Advanced Computer Architecture: Parallelism, Scalability, Programmability", McGraw Hill, Second Edition, 2010.
3. Edward Kandrot and Jason Sanders, "CUDA by Example – An Introduction to General Purpose GPU Programming", Addison-Wesley Professional ©, 2010.
4. Georg Hager, Gerhard Wellein, "Introduction to High Performance Computing for Scientists and Engineers", Chapman & Hall / CRC Computational Science series, 2011.

**Reference Books:**

1. Michael J. Quinn, "Parallel Programming in C with MPI and OpenMP", McGraw-Hill International Editions, Computer Science Series, 2008.
2. Kai Hwang, Zhiwei Xu, "Scalable Parallel Computing: Technology, Architecture, Programming", McGraw Hill, 1998.
3. Laurence T. Yang, MinyiGuo, "High- Performance Computing: Paradigm and Infrastructure" Wiley, 2006.

**Assessment:**

**Internal Assessment for 20 marks:**
Consisting of **Two Compulsory Class Tests**
Approximately 40% to 50% of syllabus content must be covered in First test and remaining 40% to 50% of syllabus contents must be covered in second test.

**End Semester Examination:**  Some guidelines for setting the question papers are as:
- Weightage of each module in end semester examination is expected to be/will be proportional to number of respective lecture hours mentioned in the syllabus.
- Question paper will comprise of total **six questions**, **each carrying 20 marks.**
- **Q.1** will be **compulsory** and should **cover maximum contents of the syllabus**.
- **Remaining question will be mixed in nature** (for example if Q.2 has part (a) from module 3 then part (b) will be from any other module. (Randomly selected from all the modules.)
- Total **four questions** need to be solved.

| Course Code | Course Name | Theory | Practical | Tutorial | Theory | Practical /Oral | Tutorial | Total |
|---|---|---|---|---|---|---|---|---|
| ITDLO7034 | Software Testing and Quality Assurance | 04 | -- | -- | 04 | -- | -- | 04 |

| Course Code | Course Name | Examination Scheme | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | Theory Marks | | | | Term Work | Practical & Oral | Oral | Total |
| | | Internal assessment | | | End Sem. Exam | | | | |
| | | Test1 | Test2 | Avg. of two Tests | | | | | |
| ITDLO7034 | Software Testing and Quality Assurance | 20 | 20 | 20 | 80 | -- | -- | -- | 100 |

**Course Objectives:** Students will try to learn:

1 Basic software debugging methods.
2 White box testing methods and techniques.
3 Black Box testing methods and techniques.
4 Designing test plans.
5 Different testing tools ( familiar with open source tools )
6 Quality Assurance models.

**Course Outcomes:** Students will be able to:

1. Investigate the reason for bugs and analyze the principles in software testing to prevent and remove bugs.
2. Implement various test processes for quality improvement
3. Design test planning.
4. Manage the test process
5. Apply the software testing techniques in commercial environment
6. Use practical knowledge of a variety of ways to test software and an understanding of some of the trade-offs  between testing techniques.

**Prerequisite:** Software Engineering.

**Detailed syllabus:**

| Sr. No. | Module | Detailed Content | Hours | CO Mapping |
|---------|--------|------------------|-------|------------|
| 0 | Prerequisite | **Software Engineering Concepts** | 02 | -- |
| I | Testing Methodology | Introduction, Goals of Software Testing, Software Testing Definitions, Model for Software Testing, Effective Software Testing vs Exhaustive Software Testing, Software Failure Case Studies, Software Testing Terminology, Software Testing Life Cycle (STLC), Software Testing methodology, Verification and Validation, Verification requirements, Verification of high level design, Verification of low level design, validation. | 09 | CO1 |
| II | Testing Techniques | Dynamic Testing: Black Box testing: boundary value analysis, equivalence class testing, state table based testing, cause-effect graphing based testing, error guessing.<br><br>White box Testing Techniques: need, logic coverage criteria, basis path testing, graph matrices, loop testing, data flow testing, mutation testing. Static Testing.<br><br>Validation Activities: Unit validation, Integration, Function, System, Acceptance Testing.<br><br>Regression Testing: Progressive vs. Regressive, regression testing produces quality software, regression testability, objectives of regression testing, regression testing types, define problem, regression testing techniques. | 08 | CO2<br><br>CO3 |
| III | Managing the Test Process | Test Management: test organization, structure and of testing group, test planning, detailed test design and test specification.<br><br>Software Metrics: need, definition and classification of software matrices.<br><br>Testing Metrics for Monitoring and Controlling the Testing Process: attributes and corresponding metrics, estimation model for testing effort, architectural design, information flow | 08 | CO4 |

| | | matrix used for testing, function point and test point analysis.<br><br>Efficient Test Suite Management: minimizing the test suite and its benefits, test suite minimization problem, test suite prioritization its type , techniques and measuring effectiveness. | | |
|---|---|---|---|---|
| IV | Test Automation | Automation and Testing Tools: need, categorization, selection and cost in testing tool, guidelines for testing tools. Study of testing tools: JIRA, Bugzilla, TestDirector and IBM Rational Functional Tester, Selenium etc. | 09 | CO1<br><br>CO5 |
| V | Testing for specialized environment | Agile Testing, Agile Testing Life Cycle, Testing in Scrum phases, Challenges in Agile Testing<br><br>Testing Web based Systems: Web based system, web technology evaluation, traditional software and web based software, challenges in testing for web based software, testing web based testing | 08 | CO2<br><br>CO3 |
| VI | Quality Management | Software Quality Management, McCall's quality factors and Criteria, ISO 9126 quality characteristics, ISO9000:2000, Software quality management | 06 | CO6 |

**Text Books :**

1. Software Testing Principles and Practices Naresh  Chauhan Oxford Higher Education
2. Software Testing and quality assurance theory and practice by Kshirasagar Naik, Priyadarshi Tripathy , Wiley Publication

**References :**

**1.** Effective Methods for Software Testing , third edition by Willam E. Perry, Wiley Publication
**2.** Software Testing Concepts and Tools by Nageswara Rao Pusuluri , Dreamtech press

**Assessment:**

**Internal Assessment for 20 marks:**
Consisting of **Two Compulsory Class Tests**
Approximately 40% to 50% of syllabus content must be covered in First test and remaining 40% to 50% of syllabus contents must be covered in second test.

**End Semester Examination:**   Some guidelines for setting the question papers are as:
- Weightage of each module in end semester examination is expected to be/will be proportional to number of respective lecture hours mentioned in the syllabus.
- Question paper will comprise of total **six questions**, **each carrying 20 marks.**
- **Q.1** will be **compulsory** and should **cover maximum contents of the syllabus**.
- **Remaining question will be mixed in nature** (for example if Q.2 has part (a) from module 3 then part (b) will be from any other module. (Randomly selected from all the modules.)
- Total **four questions** need to be solved.

| Course Code | Course Name | Theory | Practical | Tutorial | Theory | Practical /Oral | Tutorial | Total |
|---|---|---|---|---|---|---|---|---|
| ITDLO7035 | Soft Computing | 04 | -- | 01 | 04 | -- | -- | 04 |

| Subject Code | Subject Name | Examination Scheme | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | Theory Marks | | | | Term Work | Practical & Oral | Oral | Total |
| | | Internal assessment | | | End Sem. Exam | | | | |
| | | Test1 | Test2 | Avg. of two Tests | | | | | |
| ITDLO7035 | Soft Computing | 20 | 20 | 20 | 80 | -- | -- | -- | 100 |

**Course Objectives:** Students will try:

1. To familiarize with soft computing concepts.
2. To introduce the fuzzy logic concepts, fuzzy principles and relations.
3. To Basics of ANN and Learning Algorithms.
4. Ann as function approximation.
5. Genetic Algorithm and its applications to soft computing.
6. Hybrid system usage, application and optimization.

**Course Outcomes:** Students will be able to:

1. List the facts and outline the different process carried out in fuzzy logic, ANN and Genetic Algorithms.
2. Explain the concepts and meta-cognitive of soft computing.
3. Apply Soft computing techniques the solve character recognition, pattern classification, regression and similar problems.
4. Outline facts to identify process/procedures to handle real world problems using soft computing.
5. Evaluate various techniques of soft computing to defend the best working solutions.
6. Design hybrid system to revise the principles of soft computing in various applications.

**Prerequisite: NIL**

**Detailed syllabus:**

| Sr. No. | Module | Detailed Content | Hours | CO Mapping |
|---|---|---|---|---|
| 0 | Prerequisite | Probability and Statistics, C++/Java/ Matlab | 02 | |

| | | programming. | | |
|---|---|---|---|---|
| I | Fuzzy Set Theory | Fuzzy Sets: Basic definition and terminology, Basic concepts of fuzzy sets, Fuzzy set operations, Fuzzy relations: Cardinality of fuzzy relations, operations on fuzzy relations, properties of fuzzy relations, Fuzzy composition Fuzzification and Defuzzification: Features of the membership Functions, Fuzzification, Lambda-Cuts for Fuzzy Sets, Lambda-Cuts for Fuzzy Relations, Defuzzification methods | 06 | CO1 CO2 |
| II | Fuzzy Rules, Reasoning, and Inference System | Fuzzy Rules: Fuzzy If-Then Rules, Fuzzy Reasoning Fuzzy Inference System ( FIS): Mamdani FIS, Sugeno FIS, Comparison between , Mamdani and Sugeno FIS. | 06 | CO1 CO2 |
| III | Neural Network-I | Introduction: What is a Neural network? Fundamental Concepts, Basic Models of Artificial Neural Networks, Arificial Intelligence and Neural Networks, McCulloch-Pitts Neuron Learning: Error-Correction Learning, Memory based Learning, Hebbian learning, Competitive Learning, Boltzmann Learning Perceprton: Perceprton Learning Rule, Perceptron Learning Algorithm, Perceprton Convergence Theorem, Perceptron learning and Non-separable sets. | 09 | CO1 CO2 |
| IV | Neural Networks -II | Back propaggation: Multilayered Network Architecture, Back porpagation Algorithm, Practical Consideration in impin Implementing the Back propagation Algorithm. Back propagation and XOR problem. Adaptive resonance Theory: Noise-Saturation Dilemma, Solving the Noise-Saturation Dilemma, Recurrent On-center-Off-surround Networks, Building blocks of Adaptive Resonance, Substrate of resonance, Structural details of the resonance Model, Adaptive Resonance Theory I (ART I), Neurophysiological Evidence for ART Mechanism Character Recognition: Introduction, General Algorithm Architecture for Character Recognition: Binarization, Preprocessing, Filters, Smoothing, Skew Detection and Correction, Slant Correction, Character Normalization, Thinning, Segmentation, Multilingual OCR by Rule-Based Approach and ANN | 10 | CO3 CO6 |

| | | Rule-Based Approach: Classification, Tests, Rules Artificial Neural Network: Inputs, Outputs, Identification Results of Multilingual OCR | | |
|---|---|---|---|---|
| V | Genetic Algorithm | An Introduction to genetic Algorithms: What Are Genetic Algorithms? Robustness of Traditional Optimization and Search Methods, The Goals of Optimization, How Are Genetic Algorithms Different from Traditional Methods?, A Simple Genetic Algorithm Genetic Algorithms at Work—a Simulation by hand, Grist for the Search Mill—Important Similarities, Similarity Templates (Schemata), Learning the Lingo. Genetic Algorithms: Mathematical Foundations Who Shall Live and Who Shall Die? The Fundamental Theorem, Schema Processing at Work: An Example by Hand Revisited, The Two-armed and й-armed Bandit Problem, How Many Schemata Are Processed Usefully? The Building Block Hypothesis, Another Perspective: The Minimal Deceptive Problem, Schemata Revisited: Similarity Templates as Hyperplanes, Implementation of a Genetic Algorithm: Data Structures, Reproduction, Crossover, and Mutation, A Time to Reproduce, a Time to Cross, Get with the Main Program, How Well Does it Work? Mapping Objective Functions to Fitness Form, Fitness Scaling, Codings, A Multiparameter, Mapped, Fixed-Point Coding, Discretization, Constraints. Algorithm for Handwriting Recognition Using GA Generation of Graph, Fitness Function of GA: Deviation between Two Edges, Deviation of a Graph, Crossover: Matching of Points, Generate Adjacency Matrix, Find Paths, Removing and Adding Edges, Generation of Graph Results of Handwriting Recognition: Effect of Genetic Algorithms, Distance Optimization, Style Optimization | 10 | CO1  CO3  CO6 |
| VI | Hybrid Computing | Introduction, Neuro-Fuzzy Hybrid Systems, Adaptive Neuro-Fuzzy Inference System (ANIFS): Introduction, ANFS Architecture, Hybrid Learning Algorithm, ANFIS as a Universal Approximator, Simulation Examples: Two-input Sinc Function and Three Input Nonlinear Function Genetic Neuro-Hybrid Systems: Properties of Genetic Neuro-Hybrid Systems, genetic Algorithm based Back-propagation Network, Advantages of Neuro-Genetic Hybrids, Genetic Fuzzy Hybrid and Fuzzy Genetic Hybrid Systems Genetic Fuzzy Rule based Systems, Advantages of Genetic Fuzzy Hybrids | 09 | CO4  CO6 |

**Text Books:**

1. . S.N. Sivanandan and S.N. Deepa, Principles of Soft Computing, Wiley India, 2007, ISBN: 10: 81-265-1075-7.
2. J.-S. R. Jang, C. –T. Sun, E. Mizutani, Neuro-Fuzzy and Soft Computing, A Computational Approach to Learning and Machine Intelligence, PHI Learning Private Limited-2014
3. Neural Networks: A Classroom Approach, Satish Kumar, Tata McGraw-Hill Education, 2004/2007
4. Simon Haykin, Neural Networks A Comprehensive Foundation, Second Edition, Pearson Education-2004
5. David E. Goldberg, Genetic Algorithms, in search, optimization and Machine Learning, Pearson

**References:**

1. Anupam Shukla, Ritu Tiwari, Rahul Kala, Real Life Applications of Soft Computing, CRC Press, Taylor & Francis Group, 2010.
2. Genetic Algorithms and Genetic Programming Modern Concepts and Practical Applications © 2009 Michael Affenzeller, Stephan Winkler, Stefan Wagner, and Andreas Beham, CRC Press
3. Laurene V. Fausett, Fundamentals of Neural Networks: Architectures, Algorithms And Applications, Pearson

**Assessment:**

**Internal Assessment for 20 marks:**
Consisting of **Two Compulsory Class Tests**
Approximately 40% to 50% of syllabus content must be covered in First test and remaining 40% to 50% of syllabus contents must be covered in second test.

**End Semester Examination:**  Some guidelines for setting the question papers are as:

- Weightage of each module in end semester examination is expected to be/will be proportional to number of respective lecture hours mentioned in the syllabus.
- Question paper will comprise of total **six questions**, **each carrying 20 marks.**
- **Q.1** will be **compulsory** and should **cover maximum contents of the syllabus**.
- **Remaining question will be mixed in nature** (for example if Q.2 has part (a) from module 3 then part (b) will be from any other module. (Randomly selected from all the modules.)
- Total **four questions** need to be solved.

| Course Code | Course Name | Credits |
|---|---|---|
| **ILO7011** | **Product Life Cycle Management** | **03** |

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

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

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

| | | |
|---|---|---|
| | Digital mock-up, Model building, Model analysis, Modeling and simulations in Product Design, Examples/Case studies | |
| 05 | **Integration of Environmental Aspects in Product Design:**Sustainable Development, Design for Environment,Need for Life Cycle Environmental Strategies, Useful Life Extension Strategies, End-of-Life Strategies, Introduction of Environmental Strategies into the Design Process, Life Cycle Environmental Strategies and Considerations for Product Design | 05 |
| 06 | **Life Cycle Assessment and Life Cycle Cost Analysis:**Properties, and Framework of Life Cycle Assessment, Phases of LCA in ISO Standards, Fields of Application and Limitations of Life Cycle Assessment, Cost Analysis and the Life Cycle Approach, General Framework for LCCA, Evolution of Models for Product Life Cycle Cost Analysis | 05 |

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

| Course Code | Course Name | Credits |
|:---:|:---:|:---:|
| **ILO7012** | **Reliability Engineering** | **03** |

**Objectives:**

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

**Outcomes:** Learner will be able to…

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

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

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

| Course Code | Course Name | Credits |
|---|---|---|
| **ILO7013** | **Management Information System** | **03** |

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

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

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

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

| Course Code | Course Name | Credits |
|---|---|---|
| **ILO7014** | **Design of Experiments** | **03** |

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

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

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

| 05 | **Response Surface Methods and Designs**<br>5.1 Introduction to Response Surface Methodology<br>5.2 The Method of Steepest Ascent<br>5.3 Analysis of a Second-Order Response Surface<br>5.4 Experimental Designs for Fitting Response Surfaces | 07 |
|---|---|---|
| 06 | **Taguchi Approach**<br>6.1 Crossed Array Designs and Signal-to-Noise Ratios<br>6.2 Analysis Methods<br>6.3 Robust design examples | 04 |

**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. Raymond H. Mayers, Douglas C. Montgomery, Christine M. Anderson-Cook, Response Surface Methodology: Process and Product Optimization using Designed Experiment, 3rd edition, John Wiley & Sons, New York, 2001
2. D.C. Montgomery, Design and Analysis of Experiments, 5th edition, John Wiley & Sons, New York, 2001
3. George E P Box, J Stuart Hunter, William G Hunter, Statics for Experimenters: Design, Innovation and Discovery, 2nd Ed. Wiley
4. W J Dimond, Peactical Experiment Designs for Engineers and Scintists, John Wiley and Sons Inc. ISBN: 0-471-39054-2
5. Design and Analysis of Experiments (Springer text in Statistics), Springer by A.M. Dean, and D. T.Voss

| Course  Code | Course Name | Credits |
|---|---|---|
| **ILO7015** | **Operations Research** | **03** |

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

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

| Module | Detailed Contents | Hrs |
|---|---|---|
| **01** | **Introduction to Operations Research**: Introduction, , Structure of the Mathematical Model, Limitations of Operations Research<br>**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<br>**Transportation Problem**:  Formulation, solution, unbalanced Transportation problem. Finding basic feasible solutions – Northwest corner rule, least cost method and Vogel's approximation method. Optimality test: the stepping stone method and MODI method.<br>**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<br>**Integer Programming Problem**: Introduction, Types of Integer Programming Problems, Gomory's cutting plane Algorithm, Branch and Bound Technique. Introduction to Decomposition algorithms. | 14 |
| **02** | **Queuing models**: queuing systems and structures, single server and multi-server models, Poisson input, exponential service, constant rate service, finite and infinite population | 05 |
| **03** | **Simulation**: Introduction,  Methodology of Simulation, Basic Concepts, | 05 |

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

| Course Code | Course Name | Credits |
|---|---|---|
| **ILO7016** | **Cyber Security and Laws** | **03** |

**Objectives:**

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

**Outcomes:** Learner will be able to…

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

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

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

| Course Code | Course Name | Credits |
|---|---|---|
| **ILO7017** | **Disaster Management and Mitigation Measures** | **03** |

**Objectives:**

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

**Outcomes: Learner will be able to…**

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

| Module | Detailed Contents | Hrs |
|---|---|---|
| 01 | Introduction<br>1.1 Definition of Disaster, hazard, global and Indian scenario, general perspective, importance of study in human life, Direct and indirect effects of disasters, long term effects of disasters. Introduction to global warming and climate change. | 03 |
| 02 | Natural Disaster and Manmade disasters:<br>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<br>**2.2** Manmade Disasters: Chemical, Industrial, Nuclear and Fire Hazards. Role of growing population and subsequent industrialization, urbanization and changing lifestyle of human beings in frequent occurrences of manmade disasters. | 09 |
| 03 | Disaster Management, Policy and Administration<br>3.1 Disaster management: meaning, concept, importance, objective of disaster management policy, disaster risks in India, Paradigm shift in disaster management.<br>3.2 Policy and administration:<br>Importance and principles of disaster management policies, command and co-ordination of in disaster management, rescue operations-how to start with and how to proceed in due course of time, study of flowchart showing the entire process. | 06 |
| 04 | Institutional Framework for Disaster Management in India:<br>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 | 06 |

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|---|---|---|
| | casualties, set up of emergency facilities, importance of effective communication amongst different agencies in such situations.<br>4.2 Use of Internet and softwares for effective disaster management. Applications of GIS, Remote sensing and GPS in this regard. | |
| 05 | Financing Relief Measures:<br>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.<br>5.2 International relief aid agencies and their role in extreme events. | 09 |
| 06 | Preventive and Mitigation Measures:<br>6.1 Pre-disaster, during disaster and post-disaster measures in some events in general<br>6.2 Structural mapping: Risk mapping, assessment and analysis, sea walls and embankments, Bio shield, shelters, early warning and communication<br>6.3 Non Structural Mitigation: Community based disaster preparedness, risk transfer and risk financing, capacity development and training, awareness and education, contingency plans.<br>6.4 Do's and don'ts in case of disasters and effective implementation of relief aids. | 06 |

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

| Course  Code | Course Name | Credits |
|---|---|---|
| **ILO7018** | **Energy Audit and Management** | **03** |

**Objectives:**

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

**Outcomes: Learner will be able to…**

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

| Module | Detailed Contents | Hrs |
|---|---|---|
| **01** | **Energy Scenario:**<br>Present Energy Scenario, Energy Pricing, Energy Sector Reforms, Energy Security, Energy Conservation and its Importance, Energy Conservation Act-2001 and its Features. Basics of Energy and its various forms, Material and Energy balance | 04 |
| **02** | **Energy Audit Principles:**<br>Definition, Energy audit- need, Types of energy audit, Energy management (audit) approach-understanding energy costs, Bench marking, Energy performance, Matching energy use to requirement, Maximizing system efficiencies, Optimizing the input energy requirements, Fuel and energy substitution. Elements of monitoring& targeting; Energy audit Instruments; Data and information-analysis.<br>Financial analysis techniques: Simple payback period, NPV, Return on investment (ROI), Internal rate of return (IRR) | 08 |
| **03** | **Energy Management and Energy Conservation in Electrical System:**<br>Electricity billing, Electrical load management and maximum demand Control; Power factor improvement, Energy efficient equipments and appliances, star ratings.<br>**Energy efficiency measures in lighting system, Lighting control:** Occupancy sensors, daylight integration, and use of intelligent controllers.<br>Energy conservation opportunities in: water pumps, industrial drives, induction motors, motor retrofitting, soft starters, variable speed drives. | 10 |

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

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

| Course Code | Course Name | Credits |
|---|---|---|
| **ILO7019** | **Development Engineering** | **03** |

**Objectives:**

1. To familiarise the characteristics of rural Society and the Scope, Nature and Constraints of rural Development
2. To provide an exposure toimplications of 73$^{rd}$CAA on Planning, Development and Governance of Rural Areas
3. An exploration of human values, which go into making a 'good' human being, a 'good' professional, a 'good' society and a 'good life' in the context of work life and the personal life of modern Indian professionals
4. To familiarise the Nature and Type of Human Values relevant to Planning Institutions

**Outcomes: Learner will be able to…**

1. Demonstrateunderstanding of knowledge for Rural Development.
2. Prepare solutions for Management Issues.
3. Take up Initiatives and design Strategies to complete the task
4. Develop acumen for higher education and research.
5. Demonstrate the art of working in group of different nature
6. Develop confidence to take up rural project activities independently

| Module | Contents | Hrs |
|---|---|---|
| **1** | Introduction to Rural Development Meaning, nature and scope of development; Nature of rural society in India; Hierarchy of settlements; Social, economic and ecological constraints for rural development<br><br>Roots of Rural Development in India Rural reconstruction and Sarvodaya programme before independence; Impact of voluntary effort and Sarvodaya Movement on rural development; Constitutional direction, directive principles; Panchayati Raj - beginning of planning and community development; National extension services. | **08** |
| **2** | Post-Independence rural Development Balwant Rai Mehta Committee - three tier system of rural local Government; Need and scope for people's participation and Panchayati Raj; Ashok Mehta Committee - linkage between Panchayati Raj, participation and rural development. | **06** |
| **3** | Rural Development Initiatives in Five Year Plans Five Year Plans and Rural Development; Planning process at National, State, Regional and District levels; Planning, development, implementing and monitoring organizations and agencies; Urban and rural interface - integrated approach and local plans; Development initiatives and their convergence; Special component plan and sub-plan for the weaker section; Micro-eco zones; Data base for local planning; Need for decentralized planning; Sustainable rural development | **07** |

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| 4 | Post 73rd Amendment Scenario 73rd Constitution Amendment Act, including - XI schedule, devolution of powers, functions and finance; Panchayati Raj institutions - organizational linkages; Recent changes in rural local planning; Gram Sabha - revitalized Panchayati Raj; Institutionalization; resource mapping, resource mobilization including social mobilization; Information Technology and rural planning; Need for further amendments. | 04 |
| 5 | Values and Science and Technology Material development and its values; the challenge of science and technology; Values in planning profession, research and education

Types of Values Psychological values — integrated personality; mental health; Societal values — the modern search for a good society; justice, democracy, rule of law, values in the Indian constitution; Aesthetic values — perception and enjoyment of beauty; Moral and ethical values; nature of moral judgment; Spiritual values; different concepts; secular spirituality; Relative and absolute values; Human values— humanism and human values; human rights; human values as freedom, creativity, love and wisdom | 10 |
| 6 | Ethics Canons of ethics; ethics of virtue; ethics of duty; ethics of responsibility; Work ethics; Professional ethics; Ethics in planning profession, research and education | 04 |

**Assessment:**

**Internal Assessment for 20 marks:**
Consisting **Two Compulsory Class Tests**
First test based onapproximately 40% of contents and second test based on remainingcontents (approximately 40% but excluding contents covered in Test I)

**End Semester Examination:**
Weightage of each module in end semester examination will be proportional to number of respective lecture hours mentioned in the curriculum.
1. Question paper will comprise of total **six questions**, **each carrying 20 marks**
2. **Question 1** will be **compulsory** and should **cover maximum contents of the curriculum**
3. **Remaining questions will be mixed in nature** (for example if Q.2 has part (a) from module 3 then part (b) will be from any module other than module 3)
4. Only **Four questions need to be solved**

**Reference**
1. ITPI, Village Planning and Rural Development, ITPI, New Delhi
2. Thooyavan, K.R. Human Settlements: A 2005 MA Publication, Chennai
3. GoI, Constitution (73rd GoI, New Delhi Amendment) Act, GoI, New Delhi
4. Planning Commission, Five Year Plans, Planning Commission
5. Planning Commission, Manual of Integrated District Planning, 2006, Planning Commission New Delhi
6. Planning Guide to Beginners
7. Weaver, R.C., The Urban Complex, Doubleday
8. Farmer, W.P. et al, Ethics in Planning, American Planning Association, Washington

9. How, E., Normative Ethics in Planning, Journal of Planning Literature, Vol.5, No.2, pp. 123-150
10. Watson, V. Conflicting Rationalities: -- Implications for Planning Theory and Ethics, Planning Theory and Practice, Vol. 4, No.4, pp.395 – 407