

**UNIVERSITY OF MUMBAI**

No. UG/251 of 2016-17

**CIRCULAR:-**

The Principals of affiliated Colleges in Engineering, hereby informed that the recommendation made by Ad-hoc Board of Studies in Electrical Engineering at its meeting held on 8<sup>th</sup> July, 2016 has been accepted by the Academic Council at its meeting held on 14<sup>th</sup> July, 2016 **vide** item No. 4.26 and that in accordance therewith, the revised syllabus as per the (CBCS) for Master of Engineering (Computer Network & Information Security) (Sem. I to IV), which is available on the University's web site ([www.mu.ac.in](http://www.mu.ac.in)) and that the same has been brought into force with effect from the academic year 2016-17.

MUMBAI – 400 032

7<sup>th</sup> February, 2017

To,

The Principals of affiliated Colleges in Engineering.

(Dr.M.A.Khan)  
REGISTRAR

**A.C/ 4.26/14/07/2016.**

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No. UG/251 -A of 2016-17

MUMBAI-400 032

7<sup>th</sup> February, 2017

Copy forwarded with compliments for information to:-

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

(Dr.M.A.Khan)  
REGISTRAR

... PTO

AC 14/7/2016

Item No. 4.26

UNIVERSITY OF MUMBAI



Revised Syllabus

For

Master of Engineering

Program: M. E. (Computer Network & Information  
Security)

Under

FACULTY OF TECHNOLOGY

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

from

Academic Year 2016-17

## **From Co-ordinator's Desk:**

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

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

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

**Dr. Suresh K. Ukarande**

Co-ordinator,  
Faculty of Technology,  
Member - Academic Council  
University of Mumbai, Mumbai

## **Preamble:**

The M. E. in Computer Network & Information Security is specialization programme in the field of Computer science and Engineering. This programme is offered to students who are interested in advanced learning and research in any area of Computer Science and Engineering. Applicants to this programme are expected to have a background in Computer Science and Engineering or Information Technology.

The objective of the programme is to enable the learner to apply his/her enhanced skill and knowledge at the top research laboratories and companies in the country and even abroad.

The programme is a 72-credit degree programme, which is usually spread over 4 semesters for a full-time student. About two-thirds of the credits involve coursework, and the remaining consists of project work. The emphasis is on conducting original research and writing a thesis individually. The programme is flexible enough to allow a student to specialize in any topic of interest by taking elective (optional) courses and working on a research project in that area.

University of Mumbai feels that it is desirable to provide specialized ME programme in Computer Network & Information Security to address the needs of the industry, which today requires more specialized resource in each field.

Faculty of Technology, University of Mumbai has taken a lead in incorporating philosophy of Choice Based Education in the process of curriculum development.

**Dr. Subhash K. Shinde**

Chairperson,

Adhoc Board of Studies in Computer Engineering,

University of Mumbai, Mumbai.

Program Structure for ME Computer Network & Information Security,  
(With Effect from 2016-2017)

University of Mumbai

**Semester –I**

Course Code	Course Name	Teaching Scheme (Contact Hours)			Credits Assigned			
		Theory	Pract	Tut	Theory	Pract	Tut	Total
CISC101	Mobile & Adaptive System	04	--	-	04	-	-	04
CISC102	Advanced Network Programming	04	--	-	04	-	-	04
CISC103	Information Security System	04	--	-	04	-	-	04
CISDLO-I	Department Level Optional Course-I	04	--	-	04	-	-	04
ILO-I	Institute Level Optional Course-I	03	--	-	03	-	-	03
CISL101	Computational Laboratory-I	-	03	-	01		-	01
CISL102	DEC Laboratory-I	-	02	-	01		-	01
<b>Total</b>		<b>19</b>	<b>04</b>	<b>-</b>	<b>21</b>	<b>--</b>	<b>-</b>	<b>21</b>

Course Code	Course Name	Examination Scheme							
		Theory					TW	Oral/ Pract	Total
		Internal Assessment			End Sem. Exam	Exam Duration (in Hrs)			
		Test 1	Test 2	Avg.					
CISC101	Mobile & Adaptive System	20	20	20	80	3	--	---	100
CISC102	Advanced Network Programming	20	20	20	80	3	--	---	100
CISC103	Information Security System	20	20	20	80	3	--	---	100
CISDLO-I	Department Level Optional Course-I	20	20	20	80	3	--	---	100
ILO-I	Institute Level Optional Course-I	20	20	20	80	3	--	---	100
CISL101	Computational Laboratory-I	---	---	---	---	---	25	25	50
CISL102	DEC Laboratory-I	---	---	---	---	---	25	25	50
<b>Total</b>		<b>100</b>	<b>100</b>	<b>100</b>	<b>400</b>	<b>---</b>	<b>50</b>	<b>50</b>	<b>600</b>

Course Code	Department Level Optional Course-I	Course Code	Institute Level Optional Course-I
CISDLO1011	Ad-hoc and Sensor Networks	ILO1011	Product Lifecycle Management
CISDLO1012	Grid and Cloud Computing	ILO1012	Reliability Engineering
CISDLO1013	Network Vulnerabilities & Risk Management	ILO1013	Management Information System
CISDLO1014	Advanced Computer Forensic Analysis	ILO1014	Design of Experiments
CISDLO1015	High Speed and Broadband Networks	ILO1015	Operation Research
		ILO1016	Cyber Security and Laws
		ILO1017	Disaster Management & Mitigation Measures
		ILO1018	Energy Audit and Management

Program Structure for ME Computer Network & Information Security,  
(With Effect from 2016-2017)  
University of Mumbai

**Semester –II**

Course Code	Course Name	Teaching Scheme (Contact Hours)			Credits Assigned			
		Theory	Pract	Tut	Theory	Pract	Tut	Total
CISC201	Internet Routing Design	04	--	--	04	--	--	04
CISC202	Mobile Wireless Security	04	--	--	04	--	--	04
CISC203	Web Application Security	04			04			04
CISDLO-II	Department Level Optional Course-II	04	--	--	04	--	--	04
ILO-II	Institute Level Optional Course-II	03	--	--	03	--	--	03
CISL201	Computational Laboratory-II	--	02	--	01	--	--	01
CISL202	DEC Laboratory-II	--	02	--	01	--	--	01
<b>Total</b>		<b>19</b>	<b>04</b>	<b>---</b>	<b>21</b>	<b>--</b>	<b>--</b>	<b>21</b>

Course Code	Course Name	Examination Scheme							
		Theory					TW	Oral/Pract	Total
		Internal Assessment			End Sem. Exam	Exam Duration (in Hrs)			
		Test 1	Test 2	Avg.					
CISC201	Internet Routing Design	20	20	20	80	3	--	---	100
CISC202	Mobile Wireless Security	20	20	20	80	3	--	---	100
CISC203	Web Application Security	20	20	20	80	3	--	---	100
CISDLO-II	Department Level Optional Course-II	20	20	20	80	3	--	---	100
ILO-II	Institute Level Optional Course-II	20	20	20	80	3	--	---	100
CISL201	Computational Laboratory-II	---	---	---	----	----	25	25	50
CISL202	DEC Laboratory-II	---	---	---	----	----	25	25	50
		100	100	100	400	----	50	50	600

Course Code	Department Level Optional Course-II	Course Code	Institute Level Optional Course-I
CISDLO2021	TCP/IP Technology	ILO2021	Project Management
CISDLO2022	Database Issues and Security	ILO2022	Finance Management
CISDLO2023	Network Management and Performance Evaluation	ILO2023	Entrepreneurship Development and Management
CISDLO2024	Information Hacking Techniques	ILO2024	Human Resource Management
CISDLO2025	Internet of Things	ILO2025	Professional Ethics and CSR
		ILO 2026	Research Methodology
		ILO2027	IPR and Patenting
		ILO2028	Digital Business Management
		ILO2029	Environmental Management

Program Structure for ME Computer Network & Information Security,  
(With Effect from 2016-2017)  
University of Mumbai

### Semester –III

Course Code	Course Name	Teaching Scheme (Contact Hours)			Credits Assigned				
		Theory	Pract	Tut	Theory	Pract	Tut	Total	
CIS301	Special Topic Seminar	--	06	--	--	03	--	03	
CIS302	Dissertation I	--	24	--	--	12	--	12	
<b>Total</b>		----	<b>30</b>	--	---	<b>15</b>	--	<b>15</b>	
Course Code	Course Name	Examination Scheme							
		Theory					TW	Oral/ Pract	Total
		Internal Assessment			End Sem. Exam	Exam Duration (in Hrs)			
		Test 1	Test 2	Avg.					
CIS301	Special Topic Seminar	---	---	---	---	---	50	50	100
CIS302	Dissertation-I	---	---	---	---	---	100	---	100
<b>Total</b>		---	---	---	----	---	<b>150</b>	<b>50</b>	<b>200</b>

### Semester –IV

Course Code	Course Name	Teaching Scheme (Contact Hours)			Credits Assigned				
		Theory	Pract	Tut	Theory	Pract	Tut	Total	
CIS401	Dissertation-II	--	30	--	---	15	--	15	
<b>Total</b>		--	<b>30</b>	--	---	<b>15</b>	--	<b>15</b>	
Course Code	Course Name	Examination Scheme							
		Theory					TW	Oral/ Pract	Total
		Internal Assessment			End Sem. Exam	Exam Duration (in			
		Test 1	Test 2	Avg.					
ME-CIS401	Dissertation-II	--	---	---	---	---	100	100	200
<b>Total</b>		--	---	---	---	---	<b>100</b>	<b>100</b>	<b>200</b>

Subject Code	Subject Name	Teaching Scheme (Contact Hours)			Credits Assigned				
		Theory	Pract	Tut	Theory	Pract	Tut	Total	
CISC101	Mobile and Adaptive System	04	--	--	04	--	--	04	
		Examination Scheme							
		Theory Examination				End Sem Exam	Term Work	Pract/ Oral	Total
		Internal Assessment							
		Test 1	Test 2	Avg					
		20	20	20	80	--	--	100	

### Course Objectives:

1. Understand various Mobile and wireless systems
2. Study Architecture and various processes of GSM
3. Provide the knowledge of concept of Mobile IP and related issues
4. Detailed study of security issues in Ad-hoc networks

### Course Outcomes: Learner will able to -

- Gain knowledge about Voice and Data communication wireless systems
- Able to develop and design mechanisms for Mobile and wireless communication.
- Demonstrate the technical competence necessary for solving problems in Mobile and wireless systems.

Sr. No.	Module	Detailed Content	Hours
1	Introduction and overview	General issues that will be addressed on this module. Properties of wireless PANs, LANs, WANs, Basic structure and operation, Ad-hoc and Infrastructure networks. Physical constraints and limitations (transmission & reception).	8
2	Network structures and architectures	Hand-off and mobility support at the physical/link level. Technologies at physical link layer. PANs Bluetooth, LANs IEEE802.11, Hiper LAN.	8
3	Global system for mobile communication (GSM)	Mobile Services, System Architecture, Protocols, Localization & Calling, Handover, Security. GPRS: GPRS System Architecture. UMTS: UMTS System Architecture. LTE: Long Term Evolution.	10
4	Mobile IP	Mobile IPv4 and Mobile IPv6. Problems with routing, QoS and security. Overview of use of intelligence in mobile systems, Power management, replication, adaptation. Power management issues. From the lowest (physical device) levels, through communication protocols, broadcast methodologies, trans coding, etc.	8
5	File Systems	CODA, Mobile Infrastructure support, Mobile middleware, Adaptive and reconfigurable Systems, Next generation wireless overview (4G/5G): UMTS, IMT 2000 and W-CDMA.	8



6	Mobile multimedia and their relationship to proxying	Programmable networking and Applications for mobile systems. Code mobility and control/signaling.	6
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**Text Books:**

1. Jochen Schiller, "Mobile Communications", Pearson Education, Second Edition, 2008.
2. Dr. Sunilkumar, "Wireless and Mobile Networks: Concepts and Protocols", Wiley Publication.

**Reference Books:**

1. Raj Kamal, "Mobile Computing", OXFORD UNIVERSITY PRESS.
2. Ed. Dejan Milojicic, Frederick Douglass and Richard Wheeler, "Mobility: Processes, computers and agents." ACM Press.

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

**Theory Examination:**

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.

**In question paper weightage of each module will be proportional to number of respective lecture hours as mention in the syllabus.**

Subject Code	Subject Name	Teaching Scheme (Contact Hours)			Credits Assigned				
		Theory	Pract	Tut	Theory	Pract	Tut	Total	
CISC102	Advanced Network Programming	04	--	--	04	--	--	04	
		Examination Scheme							
		Theory Examination				End Sem Exam	Term Work	Pract/ Oral	Total
		Internal Assessment							
		Test 1	Test 2	Avg					
20	20	20	80	--	--	100			

### Course Objectives:

1. Provide students with a thorough introduction to a variety of important principles in networking, with a strong focus on the Internet.
2. Learn to write programs using the socket interface.
3. Give an introduction to the TCP/IP client-server model of interaction, and to writing networking applications using the client/server technology.
4. Discussion on writing of secure software.

### Course Outcomes: Learner will able to -

- Write socket API based programs
- Design and implement client-server applications using TCP and UDP sockets
- Understand with several common programming interfaces for network communication
- Formulate the basic concept of socket programming and client server model

Sr. No.	Module	Detailed Content	Hours
1	Transport Layer	TCP and UDP with policy control, TCP Connection Establishment and Termination, TIME_WAIT State, Port Numbers and Concurrent Servers, Buffer Sizes and Limitations.	6
2	Sockets and Socket Programming	Introduction, Socket Address Structures, Value-Result Arguments, Byte Ordering Functions, Byte Manipulation Functions, socket Function.	8
3	Application Development	TCP Echo Server: main and str_echo Function, TCP Echo Client: main and str_cli Function, Normal Startup, Normal Termination, POSIX Signal Handling, SIGPIPE Signal, wait and waitpid function Connection abort before accept return, Termination of server process, Crashing of Server Host, Crashing and Rebooting of Server Host and Shutdown of Server Host.	10
4	Socket Option and Elementary UDP Socket	Getsocket and setsocket functions – generic socket options, IP socket options, ICMP socket options, Elementary UDP sockets: UDP echo Server, UDP echo Client, Multiplexing TCP and UDP sockets.	8

5	Advanced Sockets	IPv4 and IPv6 Interoperability: IPv4 Client, IPv6 Server, IPv6 Client, IPv4 Server, IPv6 Address Testing Macros, IPV6_ADDRFORM Socket Option ICMPv4 and ICMPv6. Name and Address Conversions: Domain Name System, Functions. Advanced Name and Address Conversions: Functions and Implementation Threads: Thread Functions: Creation and Termination, Thread-Specific Data, Web Client and Simultaneous Connections	8
6	Routing Sockets	Data link Socket, Address Structure, Reading and Writing, Interface Name and Index Functions, data link access, raw socket (creation input, output)  Client-Server Design Alternatives: TCP Client Alternatives, TCP Test Client, Iterative Server, Concurrent Server, Thread Locking around accept, Descriptor Passing, TCP Concurrent Server, One Thread per Client, TCP Pre-threaded Server.	8

**Text Books:**

1. Richard Stevens, Bill Fenner, "UNIX network programming Volume-1 - The Sockets Networking API", 3rd edition.
2. W. Richard Stevens, "Advanced Programming in the Unix Environment", Addison Wesley.

**Reference Books:**

1. UNIX Internals – "A new Frontier", PHI

**Internal Assessment:** Assessment consists of two tests out of which; one should be compulsory class test (on minimum 2 Modules) and the other is either a class test or assignment on live problems or course project.

**Theory Examination:**

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.

**In question paper weightage of each module will be proportional to number of respective lecture hours as mention in the syllabus.**

Subject Code	Subject Name	Teaching Scheme (Contact Hours)			Credits Assigned				
		Theory	Pract	Tut	Theory	Pract	Tut	Total	
CISC103	Information Security System	04	--	--	04	--	--	04	
		Examination Scheme							
		Theory Examination				End Sem Exam	Term Work	Pract/ Oral	Total
		Internal Assessment							
		Test 1	Test 2	Avg					
		20	20	20	80	--	--	100	

### Course Objectives:

1. Develop an understanding of information assurance as practiced in computer operating systems, distributed systems, networks and representative applications.
2. Gain familiarity with prevalent network and distributed system attacks, defenses against them.
3. Build up a basic understanding of cryptography, how it has evolved, and some key encryption techniques used today.

### Course Outcomes: Learner will able to -

- Master fundamentals of secret and public cryptography, protocols for security services.
- Understand the network security threats and counter measures, network security designs using available secure solutions.
- Familiar with advanced security issues and technologies

Sr. No.	Module	Detailed Content	Hours
1	Computer Security Overview	Computer Security Concepts, OSI Security Architecture, Security Attacks, Security Services, Security Mechanism, A Model for Network Security. Classical Encryption Techniques – Substitution Techniques & Transformation Techniques.	06
2	Symmetric Key Cryptography	DES Structure, DES Analysis, Security of DES. AES Intro, Transformation, Key Expansions, AES Ciphers, Analysis of AES. IDEA Modern Symmetric Key cryptography ECB, CBC, CFD, OFB and CTR.	08
3	Asymmetric Key Cryptography	Number Theory: Primes, Primarily Testing, Factorization, Chinese Remainder Theorem, Exponentiation and logarithm. Public key Cryptography RSA, RABIN Cryptosystem EIGamal Cryptosystem, Elliptic Curve Cryptosystems.	10
4	Digital	Attacks on Digital Signature, Digital Signature Schemes, Variations and Applications. Entity Authentication:	08

	Signature	Introduction, Password, Challenges-Response, Zero Knowledge authentication: Fiat Shamin Protocol, Feige Fiat Shamin Protocol, Biometrics.	
5	Cryptographic Hash Function	Application of Cryptographic Hash Functions, Two simple Hash Functions, Requirements and Security, Hash Functions Based on Cipher Block Chaining, Secure Hash Algorithm(SHA),SHA-3.	08
6	Key Management & Distribution	Symmetric Key Distribution , Kerberos, Symmetric –Key Agreement , Public –Key Distribution ,Hijacking. System Security: Buffer Overflow & Malicious Software, Malicious Programs, Intrusions Detection System, Firewalls, Legal and Ethical Issues.	08

**Text Books:**

1. B.A. Forouzan and Debdeep Mukhopadhyay, Tata “ Cryptography and Network Security, Mc Graw Hill, 2<sup>nd</sup> Edition.
2. William Stallng, “Cryptography and Network Security, Principles & Practices, Pearson Education Publication Fifth Edition.

**Reference Books:**

1. Matt Bishop and S.S. Venkatramanayya , “Introduction to Computer Security”, Pearson Education Publication.
2. Atul Kahate, “Cryptography and Network Security”, Tata McGraw Hill, 2<sup>nd</sup> Edition.

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

**Theory Examination:**

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.

**In question paper weightage of each module will be proportional to number of respective lecture hours as mention in the syllabus.**

Subject Code	Subject Name	Teaching Scheme (Contact Hours)			Credits Assigned				
		Theory	Pract	Tut	Theory	Pract	Tut	Total	
CISDLO1011	Ad-hoc and Sensor Networks	04	--	--	04	--	--	04	
		Examination Scheme							
		Theory Examination				End Sem Exam	Term Work	Pract/ oral	Total
		Internal Assessment							
		Test 1	Test 2	Avg					
		20	20	20	80	--	--	100	

### Course Objectives:

1. Understand Ad-hoc networks and issues.
2. Provide understanding of routing in Ad-hoc networks and related issues
3. Study of wireless sensor networks
4. Detailed of security issues in Ad-hoc networks

### Course Outcomes: Learner will able to -

- Gain knowledge about Ad-hoc and sensor networks and required protocols.
- Develop Routing protocol for Ad-hoc and sensor networks.
- Demonstrate the technical competence necessary for solving problems in Ad-hoc networks.

Sr. No.	Module	Detailed Content	Hours
1	Introduction	Issues in Ad-Hoc Wireless Networks, Applications in Adhoc networks and challenges, IEEE 802.11 MAC Protocols – Issues, Classifications of MAC protocols, Design issues and goals in MAC, synchronous and asynchronous MAC, Multi channel MAC & Power control MAC protocol.	6
2	Ad-hoc Network Routing & TCP	Issues – Classifications of routing protocols – Hierarchical and Power aware. Multicast routing – Classifications, Tree based, Mesh based. Ad Hoc Transport Layer Issues. TCP Over Ad Hoc – Feedback based, TCP with explicit link, TCP-Bus, Ad Hoc TCP, and Split TCP.	10
3	Wireless Sensor Networks – MAC	Introduction – Sensor Network Architecture, Data dissemination, Gathering. MAC Protocols – self-organizing, Hybrid TDMA/FDMA and CSMA based MAC.	8
		Issues in WSN routing – OLSR, AODV. Localization –	8

4	WSN Routing, Localization & QoS	Indoor and Sensor Network Localization. QoS in WSN.	
5	Mesh Networks	Necessity for Mesh Networks – MAC enhancements – IEEE 802.11s Architecture – Opportunistic routing – Self configuration and Auto configuration – Capacity Models – Fairness – Heterogeneous Mesh Networks – Vehicular Mesh Networks.	8
6	Security	Security in wireless Ad hoc wireless Networks, Network security requirements, Issues & challenges in security provisioning, secure routing in ad-hoc and sensor networks. QoS: Introduction, Issues and challenges in providing QoS in Ad hoc wireless Networks, Classification of QoS solutions.	8

**Text Books:**

1. C.Siva Ram Murthy and B.Smanoj, “Ad Hoc Wireless Networks – Architectures and Protocols”, Pearson Education, 2004.
2. Feng Zhao and Leonidas Guibas, “Wireless Sensor Networks”, Morgan Kaufman Publishers, 2004.

**Reference Books:**

1. C.K.Toh, “Ad Hoc Mobile Wireless Networks”, Pearson Education, 2002.
2. Thomas Krag and Sebastin Buettrich, “Wireless Mesh Networking”, O’Reilly Publishers, 2007.

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

**Theory Examination:**

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.

**In question paper weightage of each module will be proportional to number of respective lecture hours as mention in the syllabus.**

Subject Code	Subject Name	Teaching Scheme (Contact Hours)			Credits Assigned				
		Theory	Pract	Tut	Theory	Pract	Tut	Total	
CISDLO1012	Grid and Cloud Computing	04	--	--	04	--	--	04	
		Examination Scheme							
		Theory Examination				End Sem Exam	Term Work	Pract/ Oral	Total
		Internal Assessment							
		Test 1	Test 2	Avg					
		20	20	20	100	--	--	100	

**Course Objectives:**

1. Classify and describe the architecture and taxonomy of parallel and distributed computing,
2. Get familiarized with the role of Cloud computing.
3. Make the students understand basic knowledge of grid computing
4. Familiarized with virtualization concepts and Service Oriented Architectures (SOA).

**Course Outcomes:** Learner will able to -

- Understand the benefits of Cloud Computing
- Learn how to provide Flexible and scalable infrastructures
- Simulate characterize the distinctions between Infrastructure, Platform and Software as a Service (IaaS, PaaS, SaaS)
- Identify the concept of Public and Private Clouds, and analyze their advantages and disadvantages.

Sr. No.	Module	Detailed Content	Hours
1	System models for Distributed and Cloud Computing	Clusters of cooperative computers, Grid computing and cloud computing; software environment for advanced computing, Service oriented Architecture (SOA), Parallel and distributed programming models, Features of grid and cloud platform.	6
2	Cloud Computing services models and features	SaaS, PaaS and IaaS, Service oriented architecture and web services; Features of cloud computing architectures and simple case studies.	10
3	Virtualization	Characteristic features, Taxonomy Hypervisor, Virtualization and Cloud Computing, Pros and Cons of Cloud Computing, Technology Examples/Case Studies.	8
4	Cloud programming Environmental	Map Reduce Hadoop Library from Apache, Open Source Cloud Software Systems –Eucalyptus.	8
5	Grid Computing	Grid Architecture and Service modeling, Grid resource management, software and Middleware for grid computing, Grid Application trends.	8
6	Ubiquitous clouds and the	Cloud Trends in supporting Ubiquitous Computing, Enabling Technology for the Internet of Things,	8



	Internet of Things	Innovative Applications of the Internet of Things.	
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**Text Books:**

1. Distributed and Cloud Computing, Kaittwang Geoffrey C.Fox and Jack J Dongrra, Elsevier India 2012.
2. Mastering Cloud Computing- Raj Kumar Buyya, Christian Vecchiola and S.Tanurair Selvi, TMH, 2012.

**Reference Books:**

1. Cloud Computing, John W. Ritting House and James F Ramsome, CRC Press, 2012.
2. Enterprise Cloud Computing, Gautam Shroff, Cambridge University Press, 2012.

**Internal Assessment:**

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

**Theory Examination:**

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.

**In question paper weightage of each module will be proportional to number of respective lecture hours as mention in the syllabus.**

Subject Code	Subject Name	Teaching Scheme (Contact Hours)			Credits Assigned				
		Theory	Pract	Tut	Theory	Pract	Tut	Total	
CISDLO1013	Network Vulnerabilities and Risk Management	04	--	--	04	--	--	04	
		Examination Scheme							
		Theory Examination				End Sem Exam	Term Work	Pract/oral	Total
		Internal Assessment							
		Test 1	Test 2	Avg					
		20	20	20	80	--	--	100	

### Course Objectives:

1. Make students aware of various types of vulnerabilities which are faced by the network.
2. Knowledge of the basic principles of network security, IDS and web security services
3. Learn about various laws, regulations and different types of risk assessing methods.
4. Understand the concept of vulnerabilities by using various techniques.

### Course Outcomes: Learner will able to -

- Identity various types of vulnerabilities to which network may be subjected.
- Understand various types of network security, IDS and web security services.
- Study about the various legal techniques through which network can be saved from getting exposed to various sorts of vulnerabilities.

Sr. No.	Module	Detailed Content	Hours
1	Introduction to assessing Network Vulnerabilities	Type and procedure of network vulnerability assessment. Non-Cryptographic Protocol Vulnerabilities: DoS and DDoS, Session Hijacking and Spoofing, Pharming Attacks, Wireless LAN Vulnerabilities Software Vulnerabilities: Phishing, Buffer Overflow, Format String Attacks, Cross-Site Scripting(XSS), SQL Injection Access Control in the Operating System: Preliminaries, Discretionary Access Control	8
2	Principles of Security	Information Classification, Policy framework, role based security in an organization	6
3	Intrusion Prevention and Detection	Introduction, Prevention versus Detection, Types of Intrusion Detection systems, DdoS Attack Prevention/Detection, Malware Defense Web Services Security: Motivation, Technologies for Web Services: XML, SOAP, WSDL and UDDI	10
4	Risk Assessment	Laws, Mandates and Regulations, Risk assessment best practices, Risk assessment best practice. Risk Assessment Methodologies: Defense –in depth approach, risk analysis, Asset valuation approach, Quantitative and Qualitative risk- assessment approaches. Scoping the project,	8

		Understanding the attacker.	
5	Performing the Assessment	Vulnerability scan and Exploitation: Internet Host and network enumeration, IP network Scanning, Assessing Remote Information Services, Assessing Web servers, Assessing Web Applications, Assessing Remote Maintenance Services, Assessing Database services, Assessing Windows Networking Services, Assessing Email services.	8
6	Tools	Open source tools used for Assessment and Evaluation, and exploitation framework.	8

**Text Books:**

1. Network Security assessment, Chris McNab, O'reilly Second Edition.
2. Security in Computing, Charles Pfleeger, Pearson Education Publication, 4<sup>th</sup> edition

**Reference Books:**

1. The Security Risk Assessment Handbook, Douglas LanDoll, Auerbach Publication.
2. Cyber Security, Sunit Belapur, Wiley Publication
3. Whitman & Mattord. Management of Information Security. Thomson Course

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

**Theory Examination:**

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.

**In question paper weightage of each module will be proportional to number of respective lecture hours as mention in the syllabus.**

Subject Code	Subject Name	Teaching Scheme (Contact Hours)			Credits Assigned				
		Theory	Pract	Tut	Theory	Pract	Tut	Total	
CISDLO1014	Advanced Computer Forensic Analysis	04	--	--	04	--	--	04	
		Examination Scheme							
		Theory Examination				End Sem Exam	Term Work	Pract/oral	Total
		Internal Assessment							
		Test 1	Test 2	Avg					
		20	20	20	80	--	--	100	

### Course Objectives:

1. Provide students with contemporary knowledge in Computer forensics.
2. Equipped students with skills to analyze different terrorists and Rogues forensic activities.

### Course Outcomes: Learner will able to -

- Understand different computer forensic technology.
- Analyze Computer forensic evidence.
- Appreciate Cybercrime Provisions in Indian Laws in dealing with Cyber Crimes.
- Appreciate the future direction of computer forensics.

Sr. No.	Module	Detailed Content	Hours
1	Overview of computer Forensics Technology	Introduction to computer forensics, Role of computer in crime, use of forensics in law enforcement, employment proceedings, computer Forensics services. Types of computer Forensics Technology- Military, law, spyware and Adware, Biometrics security systems.	08
2	Types of Computer Forensics systems	Internet security, IDS, Firewall, Public key, net privacy systems, vendor and computer Forensics services. Identity management security system, Identity theft.	08
3	Preserving and recovering Computer Forensics evidence	Data recovery, evidence collection and data seizure, Type of evidence, The rules of evidence, duplication and preservation of digital evidence, Method of collection computer image verification and authentication evidence.	06
4	Computer Forensics Analysis	Discovery of electronic evidence- electronic document discovery, identification of data- Time keeping, forensic identification and analysis of technical surveillance devices. Reconstructing fast events: Usable File Formats, Unusable File Formats, Converting Files, Investigating Network Intrusions and Cyber Crime, Network Forensics and Investigating logs, Investigating network Traffic, Investigating Web attacks, Router Forensics.	10

5	Cybercrime Provisions in Indian Laws	Cybercrime Provisions in Indian Laws in dealing with Cyber Crimes and its critical analysis Information Technology Act, 2000. Penalties Under IT Act, Offences Under IT Act, Offences Related With Digital Signature and Electronic Signature Under IT Act, Statutory Provisions Establishment of Authorities under IT Act and their functions, powers, etc.	08
6	Arsenal and Tactics of terrorists and Rogues and Advanced Forensics	The Terrorist profile, the dark world of the cyber underground, new tools of terrorism, information warfare, Arsenal and Tactics of private companies. Advanced computer Forensics systems and future directions, advanced encryption, hacking, advanced trackers, case studies.	08

**Text Books:**

1. Cyber Security, Sunit Belapur, Wiley Publication
2. Computer forensics: computer crime scene investigation, John R. Vacca, Firewall Media.

**Reference Books:**

1. Cyber Laws Simplified, Vivek Sood, Mc Graw Hill Publications.
2. B.A. Forouzan and Debdeep Mukhopadhyay. "Cryptography and Network Security, 2<sup>nd</sup> Edition. Tata Mc Graw Hill Publications.

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

**Theory Examination:**

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.

**In question paper weightage of each module will be proportional to number of respective lecture hours as mention in the syllabus.**

Subject Code	Subject Name	Teaching Scheme (Contact Hours)			Credits Assigned				
		Theory	Pract	Tut	Theory	Pract	Tut	Total	
CISDLO1015	High Speed & Broadband Networks	04	--	--	04	--	--	04	
		Examination Scheme							
		Theory Examination				End Sem Exam	Term Work	Pract/ oral	Total
		Internal Assessment							
		Test 1	Test 2	Avg					
		20	20	20	80	--	--	100	

### Course Objectives:

1. Basics knowledge of High Speed Networks.
2. Understand Optical fiber and Optical communication system components.
3. Learn asynchronous transmission and ATM components.

### Course Outcomes: Learner will able to -

- Analyze and design High Speed Networks.
- Set up Optical fiber networks as per the requirement.
- Simulate asynchronous data transmission and design ATM System.

Sr. No.	Module	Detailed Content	Hours
1	Introduction	Introduction to modern networking trends Optical networking: principles and challenges; evolution of optical networks, wavelength routed network, wavelength division multiplexing (WDM) network technology, sub-carrier multiplexing optical networks. Enabling technologies: optical transmitter, optical fiber, optical receivers, optical amplifiers, optical switching elements, optical cross-connects (OXC), multiplexers/demultiplexers, wavelength routers, optical wavelength converters, WDM network test beds. Network architecture, IP over WDM.	8
2	Optical Communication Systems	Block diagrams of optical communication systems, direct intensity modulation, digital communication systems, Laser semiconductor transmitter, Generations of optical fiber link, description of 8 Mb/s optical fiber communication link, description of 2.5 Gb/s optical fiber communication link.	8
3	Components of fiber optic Networks	Overview of fiber optic networks, Transreceiver, semiconductors optical amplifiers, couplers/splicers, wavelength division multiplexers and demultiplexers, filters, isolators and optical switches.	8

4	Fiber Optic Networks	Basic networks, SONET/SDH, Broad cast and select WDM Networks, wavelength routed networks, optical CDMA.	10
5	ATM	The WAN Protocol : Faces of ATM, ATM Protocol operations (ATM cell and Transmission) ATM Networking basics, Theory of Operations,	6
6	ATM Layers	B-ISDN reference model, PHY layer , ATM Layer ( Protocol model), ATM layer and cell, Traffic Descriptor and parameters, Traffic Congestion control defined, AAL Protocol model, Traffic contract and QoS, User Plane overview, Control Plane AAL, Management Plane, Sub-DS3 ATM, ATM public services.	8

**Text Books:**

1. Optical fiber communications – Gerd Keiser, 3 rd Ed. MGH.
2. Fiber Optic Communication Technology – Djafar K. Mynbaev and Lowell L. Scheiner, (Pearson Education Asia)

**Reference Books:**

1. Optoelectronic devices and systems, S.C. Gupta, PHI, 2005.
2. Fiber Optics Communications , Harold Kolimbiris (Pearson Education Asia)
3. Optical Fiber Communications and its applications, S.C. Gupta (PHI) 2004.
4. WDM Optical Networks, C. Siva Ram Murthy and Mohan Guru Swamy, PHI.
5. Fiber Optic communications, D.C. Agarwal, S.Chand Publications, 2004.
6. Multiwavelength Optical Networks: A Layered Approach by Thomas E. Stern, Krishna Bala.
7. DWDM Network Designs and Engineering Solutions, Ashwin Gumaste, Tony Antony, Pearson Education.

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

**Theory Examination:**

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.

**In question paper weightage of each module will be proportional to number of respective lecture hours as mention in the syllabus.**

<b>Course Code</b>	<b>Course Name</b>	<b>Credits</b>
<b>ILO 1011</b>	<b>Product Life Cycle Management</b>	<b>03</b>

**Objectives:**

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

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

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

<b>Module</b>	<b>Detailed Contents</b>	<b>Hrs</b>
<b>01</b>	<b>Introduction to Product Lifecycle Management (PLM):</b> 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 <b>PLM Strategies:</b> Industrial strategies, Strategy elements, its identification, selection and implementation, Developing PLM Vision and PLM Strategy , Change management for PLM	10
<b>02</b>	<b>ProductDesign:</b> 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
<b>03</b>	<b>Product Data Management (PDM):</b> 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
<b>04</b>	<b>Virtual Product Development Tools:</b> For components, machines, and manufacturing plants, 3D CAD systems and realistic rendering techniques, Digital mock-up, Model building, Model analysis, Modeling and simulations in Product Design, Examples/Case studies	05



<b>05</b>	<b>Integration of Environmental Aspects in Product Design:</b> 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
<b>06</b>	<b>Life Cycle Assessment and Life Cycle Cost Analysis:</b> 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

<b>Course Code</b>	<b>Course Name</b>	<b>Credits</b>
<b>ILO 1012</b>	<b>Reliability Engineering</b>	<b>03</b>

**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

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

**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. Conon, "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
<b>ILO 1013</b>	<b>Management Information System</b>	<b>03</b>

**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
<b>01</b>	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
<b>02</b>	Data and Knowledge Management: Database Approach, Big Data, Data warehouse and Data Marts, Knowledge Management. Business intelligence (BI): Managers and Decision Making, BI for Data analysis and Presenting Results	7
<b>03</b>	Ethical issues and Privacy: Information Security. Threat to IS, and Security Controls	7
<b>04</b>	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
<b>05</b>	Computer Networks Wired and Wireless technology, Pervasive computing, Cloud computing model.	6
<b>06</b>	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, 10<sup>th</sup> Ed., Prentice Hall, 2007.
3. D. Boddy, A. Boonstra, Managing Information Systems: Strategy and Organization, Prentice Hall, 2008

<b>Course Code</b>	<b>Course Name</b>	<b>Credits</b>
<b>ILO 1014</b>	<b>Design of Experiments</b>	<b>03</b>

**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...

- Plan data collection, to turn data into information and to make decisions that lead to appropriate action.
- Apply the methods taught to real life situations.
- Plan, analyze, and interpret the results of experiments

<b>Module</b>	<b>Detailed Contents</b>	<b>Hrs</b>
01	<b>Introduction:</b> Strategy of Experimentation, Typical Applications of Experimental Design, Guidelines for Designing Experiments, Response Surface Methodology.	06
02	<b>Fitting Regression Models:</b> Linear Regression Models, Estimation of the Parameters in Linear Regression Models, Hypothesis Testing in Multiple Regression, Confidence Intervals in Multiple Regression, Prediction of new response observation, Regression model diagnostics, Testing for lack of fit.	08
03	<b>Two-Level Factorial Designs:</b> The $2^2$ Design, The $2^3$ Design, The General $2^k$ Design, A Single Replicate of the $2^k$ Design, The Addition of Center Points to the $2^k$ Design, Blocking in the $2^k$ Factorial Design, Split-Plot Designs.	07
04	<b>Two-Level Fractional Factorial Designs:</b> The One-Half Fraction of the $2^k$ Design, The One-Quarter Fraction of the $2^k$ Design, The General $2^{k-p}$ Fractional Factorial Design, Resolution III Designs, Resolution IV and V Designs, Fractional Factorial Split-Plot Designs.	07
05	<b>Conducting Tests:</b> Testing Logistics, Statistical aspects of conducting tests, Characteristics of good and bad data sets, Example experiments, Attribute Vs Variable data sets.	07
06	<b>Taguchi Approach:</b> Crossed Array Designs and Signal-to-Noise Ratios, Analysis Methods, Robust design examples.	04

**Assessment:****Internal:**

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

**End Semester Examination:** Some guidelines for setting the question papers are as, six questions to be set each of 20 marks, out of these any four questions to be attempted by students. Minimum 80% syllabus should be covered in question papers of end semester examination. **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. Myers, Douglas C. Montgomery, Christine M. Anderson-Cook, Response Surface Methodology: Process and Product Optimization using Designed Experiment, 3<sup>rd</sup> 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, 2<sup>nd</sup> 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
6. Philip J Ross, "Taguchi Technique for Quality Engineering," McGraw Hill.
7. Madhav S Phadake, "Quality Engineering using Robust Design," Prentice Hall.

<b>Course Code</b>	<b>Course Name</b>	<b>Credits</b>
<b>ILO 1015</b>	<b>Operations Research</b>	<b>03</b>

**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

<b>Module</b>	<b>Detailed Contents</b>	<b>Hrs</b>
<b>01</b>	<p><b>Introduction to Operations Research:</b> Introduction, , Structure of the Mathematical Model, Limitations of Operations Research</p> <p><b>Linear Programming:</b> 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, <b>Duality</b>, Primal – Dual construction, Symmetric and Asymmetric Dual, Weak Duality Theorem, Complimentary Slackness Theorem, Main Duality Theorem, Dual Simplex Method, Sensitivity Analysis</p> <p><b>Transportation Problem:</b> 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.</p> <p><b>Assignment Problem:</b> 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</p> <p><b>Integer Programming Problem:</b> Introduction, Types of Integer Programming Problems, Gomory's cutting plane Algorithm, Branch and Bound Technique. Introduction to Decomposition algorithms.</p>	14
<b>02</b>	<p><b>Queuing models:</b> queuing systems and structures, single server and multi-server models, Poisson input, exponential service, constant rate service, finite and infinite population</p>	05
<b>03</b>	<p><b>Simulation:</b> Introduction, Methodology of Simulation, Basic Concepts, Simulation Procedure, Application of Simulation Monte-Carlo Method: Introduction, Monte-Carlo Simulation, Applications of Simulation, Advantages of Simulation, Limitations of Simulation</p>	05
<b>04</b>	<p><b>Dynamic programming.</b> Characteristics of dynamic programming. Dynamic programming approach for Priority Management employment smoothening, capital</p>	05



	budgeting, Stage Coach/Shortest Path, cargo loading and Reliability problems.	
05	<b>Game Theory.</b> 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	<b>Inventory Models:</b> 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.

<b>Course Code</b>	<b>Course Name</b>	<b>Credits</b>
<b>ILO 1016</b>	<b>Cyber Security and Laws</b>	<b>03</b>

**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

<b>Module</b>	<b>Detailed Contents</b>	<b>Hrs</b>
<b>01</b>	<b>Introduction to Cybercrime:</b> 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
<b>02</b>	<b>Cyber offenses &amp; Cybercrime:</b> How criminal plan the attacks, Social Engg, Cyber stalking, Cyber café and Cybercrimes, Botnets, 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
<b>03</b>	<b>Tools and Methods Used in Cyberline</b> Phishing, Password Cracking, Keyloggers and Spywares, Virus and Worms, Steganography, DoS and DDoS Attacks, SQL Injection, Buffer Over Flow, Attacks on Wireless Networks, Phishing, Identity Theft (ID Theft)	6
<b>04</b>	<b>The Concept of Cyberspace</b> 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
<b>05</b>	<b>Indian IT Act.</b> Cyber Crime and Criminal Justice : Penalties, Adjudication and Appeals Under the IT Act, 2000, IT Act. 2008 and its Amendments	6
<b>06</b>	<b>Information Security Standard compliances</b> 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. Kenneth 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
<b>ILO 1017</b>	<b>Disaster Management and Mitigation Measures</b>	<b>03</b>

**Objectives:**

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

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

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

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

	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: 5.1 Ways to raise finance for relief expenditure, role of government agencies and NGO's in this process, Legal aspects related to finance raising as well as overall management of disasters. Various NGO's and the works they have carried out in the past on the occurrence of various disasters, Ways to approach these teams. 5.2 International relief aid agencies and their role in extreme events.	09
06	Preventive and Mitigation Measures: 6.1 Pre-disaster, during disaster and post-disaster measures in some events in general 6.2 Structural mapping: Risk mapping, assessment and analysis, sea walls and embankments, Bio shield, shelters, early warning and communication 6.3 Non Structural Mitigation: Community based disaster preparedness, risk transfer and risk financing, capacity development and training, awareness and education, contingency plans. 6.4 Do's and don'ts in case of disasters and effective implementation of relief aids.	06

### **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)

<b>Course Code</b>	<b>Course Name</b>	<b>Credits</b>
<b>ILO 1018</b>	<b>Energy Audit and Management</b>	<b>03</b>

**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

<b>Module</b>	<b>Detailed Contents</b>	<b>Hrs</b>
<b>01</b>	<b>Energy Scenario:</b> 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
<b>02</b>	<b>Energy Audit Principles:</b> Definition, Energy audit- need, Types of energy audit, Energy management (audit) approach-understanding energy costs, Bench marking, Energy performance, Matching energy use to requirement, Maximizing system efficiencies, Optimizing the input energy requirements, Fuel and energy substitution. Elements of monitoring& targeting; Energy audit Instruments; Data and information-analysis. Financial analysis techniques: Simple payback period, NPV, Return on investment (ROI), Internal rate of return (IRR)	08
<b>03</b>	<b>Energy Management and Energy Conservation in Electrical System:</b> Electricity billing, Electrical load management and maximum demand Control; Power factor improvement, Energy efficient equipments and appliances, star ratings. <b>Energy efficiency measures in lighting system, Lighting control:</b> Occupancy sensors, daylight integration, and use of intelligent controllers. Energy conservation opportunities in: water pumps, industrial drives, induction motors, motor retrofitting, soft starters, variable speed drives.	10
<b>04</b>	<b>Energy Management and Energy Conservation in Thermal Systems:</b> 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	<b>Energy Performance Assessment:</b> 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	<b>Energy conservation in Buildings:</b> 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](http://www.energymanagertraining.com)
9. [www.bee-india.nic.in](http://www.bee-india.nic.in)

Subject Code	Subject Name	Teaching Scheme (Contact Hours)			Credits Assigned				
		Theory	Pract	Tut	Theory	Pract	Tut	Total	
CISL101	Computational Laboratory -I	--	02	--	01	--	--	01	
		Examination Scheme							
		Theory Examination				End Sem Exam	Term Work	Pract	Total
		Internal Assessment							
		Test 1	Test 2	Avg					
		--	--	--	--	25	25	50	

Subject teacher shall design mini projects based on core subjects.

Design and implement using latest 64-bit C++/JAVA/ Python programming tools.

Use development tools such as MATLAB/OPENCV/Wireshark/VNC/PUTTY or equivalent may be used if required to interface the developed classes to the simulators.

Develop a mini project based on java socket programming.

Subject Code	Subject Name	Teaching Scheme (Contact Hours)			Credits Assigned				
		Theory	Pract	Tut	Theory	Pract	Tut	Total	
CISL102	DEC Laboratory -I	--	02	--	01	--	--	01	
		Examination Scheme							
		Theory Examination				End Sem Exam	Term Work	Pract	Total
		Internal Assessment							
		Test 1	Test 2	Avg					
		--	--	--	--	25	25	50	

Students should study the tools and techniques related to the elective subject.

Students should complete a mini project based on the elective subject using various tools.



Subject Code	Subject Name	Teaching Scheme (Contact Hours)			Credits Assigned				
		Theory	Pract	Tut	Theory	Pract	Tut	Total	
CISC201	Internet Routing Design	04	--	--	04	--	--	04	
		Examination Scheme							
		Theory Examination				End Sem Exam	Term Work	Pract	Oral
		Internal Assessment							
		Test 1	Test 2	Avg					
		20	20	20	80	--	--	--	

**Course Objectives:**

1. To understand in depth Routing protocols used on Internet
2. To know about routing related issues on Internet
3. To develop the thinking about how to analyze Network Algorithms
4. To become familiar with the concepts of Traffic Engineering

**Course Outcomes:** Learner will able to –

- gain knowledge about various Routing protocols used on Internet.
- design Routing protocol for Internet.
- demonstrate the technical competence necessary for solving problems in Routing on Internet.

Sr. No.	Module	Detailed content	Hours
1	Networking and Network Routing: An Introduction	Addressing and Internet Service: An Overview, Network Routing, IP Addressing, Service Architecture, Protocol Stack Architecture, Router Architecture, Network Topology, Architecture, Network Management Architecture, Public Switched Telephone.	8
2	Routing Algorithms	OSPF and Integrated IS-IS: OSPF: Protocol Features, OSPF Packet Format, Integrated IS-IS, Key Features, comparison BGP: Features, Operations, Configuration Initialization, phases, Message Format. IP Routing and Distance Vector Protocol Family: RIPv1 and RIPv2.	8
3	Routing Protocols :Framework and Principles	Routing Protocol, Routing Algorithm, and Routing Table, Routing Information Representation and Protocol Messages. Internet Routing and Router Architectures: Architectural View of the Internet, Allocation of IP Prefixes and AS Number, Policy-Based Routing, Point of Presence, Router Architectures: Functions, Types, Elements of a Router, Packet Flow, and Packet Processing: Fast Path versus Slow Path, Router Architectures.	8
4	Analysis of Network Algorithms	Network Bottleneck, Network Algorithmic, Thinking Algorithmically, Refining the Algorithm, Cleaning up, Characteristics of Network Algorithms. IP Address Lookup Algorithms : Impact, Address Aggregation,	10

		Longest Prefix Matching, Naïve Algorithms, Binary, Multi-bit and Compressing Multi-bit Tries, Search by Length Algorithms, Search by Value Approaches, Hardware Algorithms, Comparing Different Approaches. IP Packet Filtering and Classification: Classification, Classification Algorithms, Naïve Solutions, Two-Dimensional Solutions, Approaches for $d$ Dimensions.	
5	Quality of Service Routing	QoS Attributes, Adapting Routing: A Basic Framework. Update Frequency, Information Inaccuracy, and Impact on Routing, Dynamic Call Routing in the PSTN, Heterogeneous Service, Single-Link Case, A General Framework for Source-Based QoS Routing with Path Caching	8
6	Routing and Traffic Engineering	Traffic Engineering of IP/MPLS Networks, VPN Traffic Engineering, Problem Illustration: Layer 3 VPN, LSP Path Determination: Constrained Shortest Path Approach, LSP Path Determination: Network Flow Modeling Approach, Layer 2 VPN Traffic Engineering,	6

**Text Books:**

1. Network Routing: Algorithms, Protocols, and Architectures Deepankar Medhi and Karthikeyan Ramasamy (Morgan Kaufmann Series in Networking)
2. Network Algorithmics: An Interdisciplinary Approach to Designing Fast Networked Devices George Varghese (Morgan Kaufmann Series in Networking)

**Reference Books:**

1. Sam Halabi and Danny McPherson, Internet Routing Architecture, Second Edition, Cisco Press

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

**Theory Examination:**

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.

**In question paper weightage of each module will be proportional to number of respective lecture hours as mention in the syllabus.**

Subject Code	Subject Name	Teaching Scheme (Contact Hours)			Credits Assigned				
		Theory	Pract	Tut	Theory	Pract	Tut	Total	
CISC202	Mobile Wireless Security	04	--	--	04	--	--	04	
		Examination Scheme							
		Theory Examination				End Sem Exam	Term Work	Pract	Oral
		Internal Assessment							
		Test 1	Test 2	Avg					
		20	20	20	80	--	--	--	

### Course Objectives:

1. Gain in-depth knowledge on wireless and mobile network security and its relation to the new security based protocols.
2. Design secured wireless and mobile networks that optimize accessibility with minimizing vulnerability to security risks.
3. Apply proactive and defensive measures to counter potential threats, attacks and intrusions.
4. Gain a broad knowledge regarding real-world security architectures of WLANs, GSM, UMTS, WSNs, RFIDs etc.

### Course Outcomes: Learner will able to -

- Diagnose distributed denial-of-service attacks and specify mitigation techniques.
- Explain the vulnerabilities introduced into an infrastructure by wireless and cellular technologies.
- Knowledge of cloud security and fundamental of architecture

Sr. No.	Module	Detailed Content	Hours
1	Introduction	Security and Privacy for Mobile and Wireless Networks: Introduction- State of the Art- Areas for Future Research- general recommendation for research. pervasive Systems: Enhancing Trust Negotiation With Privacy Support: Trust Negotiation- Weakness of Trust Negotiation- Extending Trust Negotiation to Support Privacy	8
2	Mobile Security	Mobile system architectures, Overview of mobile cellular systems, GSM and UMTS Security & Attacks, Vulnerabilities in Cellular Services, Cellular Jamming Attacks & Mitigation, Security in Cellular VoIP Services, Mobile application security.	8

3	Securing Wireless Networks	Overview of Wireless security, Scanning and Enumerating 802.11 Networks, Attacking 802.11 Networks, Attacking WPA protected 802.11 Networks, Bluetooth Scanning and Reconnaissance, Bluetooth Eavesdropping, Attacking and Exploiting Bluetooth, Zigbee Security, Zigbee Attacks	8
4	Cloud Security Fundamental and Architecture	Cloud information security objectives, cloud security services, Relevant cloud security design principle, secure cloud software requirement, cloud security policy implementation, Architecture consideration, Identity management and access control	8
5	RFID Security	Introduction, RFID Security And Privacy, RFID Chips, Techniques and Protocols, Man in the Middle Attacks On RFID Systems, User Centric Security for RFID based Distributed System, Optimizing RFID Protocols for Low Information Leakage.	8
6	Security in Mobile Ad-hoc Networks	Introduction, Background and Related work: Detection, identification, and isolation of malicious nodes, Secure and QOS-aware routing, Comprehensive Software/Hardware Schemes for Security in Ad-hoc Networks: Detecting misbehavior, identifying and isolating malicious nodes: Software Monitoring, Hardware Monitoring	8

**Text Books:**

1. Ronald L. Krutz, Russell Dean Vines, "Cloud Security: A Comprehensive guide to secure cloud computing", Wiley.
2. Kia Makki, Peter Reiher, "Mobile and Wireless Network Security and Privacy", Springer, 2007.

**Reference Books:**

1. C.Siva Ram Murthy, B.S. Manoj, "Adhoc Wireless Networks Architectures and Protocols", Prentice Hall, 2004.
2. Kitsos, Paris; Zhang, Yan, "RFID Security Techniques, Protocols and System-On-Chip Design", 2008.
3. Johnny Cache, Joshua Wright and Vincent Liu, "Hacking Wireless Exposed: Wireless Security Secrets & Solutions", second edition, McGraw Hill, 2010.

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

**Theory Examination:**

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.

**In question paper weightage of each module will be proportional to number of respective lecture hours as mention in the syllabus.**

Subject Code	Subject Name	Teaching Scheme (Contact Hours)			Credits Assigned				
		Theory	Pract	Tut	Theory	Pract	Tut	Total	
CISC203	Web Application Security	04	--	--	04	--	--	04	
		Examination Scheme							
		Theory Examination				End Sem Exam	Term Work	Pract	Oral
		Internal Assessment							
		Test 1	Test 2	Avg					
		20	20	20	80	--	--	--	

### Course Objectives:

1. Understand the need for security in web application development
2. Learn the various security threats and countermeasures to web applications
3. Design and Develop secured web applications

### Course Outcomes: Learner will able to -

- Demonstrate knowledge about the principles of web security, browser security, database security and secure software engineering.
- Build up same origin policy and cross origin resource sharing
- Develop the technical competence necessary for web application security

Sr. No.	Module	Detailed content	Hours
1	Introduction	Network security versus Application security, open web application security projects, Security fundamentals: Input validation, Attack surface reduction, classifying and prioritizing threats.	8
2	Web application security principles	Authentication: Access Control overview, authentication fundamentals, two factor and three factor authentication, web application authentication, securing password based authentication, secure authentication best practices. Authorization: Access control, Authorization, session management, authorization fundamentals, authorization goals, types of permissions, Authorization layers, controls by layer, client site attack	8
3	Browser Security Principles	Defining the same origin policy, Exceptions to the same origin policy: HTML<script> element, JSON and JSONP, iframe and java script document domain, Adobe flash player cross domain policy file, XML Http Request (ajax) and cross-origin resource sharing Cross-site Scripting: Reflected XSS, POST based Reflected XSS, stored XSS, Local XSS, XSS defense in depth CSP and Cross-site Request Forgery: HTTP Get, relying on POST, URL rewriting, Shared Secretes.	8

4	Database security principles	Structure Query Language (SQL) injection, Setting Database Permissions, Stored Procedure Security.	8
5	Application Security basics	Reverse Engineering, Attack vectors, input Validation, Secure SDLC- Data classification, Secure requirement-Secure Architecture. Factors in Developing An Application Security Program- Policies, procedures, baselines and guidelines, ROI on application security.	8
6	Software Engineering and Security	Security Challenge in software engineering, Secure Software development methodologies, Waterfall model with security, Comprehensive Lightweight Application Security Process, Extreme Programming and Security, Aspect-Oriented Programming and Security.	8

### **Text Books:**

1. Web application Security, Bryan Sullivan and Vincent Liu , TMH Publication
2. Semantic Web Technologies: Trends and Research in Ontology-based Systems, John Davies, Rudi Studer, and Paul Warren John , “”, Wiley & Son's

### **Reference Books:**

1. Carlos Serrao, Vicente Aguilera, Fabio Cerullo, “Web Application Security”Springer; 1st Edition
2. Jeffrey C. Jackson, “Web Technologies: A Computer Science Perspective”, Prentice Hall, 2006
3. Joel Scambray, Vincent Liu, Caleb Sima ,“Hacking exposed”, McGraw-Hill; 3rd Edition (October, 2010)
4. Software Security Theory Programming and Practice, Richard sinn, cengage Learning
5. The Web Application Hacker’s handbook, Defydd Stuttard, Wiley Publishing

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

### **Theory Examination:**

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.

**In question paper weightage of each module will be proportional to number of respective lecture hours as mention in the syllabus.**

Subject Code	Subject Name	Teaching Scheme (Contact Hours)			Credits Assigned				
		Theory	Pract	Tut	Theory	Pract	Tut	Total	
CISDLO2021	TCP/IP Technology	04	--	--	04	--	--	04	
		Examination Scheme							
		Theory Examination				End Sem Exam	Term Work	Pract	Oral
		Internal Assessment							
		Test 1	Test 2	Avg					
20	20	20	80	--	--	--			

### Course Objectives:

1. Provide students with contemporary knowledge of how TCP/IP model works.
2. Understand how to configure subnets using IP classes.
3. Give knowledge about different routing protocols, ports ,sockets, IPv6

### Course Outcomes: Learner will able to -

- Know TCP/IP Technology in detail
- Apply appropriate methods to solve subnetting, supernetting problems
- Differentiate routing protocols on the basis of performance
- Gain knowledge about IPv6 and Mobile IPv6

Sr. No.	Module	Detailed content	Hours
1	Introduction	Introduction to Layered Architecture (TCP/IP, OSI), Networking Devices, IPv4 Classes (A-E) Addressing, Subnetting, Supernetting, VLSM, CIDR	08
2	Routing TCP/IP	Static Routing ,Dynamic Routing Protocols, Interior Routing Protocols, RIPv2,classless routing, Enhanced Interior Gateway Routing Protocol	08
3	Reliable Stream Transport Service	TCP services, TCP Header, TCP connection establishment and termination, TCP & UDP Datagram and its characteristics, RTP, Flow Control and Error Control Mechanisms, Silly Window Syndrome - Clark's and Nagle Algorithm, Congestion Control Mechanisms - Token Bucket and Leaky Bucket, Karn's Algorthim and Timer back off	08
4	Network File System and other TCP/IP Applications	Introduction to Network File System, SUN RPC, XDR : External data representation, Port Mapper, NFS protocol, Finger protocol, Archie, WAIS, Gopher,Veronica, X-Window system	08



5	Introduction To Socket Programming	Concurrent processing in Client-Server Software, Byte Ordering And Address Conversion Functions , Socket Interface , System Calls used with Sockets , Iterative Server and Concurrent Server, Multi Protocol and Multi Service Server.	08
6	Future of TCP/IP	TCP/IP Vulnerabilities , Securing TCP/IP Spoofing, IPv6 , Types of IPv6 address, IPv6 identifiers, IPv6 packet header format, Mobile IPv6	08

**Text Books:**

1. Behrouz A. Forouzan, “Data Communications and Networking”, McGraw-Hill, 5th edition.
2. W. Richard Stevens, TCP/IP Illustrated, Addison-Wesley, Volume 1

**Reference Books:**

1. Douglas E. Comer, “Internetworking with TCP/IP, Principles, Protocols, and Architecture”, Addison- Wesley, 5<sup>th</sup> edition, Vol 1.
2. Douglas E. Comer, David L. Stevens ,”Internetworking with TCP/IP Vol. III, Client-Server Programming and Applications”, Addison-Wesley, 2<sup>nd</sup> edition.
3. Routing TCP/IP Vol. 1, 2<sup>nd</sup> Edition, Pearson Publication

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

**Theory Examination:**

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.

**In question paper weightage of each module will be proportional to number of respective lecture hours as mention in the syllabus.**

Subject Code	Subject Name	Teaching Scheme (Contact Hours)			Credits Assigned				
		Theory	Pract	Tut	Theory	Pract	Tut	Total	
CISDLO2022	Database Issues and Security	04	--	--	04	--	--	04	
		Examination Scheme							
		Theory Examination				End Sem Exam	Term Work	Pract	Oral
		Internal Assessment							
		Test 1	Test 2	Avg					
		20	20	20	80	--	--	--	

### Course Objectives:

1. Understand the principles and issues of database security.
2. Get familiar with the challenges of security
3. Find solution for security threats and get familiar with the security models.

### Course Outcomes: Learner will able to -

- Understand about the objectives of security.
- Know the technical points when testing database for security.
- Implement the secured database application.

Sr. No.	Module	Detailed content	Hours
1	Introduction	Security issues and challenges, Database Security Control Measures and principles, Database security objectives, Database Security and the DBA , Access Protection, User Accounts	8
2	Fundamentals and Architecture	Statistical Database Security, security architecture, operating system security fundamentals, administration of users, password policies and roles	8
3	Security models	Database application security models, virtual private databases, Discretionary Access Control Based on Granting and Revoking Privileges	8
4	SQL injection	Introduction, What Is SQL Injection, Testing for SQL Injection: Finding SQL Injection, Confirming SQL Injection, Automating SQL Injection Discovery Reviewing Code for SQL Injection: Introduction, Reviewing source code for SQL injection, Automated source code review	8
5	Exploiting SQL injection	Introduction ,Understanding common exploit techniques, Identifying the database, Extracting data through UNION statements, Using conditional statements, Enumerating the database schema, Injecting into "INSERT" queries, Escalating privileges, Stealing the password hashes, Out-of-band communication, SQL injection on mobile devices, Automating SQL injection exploitation	8

6	Advanced Topics	Introduction, Evading Input Filters, Exploiting Second order SQL Injection, Exploiting Client side SQL Injection, Using Hybrid attacks	8
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**Text Books:**

1. Elmarsi R., Navathe S.B., "Fundamentals of Database Systems", 5th Ed., Pearson, 2007
2. Justin Clarke, "SQL injection attacks And Defense ",Second edition, Syngress publishing.

**Reference Book(s):**

4. Alfred Basta, Melissa Zgola "Database Security", CENGAE Learning, First edition.

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

**Theory Examination:**

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.

**In question paper weightage of each module will be proportional to number of respective lecture hours as mention in the syllabus.**

Subject Code	Subject Name	Teaching Scheme (Contact Hours)			Credits Assigned				
		Theory	Pract	Tut	Theory	Pract	Tut	Total	
CISDLO2023	Network Management and Performance Evaluation	04	--	--	04	--	--	04	
		Examination Scheme							
		Theory Examination				End Sem Exam	Term Work	Pract	Oral
		Internal Assessment							
		Test 1	Test 2	Avg					
20	20	20	80	--	--	--			

**Course Objectives:**

1. Introduces the concepts of Telephone network management,
2. Provide knowledge about different versions of SNMP
3. Understand internet routing, and QoS in IP.

**Course Outcomes:** Learner will able to -

- Understand concepts and terminology associated with SNMP and TMN
- Detailed knowledge of current trends in network management

Sr. No.	Module	Detailed content	Hours
1	Introduction to Network Management	Analogy of Telephone Network Management, Communication protocols and Standards, Case Histories on Network, system and service Management, Challenges of IT managers, Network Management: Goals, Organization, and Functions, Network Management architecture and organization, Network perspectives.	8
2	SNMP and Network Management	Basic foundation: Standards, Models, and Language; Network Management Standards, Network Management Models, Organization Model, Information Model; Communication Model, Encoding Structure, Macro Functional Model.	8
3	SNMP v1 Network Management	Managed Network: case histories and Examples, The History of SNMP Management Internet organizations and standards, SNMP Model, Organization Model, System Overview, Information Model. The SNMP Communication Model. Functional model.	8
4	SNMP Management SNMP v2	Major Changes in SNMPv2, SNMPv2 System Architecture, SNMPv2 Structure of Management Information, The SNMPv2 Management Information Base. SNMPv2 Protocol, Compatibility with SNMP v1	8

5	Network Management Tools and Systems:	System Utilities for Management, Network Statistics Measurement Systems, MIB Engineering, NMS Design, Network management Systems, System Management, and Enterprise Management Solutions. Telecommunications Management Network, TMN conceptual Model, TMN architecture, TMN Management service Architecture, TMN Implementation.	8
6	Quality of Service in IP Networks:	Exterior Routing Protocols and Multicast - Path Vector Protocols: BGP Multicasting. Integrated and Differentiated Services - Integrated Service Architecture (ISA), Queuing Discipline, Random Early Detection, Differentiated Services, Protocol for QOS Support -Resource Reservation: RSVP Real-Time Transport Protocol (RTP).	8

### **Text Books:**

1. Mani Subramanian. "Network Management, Principles and Practice", Pearson Education, Second Edition 2010.
2. William Stallings. "High-Speed Networks and Internets: Performance and Quality of Service 2<sup>nd</sup> Edition ", Prentice Hall/Pearson Education, 2002.

### **Reference Books:**

1. Benou Claise and Ralf Wolier, "Network Management: Accounting and Performance Strategies", Pearson Education. 2008.
2. Stephen B. Morris, "Network Management, MBs and MPLS", Pearson Education, 2003.
3. Thomas G. Robertazzi, "Computer Networks and Systems -Queuing Theory and Performance Evaluation – 3rd", Springer, 2000.

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

### **Theory Examination:**

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.

**In question paper weightage of each module will be proportional to number of respective lecture hours as mention in the syllabus.**

Subject Code	Subject Name	Teaching Scheme (Contact Hours)			Credits Assigned				
		Theory	Pract	Tut	Theory	Pract	Tut	Total	
CISDLO2024	Information Hacking Techniques	04	--	--	04	--	--	04	
		Examination Scheme							
		Theory Examination				End Sem Exam	Term Work	Pract	Oral
		Internal Assessment							
		Test 1	Test 2	Avg					
		20	20	20	80	--	--	--	

### Course Objectives

1. Make students aware of current hacking frauds carried during daily transaction processes.
2. Understanding of different web applications, servers, clients, & databases which are vulnerable for hacking.
3. Learn about methodologies used to protect applications from Hackers.

### Course Outcomes: Learner will able to -

- Demonstrate knowledge about different tools and techniques in Ethical hacking and security.
- Identify and analyze the stages an ethical hacker requires to take in order to compromise a target system.
- Evaluate security techniques used to protect system and user data.
- Demonstrate systematic understanding of the concepts of security at the level of policy and strategy in a computer system.

Sr. No.	Module	Detailed Content	Hours
1	Casing the Establishment	Foot printing, Internet Foot Printing, Scanning, Enumeration, Basic Banner Grabbing, Enumerating Common Network services. Case study: Network Security Monitoring.	8
2	Attacking Authentication & Session Management	Design Flaws in Authentication Mechanism, Weaknesses in Token Generation, Weaknesses in Session Token Handling.	8
3	Wireless Hacking	Wireless Foot printing, Wireless Scanning and Enumeration, Gaining Access, Tools that exploiting WEP Weakness, Denial of Services Attacks, Firewalls landscape, Firewall Identification, Scanning Through firewalls, packet Filtering, Application Proxy Vulnerabilities, Denial of Service Attacks, Motivation of Dos Attackers, Types of DoS attacks, Generic Dos Attacks, UNIX and Windows DoS.	8

4	Infrastructure Hacking	Remote Control Insecurities, Discovering Remote Control Software, Connection, Weakness.VNC, Microsoft Terminal Server and Citrix ICA, Advanced Techniques Session Hijacking, Back Doors, Subverting the systems Environment, Social Engineering, Web Hacking, Web server hacking, Malicious Mobile code, SSL fraud, IRC hacking, Countermeasures to Internet User Hacking.	10
5	Application and Data Hacking	Web and Database Hacking, Mobile Hacking, Countermeasures Cookbook Case Study	6
6	Application Hacker's Toolkit & Methodology	Web Browsers, Other Tools, Map Application's Content, Analyze Application, Test Client-Side Controls, Test Authentication Mechanism, Test for Input-Based Vulnerabilities, Test for Application Server Vulnerabilities.	8

### **Text Books:**

1. Stuart McClure, Joel Scambray and Goerge Kurtz, Hacking Exposed 7: Network Security Secrets & Solutions, Tata Mc Graw Hill Publishers, 2010.
2. Web Application Hacker's Handbook, Dafydd Stuttarf, Marcus Pinto, Wiley publication

### **Reference Books:**

1. Allen Harper, Shon Harris, Jonathan Ness, Chris Eagle, "Gray Hat Hacking The *Ethical Hackers Handbook*", 3rd Edition, McGraw-Hill Osborne Media paperback (January 27,2011)
- 2..Hacking Exposed Web Applications, 3rd Edition, by Joel Scambray, Vincent Liu and Caleb Sima.

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

### **Theory Examination:**

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.

**In question paper weightage of each module will be proportional to number of respective lecture hours as mention in the syllabus.**

Subject Code	Subject Name	Teaching Scheme (Contact Hours)			Credits Assigned				
		Theory	Pract	Tut	Theory	Pract	Tut	Total	
CISDLO2025	Internet of Things	04	--	--	04	--	--	04	
		Examination Scheme							
		Theory Examination				End Sem Exam	Term Work	Pract	Oral
		Internal Assessment							
		Test 1	Test 2	Avg					
		20	20	20	80	--	--	--	

### Course Objectives:

- 1 Provide an overview of concepts, main trends and challenges of Internet of Things.
- 2 Develop the ability to use Internet of Things related software and hardware technologies.
- 3 Provide the knowledge of data management business processes and analytics of IoT.
4. Develop skills to relate the IoT technologies for practical IoT applications such as smart objects.

### Course Outcomes: Learner will able to -

- Explain and interpret the Internet of Things concepts and challenges.
- Experiment with the software and hardware IoT Technologies.
- Understand data management and business processes and analytics of IoT
- Design and develop small IoT applications to create smart objects

Sr. No.	Module	Detailed Content	Hours
1	Introduction to Internet of Things	IoT Paradigm, IoT Architecture – State of the Art, IoT Protocols, IoT Communication Models, IoT in Global Context, Cloud Computing, Big Data Analytics, Concepts of Web of Things, Concept of Cloud of Things with emphasis on Mobile Cloud Computing, Smart Objects.	8
2	Open – Source Prototyping Platforms for IoT	Basic Arduino Programming Extended Arduino Libraries, Arduino – Based Internet Communication, Raspberry PI, Sensors and Interfacing.	8
3	IoT Technology	RFID + NFC, Wireless Networks + WSN, RTLS + GPS, Agents + Multi – Agent Systems, Composition Models for the Web of Things and resources on the Web, Discovery, Search, IoT Mashups and Others.	8
4	Wireless Sensor Networks	History and Context, The Node, Connecting Nodes, Networking Nodes, Secured Communication for IoT.	4



5	Data Management, Business Process and Analytics	Data Management, Business Process in IoT, IoT Analytics, Creative Thinking Techniques, Modification, Combination Scenarios, Decentralized and Interoperable Approaches, Object – Information Distribution Architecture, Object Naming Service (ONS), Service Oriented Architecture, Network of Information, Etc.	12
6	Application and Use Cases	Concrete Applications and Use – Cases of Web Enabled Things: Energy Management and Smart Homes, Ambient Assisted Living, Intelligent Transport, Etc. M2M, Industrial IoT Applications.	8

**Text Books:**

1. The Internet of Things (MIT Press) by Samuel Greengard.
2. The Internet of Things (Connecting objects to the web) by Hakima Chaouchi ,Wiley .
3. Internet of Things ( A Hands-on-Approach) by Arshdeep Bhaga and Vijay Madiseti.

**Reference Books:**

1. The Internet of Things Key applications and Protocols, 2<sup>nd</sup> Edition, (Wiley Publication) by Olivier Hersent, David Boswarthick and Omar Elloumi.
2. IoT –From Research and Innovation to Market development, River Publication by Ovidiu Vermesan and Peter Friess.
3. Building Internet of Things with Arduino by Charalampos Doukas.

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

**Theory Examination:**

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.

**In question paper weightage of each module will be proportional to number of respective lecture hours as mention in the syllabus.**

<b>Course Code</b>	<b>Course Name</b>	<b>Credits</b>
<b>ILO 2021</b>	<b>Project Management</b>	<b>03</b>

**Objectives:**

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

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

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

<b>Module</b>	<b>Detailed Contents</b>	<b>Hrs</b>
<b>01</b>	<b>Project Management Foundation:</b> Definition of a project, Project Vs Operations, Necessity of project management, Triple constraints, Project life cycles (typical & atypical) Project phases and stage gate process. Role of project manager. Negotiations and resolving conflicts. Project management in various organization structures. PM knowledge areas as per Project Management Institute (PMI).	5
<b>02</b>	<b>Initiating Projects:</b> How to get a project started, Selecting project strategically, Project selection models (Numeric /Scoring Models and Non-numeric models), Project portfolio process, Project sponsor and creating charter; Project proposal. Effective project team, Stages of team development & growth (forming, storming, norming & performing), team dynamics.	6
<b>03</b>	<b>Project Planning and Scheduling:</b> Work Breakdown structure (WBS) and linear responsibility chart, Interface Co-ordination and concurrent engineering, Project cost estimation and budgeting, Top down and bottoms up budgeting, Networking and Scheduling techniques. PERT, CPM, GANTT chart. Introduction to Project Management Information System (PMIS).	8
<b>04</b>	<b>Planning Projects:</b> Crashing project time, Resource loading and leveling, Goldratt's critical chain, Project Stakeholders and Communication plan. Risk Management in projects: Risk management planning, Risk identification and risk register. Qualitative and quantitative risk assessment, Probability and impact matrix. Risk response strategies for positive and negative risks	6
<b>05</b>	<b>5.1 Executing Projects:</b> Planning monitoring and controlling cycle. Information needs and reporting, engaging with all stakeholders of the projects. Team management, communication and project meetings. <b>5.2 Monitoring and Controlling Projects:</b> Earned Value Management techniques for measuring value of work completed; Using milestones for measurement; change requests and scope creep. Project audit. <b>5.3 Project Contracting</b> Project procurement management, contracting and outsourcing,	8

06	<p><b>6.1 Project Leadership and Ethics:</b> Introduction to project leadership, ethics in projects. Multicultural and virtual projects.</p> <p><b>6.2 Closing the Project:</b> Customer acceptance; Reasons of project termination, Various types of project terminations (Extinction, Addition, Integration, Starvation), Process of project termination, completing a final report; doing a lessons learned analysis; acknowledging successes and failures; Project management templates and other resources; Managing without authority; Areas of further study.</p>	6
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### **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. Jack Meredith & Samuel Mantel, Project Management: A managerial approach, Wiley India, 7<sup>th</sup>Ed.
2. A Guide to the Project Management Body of Knowledge (PMBOK® Guide), 5<sup>th</sup> Ed, Project Management Institute PA, USA
3. Gido Clements, Project Management, Cengage Learning.
4. Gopalan, Project Management, , Wiley India
5. Dennis Lock, Project Management, Gower Publishing England, 9 th Ed.

<b>Course Code</b>	<b>Course Name</b>	<b>Credits</b>
<b>ILO 2022</b>	<b>Finance Management</b>	<b>03</b>

**Objectives:**

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

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

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

<b>Module</b>	<b>Detailed Contents</b>	<b>Hrs</b>
<b>01</b>	<p><b>Overview of Indian Financial System:</b> Characteristics, Components and Functions of Financial System.</p> <p><b>Financial Instruments:</b> Meaning, Characteristics and Classification of Basic Financial Instruments — Equity Shares, Preference Shares, Bonds-Debentures, Certificates of Deposit, and Treasury Bills.</p> <p><b>Financial Markets:</b> Meaning, Characteristics and Classification of Financial Markets — Capital Market, Money Market and Foreign Currency Market</p> <p><b>Financial Institutions:</b> Meaning, Characteristics and Classification of Financial Institutions — Commercial Banks, Investment-Merchant Banks and Stock Exchanges</p>	06
<b>02</b>	<p><b>Concepts of Returns and Risks:</b> Measurement of Historical Returns and Expected Returns of a Single Security and a Two-security Portfolio; Measurement of Historical Risk and Expected Risk of a Single Security and a Two-security Portfolio.</p> <p><b>Time Value of Money:</b> Future Value of a Lump Sum, Ordinary Annuity, and Annuity Due; Present Value of a Lump Sum, Ordinary Annuity, and Annuity Due; Continuous Compounding and Continuous Discounting.</p>	06
<b>03</b>	<p><b>Overview of Corporate Finance:</b> Objectives of Corporate Finance; Functions of Corporate Finance—Investment Decision, Financing Decision, and Dividend Decision.</p> <p><b>Financial Ratio Analysis:</b> Overview of Financial Statements—Balance Sheet, Profit and Loss Account, and Cash Flow Statement; Purpose of Financial Ratio Analysis; Liquidity Ratios; Efficiency or Activity Ratios; Profitability Ratios; Capital Structure Ratios; Stock Market Ratios; Limitations of Ratio Analysis.</p>	09
<b>04</b>	<p><b>Capital Budgeting:</b> Meaning and Importance of Capital Budgeting; Inputs for Capital Budgeting Decisions; Investment Appraisal Criterion—Accounting Rate of Return, Payback Period, Discounted Payback Period, Net Present Value(NPV), Profitability Index, Internal Rate of Return (IRR), and Modified Internal Rate of Return (MIRR)</p> <p><b>Working Capital Management:</b> Concepts of Meaning Working Capital; Importance of Working Capital Management; Factors Affecting an Entity's Working Capital Needs; Estimation of Working Capital Requirements; Management of Inventories; Management of Receivables; and Management of Cash and Marketable Securities.</p>	10
<b>05</b>	<p><b>Sources of Finance:</b> Long Term Sources—Equity, Debt, and Hybrids; Mezzanine Finance; Sources of Short Term Finance—Trade Credit, Bank Finance, Commercial Paper; Project Finance.</p> <p><b>Capital Structure:</b> Factors Affecting an Entity's Capital Structure; Overview of Capital Structure Theories and Approaches— Net Income Approach, Net Operating Income Approach; Traditional Approach, and Modigliani-Miller Approach. Relation</p>	05

	between Capital Structure and Corporate Value; Concept of Optimal Capital Structure	
<b>06</b>	<b>Dividend Policy:</b> Meaning and Importance of Dividend Policy; Factors Affecting an Entity's Dividend Decision; Overview of Dividend Policy Theories and Approaches—Gordon's Approach, Walter's Approach, and Modigliani-Miller Approach	03

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

<b>Course Code</b>	<b>Course Name</b>	<b>Credits</b>
<b>ILO2023</b>	<b>Entrepreneurship Development and Management</b>	<b>03</b>

**Objectives:**

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

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

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

<b>Module</b>	<b>Detailed Contents</b>	<b>Hrs</b>
<b>01</b>	<b>Overview Of Entrepreneurship:</b> Definitions, Roles and Functions/Values of Entrepreneurship, History of Entrepreneurship Development, Role of Entrepreneurship in the National Economy, Functions of an Entrepreneur, Entrepreneurship and Forms of Business Ownership Role of Money and Capital Markets in Entrepreneurial Development: Contribution of Government Agencies in Sourcing information for Entrepreneurship	04
<b>02</b>	<b>Business Plans And Importance Of Capital To Entrepreneurship:</b> Preliminary and Marketing Plans, Management and Personnel, Start-up Costs and Financing as well as Projected Financial Statements, Legal Section, Insurance, Suppliers and Risks, Assumptions and Conclusion, Capital and its Importance to the Entrepreneur <b>Entrepreneurship And Business Development:</b> Starting a New Business, Buying an Existing Business, New Product Development, Business Growth and the Entrepreneur Law and its Relevance to Business Operations	09
<b>03</b>	Women's Entrepreneurship Development, Social entrepreneurship-role and need, EDP cell, role of sustainability and sustainable development for SMEs, case studies, exercises	05
<b>04</b>	<b>Indian Environment for Entrepreneurship:</b> key regulations and legal aspects , MSMED Act 2006 and its implications, schemes and policies of the Ministry of MSME, role and responsibilities of various government organisations, departments, banks etc., Role of State governments in terms of infrastructure developments and support etc., Public private partnerships, National Skill development Mission, Credit Guarantee Fund, PMEGP, discussions, group exercises etc	08
<b>05</b>	<b>Effective Management of Business:</b> Issues and problems faced by micro and small enterprises and effective management of M and S enterprises (risk management, credit availability, technology innovation, supply chain management, linkage with large industries), exercises, e-Marketing	08
<b>06</b>	<b>Achieving Success In The Small Business:</b> Stages of the small business life cycle, four types of firm-level growth strategies, Options – harvesting or closing small business Critical Success factors of small business	05

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

<b>Course Code</b>	<b>Course Name</b>	<b>Credits</b>
<b>ILO2024</b>	<b>Human Resource Management</b>	<b>03</b>

**Objectives:**

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

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

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

<b>Module</b>	<b>Detailed Contents</b>	<b>Hrs</b>
<b>01</b>	<p><b>Introduction to HR</b></p> <ul style="list-style-type: none"> <li>• Human Resource Management- Concept, Scope and Importance, Interdisciplinary Approach Relationship with other Sciences, Competencies of HR Manager, HRM functions.</li> <li>• Human resource development (HRD): changing role of HRM – Human resource Planning, Technological change, Restructuring and rightsizing, Empowerment, TQM, Managing ethical issues.</li> </ul>	5
<b>02</b>	<p><b>Organizational Behavior (OB)</b></p> <ul style="list-style-type: none"> <li>• Introduction to OB Origin, Nature and Scope of Organizational Behavior, Relevance to Organizational Effectiveness and Contemporary issues</li> <li>• Personality: Meaning and Determinants of Personality, Personality development, Personality Types, Assessment of Personality Traits for Increasing Self Awareness</li> <li>• Perception: Attitude and Value, Effect of perception on Individual Decision-making, Attitude and Behavior.</li> <li>• Motivation: Theories of Motivation and their Applications for Behavioral Change (Maslow, Herzberg, McGregor);</li> <li>• Group Behavior and Group Dynamics: Work groups formal and informal groups and stages of group development. Team Effectiveness: High performing teams, Team Roles, cross functional and self-directed team.</li> <li>• Case study</li> </ul>	7
<b>03</b>	<p><b>Organizational Structure &amp; Design</b></p> <ul style="list-style-type: none"> <li>• Structure, size, technology, Environment of organization; Organizational Roles &amp; conflicts: Concept of roles; role dynamics; role conflicts and stress.</li> <li>• Leadership: Concepts and skills of leadership, Leadership and managerial roles, Leadership styles and contemporary issues in leadership.</li> <li>• Power and Politics: Sources and uses of power; Politics at workplace, Tactics and strategies.</li> </ul>	6
<b>04</b>	<b>Human resource Planning</b>	5



	<ul style="list-style-type: none"> <li>Recruitment and Selection process, Job-enrichment, Empowerment - Job-Satisfaction, employee morale.</li> <li>Performance Appraisal Systems: Traditional &amp; modern methods, Performance Counseling, Career Planning.</li> <li>Training &amp; Development: Identification of Training Needs, Training Methods</li> </ul>	
05	<p><b>Emerging Trends in HR</b></p> <ul style="list-style-type: none"> <li>Organizational development; Business Process Re-engineering (BPR), BPR as a tool for organizational development , managing processes &amp; transformation in HR. Organizational Change, Culture, Environment</li> <li>Cross Cultural Leadership and Decision Making: Cross Cultural Communication and diversity at work, Causes of diversity, managing diversity with special reference to handicapped, women and ageing people, intra company cultural difference in employee motivation.</li> </ul>	6
06	<p><b>HR &amp; MIS</b> Need, purpose, objective and role of information system in HR, Applications in HRD in various industries (e.g. manufacturing R&amp;D, Public Transport, Hospitals, Hotels and service industries)</p> <p><b>Strategic HRM</b> Role of Strategic HRM in the modern business world, Concept of Strategy, Strategic Management Process, Approaches to Strategic Decision Making; Strategic Intent – Corporate Mission, Vision, Objectives and Goals</p> <p><b>Labor Laws &amp; Industrial Relations</b> Evolution of IR, IR issues in organizations, Overview of Labor Laws in India; Industrial Disputes Act, Trade Unions Act, Shops and Establishments Act</p>	10

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

<b>Course Code</b>	<b>Course Name</b>	<b>Credits</b>
<b>ILO2025</b>	<b>Professional Ethics and Corporat Social Responsibility (CSR)</b>	<b>03</b>

**Objectives:**

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

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

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

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

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

<b>Course Code</b>	<b>Course Name</b>	<b>Credits</b>
<b>ILO2026</b>	<b>Research Methodology</b>	<b>03</b>

**Objectives:**

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

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

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

<b>Module</b>	<b>Detailed Contents</b>	<b>Hrs</b>
<b>01</b>	<b>Introduction and Basic Research Concepts</b> <b>1.1</b> Research – Definition; Concept of Construct, Postulate, Proposition, Thesis, Hypothesis, Law, Principle. Research methods vs Methodology <b>1.2</b> Need of Research in Business and Social Sciences <b>1.3</b> Objectives of Research <b>1.4</b> Issues and Problems in Research <b>1.5</b> Characteristics of Research: Systematic, Valid, Verifiable, Empirical and Critical	<b>09</b>
<b>02</b>	<b>Types of Research</b> <b>2.1.</b> Basic Research <b>2.2.</b> Applied Research <b>2.3.</b> Descriptive Research <b>2.4.</b> Analytical Research <b>2.5.</b> Empirical Research <b>2.6</b> Qualitative and Quantitative Approaches	<b>07</b>
<b>03</b>	<b>Research Design and Sample Design</b> <b>3.1</b> Research Design – Meaning, Types and Significance <b>3.2</b> Sample Design – Meaning and Significance Essentials of a good sampling Stages in Sample Design Sampling methods/techniques Sampling Errors	<b>07</b>
<b>04</b>	<b>Research Methodology</b> <b>4.1</b> Meaning of Research Methodology <b>4.2.</b> Stages in Scientific Research Process: a. Identification and Selection of Research Problem b. Formulation of Research Problem c. Review of Literature d. Formulation of Hypothesis e. Formulation of research Design f. Sample Design g. Data Collection h. Data Analysis i. Hypothesis testing and Interpretation of Data j. Preparation of Research Report	<b>08</b>
<b>05</b>	<b>Formulating Research Problem</b> <b>5.1</b> Considerations: Relevance, Interest, Data Availability, Choice of data, Analysis of data, Generalization and Interpretation of analysis	<b>04</b>
<b>06</b>	<b>Outcome of Research</b> <b>6.1</b> Preparation of the report on conclusion reached	<b>04</b>

## **Assessment:**

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### **End Semester Theory Examination:**

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

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

<b>Course Code</b>	<b>Course Name</b>	<b>Credits</b>
<b>ILO2027</b>	<b>IPR and Patenting</b>	<b>03</b>

**Objectives:**

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

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

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

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

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### **End Semester Theory Examination:**

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

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

### **REFERENCE BOOKS:**

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

Course Code	Course Name	Credits
<b>ILO 2028</b>	<b>Digital Business Management</b>	<b>03</b>

**Objectives:**

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

**Outcomes:** The learner will be able to .....

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

Module	Detailed content	Hours
1	<p><b>Introduction to Digital Business-</b> Introduction, Background and current status, E-market places, structures, mechanisms, economics and impacts Difference between physical economy and digital economy, <b>Drivers of digital business-</b> Big Data &amp; Analytics, Mobile, Cloud Computing, Social media, BYOD, and Internet of Things(digitally intelligent machines/services) <b>Opportunities and Challenges in Digital Business,</b></p>	09
2	<p><b>Overview of E-Commerce</b> <b>E-Commerce-</b> Meaning, Retailing in e-commerce-products and services, consumer behavior, market research and advertisement B2B-E-commerce-selling and buying in private e-markets, public B2B exchanges and support services, e-supply chains, Collaborative Commerce, Intra business EC and Corporate portals Other E-C models and applications, innovative EC System-From E-government and learning to C2C, mobile commerce and pervasive computing EC Strategy and Implementation-EC strategy and global EC, Economics and Justification of EC, Using Affiliate marketing to promote your e-commerce business, Launching a successful online business and EC project, Legal, Ethics and Societal impacts of EC</p>	06
3	<p><b>Digital Business Support services:</b> ERP as e –business backbone, knowledge Tope Apps, Information and referral system <b>Application Development:</b> Building Digital business Applications and Infrastructure</p>	06
4	<p><b>Managing E-Business-</b>Managing Knowledge, Management skills for e-business, Managing Risks in e –business Security Threats to e-business -Security Overview, Electronic Commerce Threats, Encryption, Cryptography, Public Key and Private Key Cryptography, Digital Signatures, Digital Certificates, Security Protocols over Public Networks: HTTP, SSL, Firewall as Security Control, Public Key Infrastructure (PKI) for Security, Prominent Cryptographic Applications</p>	06
5	<p><b>E-Business Strategy-</b>E-business Strategic formulation- Analysis of Company’s Internal and external environment, Selection of strategy, E-business strategy into Action, challenges and E-Transition (Process of Digital Transformation)</p>	04
6	<p><b>Materializing e-business: From Idea to Realization-</b>Business plan preparation <b>Case Studies and presentations</b></p>	08



## **Assessment:**

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### **End Semester Theory Examination:**

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

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

<b>Course Code</b>	<b>Course Name</b>	<b>Credits</b>
<b>ILO2029</b>	<b>Environmental Management</b>	<b>03</b>

**Objectives:**

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

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

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

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

**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. Environmental Management: Principles and Practice, C J Barrow, Routledge Publishers London, 1999
2. A Handbook of Environmental Management Edited by Jon C. Lovett and David G. Ockwell, Edward Elgar Publishing
3. Environmental Management, **T V Ramachandra and Vijay Kulkarni, TERI Press**
4. Indian Standard Environmental Management Systems — Requirements With Guidance For Use, Bureau Of Indian Standards, February 2005
5. Environmental Management: An Indian Perspective, S N Chary and Vinod Vyasulu, Macmillan India, 2000
6. Introduction to Environmental Management, Mary K Theodore and Louise Theodore, CRC Press
7. Environment and Ecology, Majid Hussain, 3<sup>rd</sup> Ed. Access Publishing.2015

Subject Code	Subject Name	Teaching Scheme (Contact Hours)			Credits Assigned				
		Theory	Pract	Tut	Theory	Pract	Tut	Total	
CISL201	Computational Laboratory -II	--	02	--	01	--	--	01	
		Examination Scheme							
		Theory Examination				End Sem Exam	Term Work	Pract/ Oral	Total
		Internal Assessment							
		Test 1	Test 2	Avg					
		--	--			25	25	50	

- Use suitable 64-bit Linux environment and tool set to implement a mini project in the lab based on core subjects.
- Design and implement using latest 64-bit C++/JAVA/ Python programming tools.
- Use development tools such as OPENCV/NS2/NS3.

Subject Code	Subject Name	Teaching Scheme (Contact Hours)			Credits Assigned				
		Theory	Pract	Tut	Theory	Pract	Tut	Total	
CISL202	DEC Laboratory -II	--	02	--	01	--	--	01	
		Examination Scheme							
		Theory Examination				End Sem Exam	Term Work	Pract/ oral	Total
		Internal Assessment							
		Test 1	Test 2	Avg					
		--	--			25	25	50	

- Students should study the tools and techniques related to the elective subject.
- Students should complete a mini project based on the elective subject using various tools.

Subject Code	Subject Name	Teaching Scheme (Contact Hours)			Credits Assigned			
		Theory	Pract	Tut	Theory	Pract	Tut	Total
CIS301	Special Topic Seminar	--	06	--	--	03	--	03
		Examination Scheme						
		Theory Examination				Term Work	Pract	Oral
		Internal Assessment			End Sem Exam			
		Test 1	Test 2	Avg				
		--	--	--	--	50	--	50

### Guidelines for Special Topic Seminar

- a. Seminar should be based on thrust areas in Computer Engineering/ Information Technology.
- b. Students should do literature survey, identify the topic of seminar and finalize it with consultation of Guide/Supervisor.
- c. Students should use multiple literatures (at least 10 papers from Refereed Journals/conferences) and understand the topic and research gap.
- d. Implementation of one paper from refereed journal as a case study.
- e. Compile the report in standard format and present in front of Panel of Examiners. (Pair of Internal and External examiners appointed by the University of Mumbai).
- f. It is advisable to students should publish at least one paper based on the work in reputed International / National Conference.

**Note:** At least 4-5 hours of course on Research Methodology should be conducted which includes literature survey, identification of problems, analysis and interpretation of results. Technical paper writing should be in the beginning of 3rd semester.

Subject Code	Subject Name	Teaching Scheme (Contact Hours)			Credits Assigned				
		Theory	Pract	Tut	Theory	Pract	Tut	Total	
CIS302	Dissertation I	--	24	--	--	12	--	12	
		Examination Scheme							
		Theory Examination				End Sem Exam	Term Work	Pract	Total
		Internal Assessment							
		Test 1	Test 2	Avg					
		--	--	--	--	100	--	100	

### Guidelines for Dissertation-I

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

### Guidelines for Assessment of Dissertation-I

Dissertation-I should be assessed based on following points:

- Relevance to the specialization
- Clarity of objective and scope
- Quality of Literature survey and Novelty in the problem statement
- Clarity of Problem definition and Feasibility of problem solution

Dissertation-I should be assessed through a presentation by a panel of Internal examiners and external examiner appointed by the Head of the Department/Institute of respective Program.

Subject Code	Subject Name	Teaching Scheme (Contact Hours)			Credits Assigned				
		Theory	Pract	Tut	Theory	Pract	Tut	Total	
CIS401	Dissertation II	--	30	--	--	15	--	15	
		Examination Scheme							
		Theory Examination				End Sem Exam	Term Work	Pract/ Oral	Total
		Internal Assessment							
		Test 1	Test 2	Avg					
		--	--	--	--	100	100	200	

### Guidelines for Assessment of Dissertation II

Dissertation II should be assessed based on following points:

- Quality of Literature survey and Novelty in the problem
- Clarity of Problem definition and Feasibility of problem solution
- Relevance to the specialization or current Research / Industrial trends
- Clarity of objective and scope
- Quality of work attempted or learner contribution
- Validation of results
- Quality of Written and Oral Presentation

Students should publish at least one paper based on the work in referred National/ International conference/Journal of repute.