Subject Code	Subject Name	Teaching Scheme (Contact Hours)			Credits Assigned			
		Theory	Pract	Tut	Theory	Pract	Tut	Total
ME-CSDLO21	Ethical Hacking and Digital Forensics	03	--	--	03	--	--	03
		Examination Scheme						
		Theory Examination				Term Work	Pract	Oral
		Internal Assessment			End Sem Exam			
		Test 1	Test 2	Avg				
		20	20	20	80	--	--	--

Course Objectives:

1. To understand underlying principles and many of the techniques associated with the digital forensic practices.
2. To explore practical knowledge about ethical hacking Methodology.
3. To develop an excellent understanding of current cyber security issues and ways that user, administrator and programmer errors can lead to exploitable in securities.

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

1. Understand the concept of ethical hacking and its associated applications in Information Communication Technology (ICT) world.
2. Acquire knowledge of various digital forensic tools and ethical hacking.
3. Interpret security issues in ICT world, and apply digital forensic tools for security and investigations.
4. Achieve adequate perspectives of digital forensic investigation in various applications /devices like Windows/Unix system, mobile, email etc.
5. Generate legal evidences and supporting investigation reports.

Sr. No.	Module	Detailed content	Hours
1	Ethical Hacking Methodology	Introduction, Steps of Ethical Hacking: Planning, Reconnaissance, Scanning, Exploitation, post exploitation and result reporting. Ethical Hacking Tool: Metasploit	6Hrs
2	Introduction to Digital Forensics	The Need for Digital Forensics, Types of Digital Forensics, Introduction to Incident Response Methodology, Incident handling steps, Ethics in Digital Forensics.	6 Hrs
3	Data Collection	Live Data Collection from Windows and Unix Systems, Tools for Forensic Duplication, Collecting Network-based Evidence, Evidence Handling - Chain of Custody. Data Collection Forensic Tools : Forensics Toolkit/ WinHex	12 Hrs
4	Data Analysis	Data Analysis, Investigating Windows, Unix Systems, Analysing Network Traffic, Investigating Routers, Email forensics	11 Hrs

		Data Analysis Tools : Nmap/Wireshark/Helix3pro	
5	Mobile Device Forensics	Crime and mobile phones, evidences, forensic procedures, files present in SIM cards, device data, external memory dump, and evidences in memory card, operator's networks.	6 Hrs
6	Forensic Investigation Reporting	Investigative Report Template, Layout of an Investigative Report, Guidelines for Writing a Report	4 Hrs

Text Books:

1. Kevin Mandia, Chris Prosise, "Incident Response and computer forensics", Tata McGraw Hill, 2006.
2. Patrick Engebretson, "The Basics of Hacking and Penetration Testing, Second Edition: Ethical Hacking and Penetration Testing Made Easy", 2nd Edition, Syngress.
3. Investigation Procedures and Response**,** EC-Council Press.

Reference Books:

1. Peter Stephenson, "Investigating Computer Crime: A Handbook for Corporate Investigations", Sept 1999.
2. Debra Littlejohn Shinder and Ed Tittel, "Scene of the Cybercrime: Computer Forensics Handbook", Syngress Publishing, Inc.
3. Eoghan Casey, "Handbook Computer Crime Investigation's Forensic Tools andTechnology", Academic Press, 1st Edition, 2001
4. Nina Godbole, "Information Systems Security", Wiley India, New Delhi
5. William Stallings, "Cryptography and Network Security", 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 carries 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.

<table>
<tr><th rowspan="2">Subject Code</th><th rowspan="2">Subject Name</th><th colspan="3">Teaching Scheme
(Contact Hours)</th><th colspan="4">Credits Assigned</th></tr>
<tr><td>Theory</td><td>Pract</td><td>Tut</td><td>Theory</td><td>Pract</td><td>Tut</td><td>Total</td></tr>
<tr><td rowspan="7">ME-CSDLO22</td><td rowspan="7">Data Storage & Retrieval</td><td>03</td><td>--</td><td>--</td><td>03</td><td>--</td><td>--</td><td>03</td></tr>
<tr><td colspan="7">Examination Scheme</td></tr>
<tr><td colspan="4">Theory Examination</td><td rowspan="3">Term Work</td><td rowspan="3">Pract</td><td rowspan="3">Oral</td></tr>
<tr><td colspan="3">Internal Assessment</td><td rowspan="2">End Sem Exam</td></tr>
<tr><td>Test 1</td><td>Test 2</td><td>Avg</td></tr>
<tr><td>20</td><td>20</td><td>20</td><td>80</td><td>--</td><td>--</td><td>--</td></tr>
</table>

Course Objectives:

1. Understand need of storage network with its architecture, features, components, topology, benefits and limitations.
2. Study the impact of downtime in terms of losses and business continuity.
3. Understand the basic terminologies and components in information retrieval systems.
4. Compare and contrast Information Retrieval models.

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

1. Evaluate storage architecture, ISS, SAN, NAS and IP SAN.
2. Design the storage infrastructure for business continuity.
3. Implement and evaluate various Information Retrieval Models.

Sr. No.	Modules	Detailed content	Hours
1	Introduction to Data Storage	Need for storage network, Evolution of storage technology and architecture, Key Challenges in managing information, Information lifecycle, Disk drive performance, Fundamental laws governing disk performance.	04
2	Storage System Environment	Basic Software for Storage Networking: Software for SANs, Shared access data managers, Volumes(RAID): Resilience, performance and flexibility, File systems and application performance. Intelligent Storage System: Storage Virtualization: Form of Virtualization, storage virtualization configurations and challenges, Types of storage virtualization. Content-Addressed Storage: Architecture, Object storage and Retrieval in CAS.	08

3	Storage Networking Technologies	Storage Area Networks: Fibre Channel, Components of SAN, FC Connectivity, Fibre Channel Ports, Fibre Channel Architecture, Zoning, Fibre Channel Login Types, FC Topologies. Network-Attached Storage: General-Purpose Servers vs. NAS Devices, Benefits of NAS, NAS File I/O, Components of NAS, NAS Implementations, NAS File-Sharing Protocols, NAS I/O Operations, Factors Affecting NAS Performance and Availability. IP SAN: iSCSI, FCIP.	10
4	Business Continuity and Enterprise backup	Introduction to Business Continuity: Information availability, BC planning lifecycle, Failure Analysis, Business impact analysis. Enterprise backup software for SAN: Backup management, Enterprise data protection, Backup architecture, Backup policies, Minimizing impact of backup, Lan-free and serverless backup.	06
5	Information Retrieval	Introduction to Information Retrieval(IR), Objectives and Components of IR system, Taxonomy of IR models, Information Retrieval process, Documents and Query forms	06
6	Retrieval Models	Query structure, The matching process, Text analysis	5

Text Books:

1. G. Somasundaram, Alok Shrivastava, "Information Storage and Management", EMC Education services", Wiley Publication, Edition 2009
2. Richard Barker, Paul Massiglia, "Storage Area Network Essentials: A Complete Guide to Understanding and Implementing SANs", Wiley India
3. Robert R. Korfhage, "Information Storage and Retrieval", Wiley Publication

Reference Books:

1. Ulf Troppens,Wolfgang Muller-Friedt,Rainer Wolafka, "Storage Networks Explained" Wiley Publication
2. Spalding, Robert. Storage Networks: The Complete Reference. Tata McGraw-Hill Education, 2003
3. Manning, Christopher D., Prabhakar Raghavan, and Hinrich Schütze. Introduction to information retrieval. Vol. 1, no. 1. Cambridge: Cambridge university press, 2008.

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 carries 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.

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<tr><th rowspan="2">Subject Code</th><th rowspan="2">Subject Name</th><th colspan="3">Teaching Scheme
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<tr><td>Theory</td><td>Pract</td><td>Tut</td><td>Theory</td><td>Pract</td><td>Tut</td><td>Total</td></tr>
<tr><td rowspan="6">ME-CSDLO23</td><td rowspan="6">Advanced Soft Computing</td><td>03</td><td>--</td><td>--</td><td>03</td><td>--</td><td>--</td><td>03</td></tr>
<tr><td colspan="7">Examination Scheme</td></tr>
<tr><td colspan="4">Theory Examination</td><td rowspan="3">Term Work</td><td rowspan="3">Pract</td><td rowspan="3">Oral</td></tr>
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<tr><td>Test 1</td><td>Test 2</td><td>Avg</td></tr>
<tr><td>20</td><td>20</td><td>20</td><td>80</td><td>--</td><td>--</td><td>--</td></tr>
</table>

Course Objectives:

1. To familiarize various soft computing techniques.
2. To relate various soft computing techniques in practical scenario.
3. To understand hybrid approach for application development.

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

1. To demonstrate various soft computing techniques.
2. To apply and analyze different soft computing techniques for solving practical applications.
3. To design an intelligent system for social and technical problems.

Pre-requisite: Basic mathematics, soft computing, Computational intelligence

Sr. No.	Module	Detailed content	Hours
1	Introduction	Differentiate Hard and Soft Computing, Soft Computing Constituents, Neuro Fuzzy and Soft Computing Characteristics	2
2	Fuzzy Logic & Rough Set Theory	Fuzzy Relations and Fuzzy Rules, Generalized Modens Ponens, Defuzzification and its Types Fuzzy Inference Systems, Design of Fuzzy Controller, Introduction to Rough Sets	9
3	Supervised Network	Error Back Propagation Training Algorithm, Radial Basis Function	8

4	Unsupervised Network	Kohenon Self Organizing Maps, Basic Learning Vector Quantization, Basic Adaptive Resonance Theory	9
5	Hybrid Systems and Introduction to Deep Learning	Fuzzy-Neural Systems, Neuro-Genetic Systems Fuzzy-Genetic Systems, Deep Learning : Definition & background, historical context of deep learning, Three classes of deep learning network.	7
6	Applications and Case Study	Automobile Fuel Efficiency using ANFIS Color Receipe prediction using CANFIS	4

Text Books

1. J.S.R.Jang "Neuro-Fuzzy and Soft Computing" PHI 2003.
2. S. Rajasekaran and G.A. Vijaylakshmi Pai.. Neural Networks Fuzzy Logic, and Genetic Algorithms, Prentice Hall of India.
3. Satish Kumar "Neural Networks A Classroom Approach" Tata McGrawHill.
4. S.N.Sivanandam, S.N.Deepa "Principles of Soft Computing" Second Edition, Wiley Publication.
5. Samir Roy, Udit Chakraborty "Introduction to Soft Computing" Pearson Education India.
6. Jacek.M.Zurada "Introduction to Artificial Neural Sytems" Jaico Publishing House.
7. Timothy J.Ross "Fuzzy Logic With Engineering Applications" Wiley.

Reference Books:

1. Fakhreddine O. Karry, Clarence De Silva," Soft Computing and Intelligent systems Design Theory, Tools and Applications" Pearson 2009.
2. Li Deng and Dong Yu , 'Deep Learning Methods and Applications'.

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 carries 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.

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<tr><td rowspan="6">ME-CSDLO24</td><td rowspan="6">Semantic Web & Social Network Analysis</td><td>03</td><td>--</td><td>--</td><td>03</td><td>--</td><td>--</td><td>03</td></tr>
<tr><td colspan="7">Examination Scheme</td></tr>
<tr><td colspan="3">Theory Examination</td><td rowspan="3">Term Work</td><td rowspan="3">Pract</td><td rowspan="3">Oral</td></tr>
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<tr><td>Test 1</td><td>Test 2</td><td>Avg</td></tr>
<tr><td>20</td><td>20</td><td>20</td><td>80</td><td>--</td><td>--</td><td>--</td></tr>
</table>

Semantic Web provide a graph model (RDF), a query language (SPARQL) and schema definition frameworks (RDFS and OWL) to represent and exchange knowledge online. These technologies provide a whole new way of capturing social networks in much richer structures. Social network Analysis(SNA) tries to understand and exploit the key features of social networks in order to manage their life cycle and predict their evolution. Objective of the course is to understand how to facilitate and enhance the analysis of online social networks, exploiting the power of semantic web technologies.

Course Objectives:

1. To understand the basics of Semantic Web Technologies
2. To Learn knowledge representation for Semantic Web
3. To understand the importance of Social Network Analysis
4. To understand and use semantic web technologies for social network analysis

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

1. Understand the Semantic Web and Social Networks
2. Understand Electronic sources for network analysis and different ontology languages.
3. Model and aggregate social network data.
4. Design and Analyze social network using semantic web technologies.

Pre-requisites: Web Technologies; Data Structures, Databases, Logic-First order logic, knowledge representation, Data Mining, Distributed Systems.

Sr. No.	Module	Detailed Contents	Hours
1	Introduction Semantic Web and Social Networks: .	The Semantic Web- Limitations of the current Web, The semantic Web Technologies, A Layered Approach, The emergence of the social web. Social Network Analysis- What is network analysis, Development of Social Network Analysis, Key concepts and measures in network analysis	**4**
2	Semantics and Knowledge Representation on the Semantic Web	Electronic sources for network analysis- Electronic discussion networks, Blogs and online communities Structured Web Documents-XML, Describing web	**8**

		Resources-RDF, RDF Schema, Querying Knowledge Representation on the Semantic Web-SPARQL	
3	Modeling and aggregating social network data:	Ontologies and their role in the Semantic Web, Ontology languages for the Semantic Web-RDFS, OWL. State-of-the-art in network data representation, Ontology Engineering, Semantic Web Knowledge Management Architecture, Ontological representation of social individuals, Ontological representation of social relationships, Aggregating and reasoning with social network data.	**9**
4	Developing social-semantic applications:	Building Semantic Web applications with social network features, Flink: the social networks of the Semantic Web community, open academia: distributed, semantic-based publication management	**6**
5	Extracting and Mining Communities in social network and social network analysis-	Extracting evolution of Web Community from series of web archive – Detecting communities in social Networks-Definition of community – Evaluating communities – methods for community detection and mining – Semantic based social network analysis.	**6**
6	Applications of community mining algorithms , Visualization-	Applications of community mining algorithms-Influence and Homophily, Recommendation, Behavior Analytics, Visualization- Graph theory – Centrality – Clustering- Node Edge Diagrams –Matrix Representation –,Benefits of semantic social networks for communities	**6**

Text Books:

1. Grigoris Antoniou and Frank van Harmelen "Semantic Web Primer"second edition
2. Peter Mika, "Social Networks and the Semantic Web", First Edition, Springer 2007.
3. Reza Zafarani,Mohammad Ali Abbasi,Huan Liu "Social Media Mining: Introduction",Cambridge University press.

Reference Books:

1. Guandong Xu ,Yanchun Zhang and Lin Li, "Web Mining and Social Networking Techniques and applications", First Edition Springer, 2011.
2. Dion Goh and Schubert Foo, "Social information Retrieval Systems: Emerging Technologies and Applications for Searching the Web Effectively", IGI Global Snippet, 2008.
3. Max Chevalier, Christine Julien and Chantal Soulé-Dupuy, "Collaborative and Social Retrieval and Access: Techniques for Improved user Modelling",IGI Global Snippet, 2009.
4. John G. Breslin, Alexander Passant and Stefan Decker, "The Social Semantic Web", Springer, 2009.
5. Charu C. Aggarwal, "Social Network Data Analytics", Springer; 2011.
6. Borko Furht, "Handbook of Social Network Technologies and Applications", 1st Edition, Springer, 2010.
7. Toby Segaran,colin Evans and Jamie Taylor "Programming Semantic Web", O'Reilly.
8. Berners Lee, Godel and Turing "Thinking on the Web ",Wiley inter science, 2008.
9. Vladimir Geroimenko, Chaomei Chen "Visualizing the Semantic Web", Springer 2006.

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 carries 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.

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<tr><td rowspan="6">ME-CSDLO25</td><td rowspan="6">Blockchain Technology and Applications</td><td>03</td><td>--</td><td>--</td><td>03</td><td>--</td><td>--</td><td>03</td></tr>
<tr><td colspan="7">Examination Scheme</td></tr>
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</table>

Sr.No	Course Objectives
1	To get acquainted with the concept of Distributed ledger system and Blockchain.
2	To learn the concepts of consensus and mining in Blockchain through the Bitcoin network.
3	To understand Ethereum and develop-deploy smart contracts using different tools and frameworks.
4	To understand permissioned Blockchain and explore Hyperledger Fabric.
5	To understand different types of crypto assets.
6	To apply Blockchain for different domains IOT, AI and Cyber Security.

Sr. No.	**Course Outcomes:** At the end of the course student should be able to
1	Describe the basic concept of Blockchain and Distributed Ledger Technology.
2	Interpret the knowledge of the Bitcoin network, nodes, keys, wallets and transactions.
3	Implement smart contracts in Ethereum using different development frameworks.
4	Develop applications in permissioned Hyperledger Fabric network.
5	Interpret different Crypto assets and Crypto currencies
6	Analyze the use of Blockchain with AI, IoT and Cyber Security using case studies.

Sr. No.	Module	Detailed Content	Hours
0	**Prerequisite**	Hash functions, Public – Private keys, SHA, ECC, Digital signatures,	
I	**Introduction to DLT and Blockchain**	Fundamental concepts of Distributed systems, Distributed Ledger Technologies (DLTs) Introduction, Types of Blockchains **Blockchain:** Origin, Phases, Components **Block in a Blockchain**: Structure of a Block, Block Header Hash and Block Height, The Genesis Block, Linking Blocks in the Blockchain, Merkle Tree. **Self-learning Topics:** Blockchain Demo	5
II	**Consensus and Mining**	What is Bitcoin and the history of Bitcoin, Bitcoin Transactions, Bitcoin Concepts: keys, addresses and wallets, Bitcoin Transactions, validation of transactions, PoW consensus **Bitcoin Network**: Peer-to-Peer Network Architecture, Node Types and Roles, Incentive based Engineering, The Extended Bitcoin Network, Bitcoin Relay Networks, Network Discovery, Full Nodes, Exchanging "Inventory", Simplified Payment Verification (SPV) Nodes, SPV Nodes and Privacy, Transaction Pools, Blockchain Forks **Self-learning Topics:** Study and compare different consensus algorithms like PoA, PoS, Pbft	8
III	**Permissionless Blockchain: Ethereum**	Components, Architecture of Ethereum, Miner and mining node, Ethereum virtual machine, Ether, Gas, Transactions, Accounts, Patricia Merkle Tree, Swarm, Whisper and IPFS, Ethash, End to end transaction in Ethereum, **Smart Contracts**: Smart Contract programming using solidity, Metamask (Ethereum Wallet), Setting up development environment, Use cases of Smart Contract, Smart Contracts: Opportunities and Risk. **Smart Contract Deployment**: Introduction to Truffle, Use of Remix and test networks for deployment	10

		Other Permissionless Blockchain platforms Introduction: IOTA, Hashgraph, EOS, etc. **Self-learning Topics:** Smart contract development using Java or Python	
IV	**Permissioned Blockchain : Hyperledger Fabric**	Introduction to Framework, Tools and Architecture of Hyperledger Fabric Blockchain. **Components**: Certificate Authority, Nodes, Chain codes, Channels, Consensus: Solo, Kafka, RAFT Designing Hyperledger Blockchain **Other Permissioned Blockchain platforms Introduction:** CORDA, Quoram, etc. **Self-learning Topics:** Fundamentals of Hyperledger Composer	7
V	**Crypto assets and Cryptocurrencies**	Fungible and Non fungible tokens, ERC20 and ERC721 standards, comparison between ERC20 & ERC721, ICO, STO, Different Crypto currencies **Self-learning Topics:** Defi, Metaverse, Types of cryptocurrencies	5
VI	**Blockchain Applications & Research Areas**	Blockchain in IoT, AI, Cyber Security **Research Areas**: Interoperability, Privacy, Performance, Oracles, Security of smart contracts and platforms **Self-learning Topics:** Applications of Blockchain in various domains Education, Energy, Healthcare, real-estate, logistics, supply chain	4

Text Books:

1. "Mastering Bitcoin, PROGRAMMING THE OPEN BLOCKCHAIN", 2nd Edition by Andreas M. Antonopoulos, June 2017, Publisher(s): O'Reilly Media, Inc. ISBN: 9781491954386.
2. Mastering Ethereum, Building Smart Contract and Dapps, Andreas M. Antonopoulos Dr. Gavin Wood, O'reilly.
3. Blockchain Technology, Chandramouli Subramanian, Asha A George, Abhillash K. A and Meena Karthikeyen, Universities press.
4. Hyperledger Fabric In-Depth: Learn, Build and Deploy Blockchain Applications Using Hyperledger Fabric, Ashwani Kumar, BPB publications
5. Solidity Programming Essentials: A beginner's Guide to Build Smart Contracts for Ethereum and Blockchain, Ritesh Modi, Packt publication
6. Cryptoassets: The Innovative Investor's Guide to Bitcoin and Beyond, Chris Burniske & Jack Tatar.

Reference Books:

1. Mastering Blockchain, Imran Bashir, Packt Publishing 2. Mastering Bitcoin Unlocking Digital Cryptocurrencies, Andreas M. Antonopoulos, O'Reilly Media
2. Blockchain Technology: Concepts and Applications, Kumar Saurabh and Ashutosh Saxena, Wiley.
3. The Basics of Bitcoins and Blockchains: An Introduction to Cryptocurrencies and the Technology that Powers Them, Antony Lewis.for Ethereum and Blockchain, Ritesh Modi, Packt publication.
4. Mastering Bitcoin Unlocking Digital Cryptocurrencies, Andreas M. Antonopoulos, O'Reilly Media

Online References:

1. NPTEL courses:
    a. Blockchain and its Applications,
    b. Blockchain Architecture Design and Use Cases
2. www.swayam.gov.in/
3. www.coursera.org
4. https://ethereum.org/en/
5. https://www.trufflesuite.com/tutorials
6. https://hyperledger-fabric.readthedocs.io/en/release-2.2/whatis.h
7. Blockchain demo: https://andersbrownworth.com/blockchain/
8. Blockchain Demo: Public / Private Keys & Signing: https://andersbrownworth.com/blockchain/public-private-keys/

Assessment:

Internal Assessment Test:

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 end semester examination.

<table>
<tr><th rowspan="2">Subject Code</th><th rowspan="2">Subject Name</th><th colspan="3">Teaching Scheme (Contact Hours)</th><th colspan="4">Credits Assigned</th></tr>
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<tr><td rowspan="6">ME-CSDLO26</td><td rowspan="6">Storage Area Network</td><td>03</td><td>--</td><td>--</td><td>03</td><td>--</td><td>--</td><td>03</td></tr>
<tr><td colspan="7">Examination Scheme</td></tr>
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</table>

Sr.No	Course Objectives
1	Understand and analyze the basics of storage network, storage technologies and various storage architectures.
2	Define and understand virtualization with respect to storage network.
3	Understand SAN Management and its various aspects.
4	Describe disaster recovery for storage network and understand strategies, parameters and Quality of Service for Business Continuity in storage infrastructure.
5	Understand and analyze security aspects for storage area network.
6	Be aware of the applications and Recent Developments in Ad Hoc Networks

Sr. No	**Course Outcomes:** At the end of the course student should be able to
1	Explain storage technologies and storage architectures.
2	Describe and apply virtualization in storage network.
3	Apply SAN Management with its various parameters.
4	Understand and apply disaster recovery and Business Continuity in storage network.
5	Understand and apply storage security and its importance.

6	Apply various storage network concepts like Implementation, SAN Management, Virtualization, Disaster Recovery and Security to design storage area network for an organization.

Sr. No.	Module	Detailed Content	Hours
0	**Prerequisite**	Basics of Networking and storage devices, Local File systems, Network File systems and file servers, Shared Disk File systems, Direct attached storage (DAS)	
I	**Need for Storage Network**	Basics of Storage Network: - Intelligent Storage Systems (ISS), Data protection (RAID implementation methods). RAID arrays, RAID technologies, RAID levels, RAID impact on disk performance & RAID comparison, SCSI, SAN: FC SAN FC Protocol Stack, IP Storage, Infiniband, Virtual Interfaces, Comparison of NAS, FC SAN and iSCSI SAN. **Self-learning Topics:** Limitations of traditional server centric architecture, Storage centric architecture and its advantages. Network Attached Storage (NAS)	**09**
II	**Storage Virtualization**	Definition, Storage virtualization on block and file level, Storage virtualization on various levels of Storage network, Symmetric and Asymmetric Virtualization. Basics of Software Defined Storage and its types **Self-learning Topics: VSAN**	**06**
III	**Managing SAN**	Storage Management tasks, What Gets Managed in SAN? Zoning, Virtualization: Allocating Capacity rather than Disk, SAN Management and Quality of online storage device: Storage capacity, Data availability and I/O performance, SAN Management and Asset Utilization, **Self-learning Topics: Storage planning and capacity planning**	**05**
IV	**Business Continuity**	**Strategies of Business Continuity:** High availability, Disaster Recovery, Continuous business operation **Parameters of Business Continuity:** Availability, characteristics of Availability (MTBF, MTTR and MTTF), characteristics of failure (RTO and RPO), Network Recovery Objective (NRO)	**06**

		Quality of Service for Business Continuity: Service level Agreements (SLAs), High availability versus disaster recovery, The Seven-Tier Model, Tier 0 to Tier 7 **Self-learning Topics: General Conditions, BC Terminology**	
V	**Storage Security**	**Overview of Storage Security**: Define storage security, Storage security framework: Security attributes (Confidentiality, Integrity, Availability, Accountability), **Security Elements:** Assets (Information, Hardware, Software, Network Infrastructure), Threats, Vulnerabilities **Security Controls:** Technical (implemented in hardware, software and firmware), Non-Technical: Administrative (Policies, Standards), FC SAN security, Basic SAN Security Mechanisms, Securing Switch Ports **Self-learning Topics: NAS security**	**06**
VI	**Designing Storage Area Network**	A case study to design a storage area network for an organization considering the following guidelines: SAN Implementation, SAN Management, SAN Virtualization, SAN Disaster Recovery and Security **Self-learning Topics: Study the Storage Area Network Design of your college/industry campus.**	**04**

Text Books:

1. Ulf Troppens, Rainer Erkens, Wolfgang Muller-Friedt, Rainer Wolafka, Nils Haustein, "Storage Networks Explained: Basics and Application of Fibre Channel SAN, NAS, iSCSI, Infiniband and FCoE", Second Edition, Wiley

2. Richard Barker and Paul Massiglia, "Storage Area Network Essentials A Complete Guide to Understanding and Implementing SANs", Wiley.

3. EMC Education Services, "Information Storage and Management," Second Edition, Wiley

4. Martin Hosken, "VMware Software-Defined Storage: A Design Guide to the Policy-Driven, Software-Defined Storage Era"

Reference Books:

1.Vaishali D. Khairnar and Nilima M. Dongre**,"** Storage Network Management and Retrieval", Wiley

2. Robert Spalding, "Storage Networks: The Complete Reference", McGraw Hill Education

3. W. Curtis Preston, "Using SANs and NAS", O'Reilly

Assessment:

Internal Assessment Test:

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 inquestion papers of end semester examination.

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<tr><th rowspan="2">Subject Code</th><th rowspan="2">Subject Name</th><th colspan="3">Teaching Scheme
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<tr><td>Theory</td><td>Pract</td><td>Tut</td><td>Theory</td><td>Pract</td><td>Tut</td><td>Total</td></tr>
<tr><td rowspan="6">ME-CSDLO27</td><td rowspan="6">Design Thinking</td><td>03</td><td>--</td><td>--</td><td>03</td><td>--</td><td>--</td><td>03</td></tr>
<tr><td colspan="7">Examination Scheme</td></tr>
<tr><td colspan="4">Theory Examination</td><td rowspan="3">Term Work</td><td rowspan="3">Pract</td><td rowspan="3">Oral</td></tr>
<tr><td colspan="3">Internal Assessment</td><td rowspan="2">End Sem Exam</td></tr>
<tr><td>Test 1</td><td>Test 2</td><td>Avg</td></tr>
<tr><td>20</td><td>20</td><td>20</td><td>80</td><td>--</td><td>--</td><td>--</td></tr>
</table>

Sr. No	Course Objectives
1	To stress the importance of good design.
2	To recognize the latest and future issues and challenges in innovation.
3	To expose the student with state of the art perspectives, ideas, concepts, and solutions related to the design and innovation using design thinking principles.
4	To develop an advanced innovation and growth mindset form of problem identification and reframing, and insight generation.
5	To provide a social and thinking space for the recognition of innovation challenges and the design of creative solutions.
6	To propose a concrete, feasible, viable and relevant innovation project/challenge with Implementation

Sr. No.	**Course Outcomes:** At the end of the course student should be able to
1	Understand good features of designs.
2	Understand importance of innovation in day to day life
3	Illustrate and analyze user needs and formulate design and innovation using design thinking principles.
4	Interpret and evaluate the data collected during the process of problem identification and reframing, and insight generation.

5	Evaluate designs based on theoretical frameworks and methodological approaches.
6	Design innovative applications that are usable, effective and efficient for intended users

Sr. No.	Module	Detailed Content	Hours
0	**Prerequisite**	Software Engineering concepts and any programming Language	
I	**Introduction to design**	Good and Poor Design, What is Interaction Design, The User Experience, The Process Of Interaction Design, Interaction Design and the User Experience, Necessity of UI/UX, **Self-learning Topics:** Study of Various interactiveday to day application	5
II	**Design Thinking Background**	Definition of design thinking, business uses ofdesign thinking, variety of approaches within the design thinking discipline, design thinking mindset **Self-learning Topics:** Design thinking in businessapplication	5
III	**Design Thinking Approach**	Fundamental Concepts: Empathy, ethnography, divergent thinking convergent thinking, visual thinking, assumption testing, prototyping, and validation within design Thinking, Design Thinking Resources Human resource, preferred space prepared, materials commonly used, dynamic between design thinking teams and the organization Design Thinking Processes Design thinking approaches, Double Diamond approach, d.School 5-Stage approach, Growth approach, role of project management within design thinking **Self-learning Topics:** Study of Various resources for design thinking	8

IV	**Design Thinking inPractice**	4.1 Process Stages of Designing for Growth 4.2 Design Thinking Tools and Methods need to use tools and methods, visualization, journey mapping, value chain analysis, mind mapping, brainstorming, concept development assumption testing, rapid prototyping customer co-creation, learning launch. **Self-learning Topics:** Study of concept development with any application	7
V	UX Evaluation, The Interaction Cycle and the User Action Framework	UX Goals, Metrics and Targets, UX Evaluation Techniques.-Formative vs summative ,Analysis,The interaction cycle, The user action framework adding a structured knowledge base to the interaction cycle, Interaction cycle and user action framework content categories, Role of affordances within the UAF, Practical value of the UAF. **Self-learning Topics:** Study of UI and UX goals with any application	7
VI	Design Thinking Applicatio n	This section explores practical case study related to product development in a design thinking effort. Any domain is preferable. **Self-learning Topics:** Study of any domain application	4

Text Books:

1. "Designing for growth: A design thinking tool kit for managers", by Jeanne Liedtka and Tim Ogilvie., 2011, ISBN 978-0-231-15838-1
2. "The design thinking playbook: Mindful digital transformation of teams, products, services, businesses and ecosystems", by Michael Lewrick, Patrick Link, Larry Leifer., 2018, ISBN 978-1-119-46747-2
3. "Presumptive design: Design provocations for innovation", by Leo Frishberg and Charles Lambdin., 2016, ISBN: 978-0-12-803086-8
4. "Systems thinking: Managing chaos and complexity: A platform for designing business architecture.", "Chapter Seven: Design Thinking", by Jamshid Gharajedaghi, 2011, ISBN 978-0-12-385915-0
5. Interaction Design, by J. Preece, Y. Rogers and H. Sharp. ISBN 0-471-49278-7.
6. Human Computer Interaction, by Alan Dix, Janet Finlay, Gregory D Abowd, Russell Beale

References:

1. Karmic Design Thinking by Prof. Bala Ramadurai, available at Amazon (paperback), Amazon(e-book), Flipkart, Pothi, halfpricebooks.in.

2. Design: Creation of Artifacts in Society by Prof. Karl Ulrich, U. Penn

3. Change by Design by Tim Brown.
4. The UX Book, by Rex Hartson and Pardha S Pyla

5. Donald A. Norman, “The design of everyday things”, Basic books.

6. Jeff Johnson, “Designing with the mind in mind”, Morgan Kaufmann Publication.

Online References: **https://nptel.ac.in/courses/110106124**

https://onlinecourses.nptel.ac.in/noc22_mg32/preview

https://onlinecourses.nptel.ac.in/noc21_ar05/preview

https://nptel.ac.in/courses/124/107/124107008/

https://nptel.ac.in/noc/courses/noc19/SEM1/noc19-ar10/

https://nptel.ac.in/courses/107/103/107103083/

https://www.youtube.com/watch?v=6C2Ye1makdY&list=PLW-zSkCnZ-gD5TDfs1eL5EnH2mQ0f9g6B

https://xd.adobe.com/ideas/process/

Assessment:

Internal Assessment Test:

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 inquestion papers of end semester examination.

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<tr><td rowspan="6">ME-CSDLO28</td><td rowspan="6">Metaverse</td><td>03</td><td>--</td><td>--</td><td>03</td><td>--</td><td>--</td><td>03</td></tr>
<tr><td colspan="7">Examination Scheme</td></tr>
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</table>

Sr.No	Course Objectives
1	To study the concepts of Metaverse.
2	To study Metaverse and Web 3.0, Virtual Reality (VR), Augmented Reality (AR), and Mixed Reality (MR), NFT in Blockchain.
3	To study the Metaverse technologies and protocols.
4	To study and identify the required infrastructure for Metaverse.
5	To study various case studies of Metaverse.
6	To study of Metaverse Immersive technology and Interfaces.

Sr. No.	**Course Outcomes:** At the end of the course student should be able to
1	Understand the concepts of Metaverse.
2	understand and study Metaverse and Web 3.0, Virtual Reality (VR), Augmented Reality (AR), and Mixed Reality (MR), NFT in Blockchain.
3	Understand the Metaverse technologies and protocols.
4	Identify the required infrastructure for Metaverse.
5	Understand different case studies of Metaverse.
6	Understand Metaverse Immersive technology and Interfaces

Sr. No.	Module	Detailed Content	Hours
0	Prerequisite	Basic Concepts of Blockchain Technology.	
I	**Introduction**	What is the Metaverse? Evaluation of Technology: Web, AR VR, 3D spaces, Immersive learning , Blockchain , Decentralised commerce	**03**
II	**Fundamental Concepts of AR, VR, MR and Blockchain**	Building block technology of metaverse , How Gaming + Web 3.0 + Blockchain are Changing the Internet: Future of Internet: How Metaverse is different from Internet, Potential of Metaverse characteristics that characterise metaverse The Different Shapes of the Metaverse: Games, NFTs (assets), Blockchain Protocols, Cryptocurrencies, etc	**07**
III	**Metaverse Technologies and Protocols**	Metaverse technologies, principles, affordances and challenges Blockchain Protocols and Platforms Involved in the Metaverse Metaverse-Related Tokens Blockchain NFT need for metaverse: working principle of blockchain, NFT based virtual assets in metaverse, case study How NFTs are Unlocking the Metaverse Potential working of ERC721 NFT	**06**
IV	**Metaverse Infrastructure**	Access the metaverse, necessary hardware Understanding Decentraland , native token MANA, creating own Avatar. Using metamask to access Decentraland, owning land to have direct access of metaverse.	**06**
V	**Case studies of Metaverse**	Various usecase of metaverse Industries Disrupted by the Metaverse: Fashion, Marketing, Brands, Finance, Gaming, Architecture, Virtual Shows/Concerts, Art Galleries and Museums Virtual Business and market, Investing In the Metaverse and Profit Asset Classes Inside the Metaverse	**07**

		Metaverse Land Ownership - Property Investment	
VI	**Metaverse Immersive technology and Interfaces**	3d Reconstruction, AI technology to analyses 3D Scan Virtual Reality (VR) and Augmented Reality (AR), Mixed Reality (MR) and Extended Reality (XR), Metaverse vs VR what is difference, IoT to bridge gap between physical world and internet Metaverse Interfaces: Personal Computer, Mobile Phone, AR Glasses, VR Goggles, Neuralink	**07**

Text & Reference Books

1. Mystakidis, Stylianos, "Metaverse", Journal=Encyclopedia,2022, https://www.mdpi.com/2673-8392/2/1/31
2. All One Needs to Know about Metaverse: A Complete Survey on Technological Singularity, Virtual Ecosystem, and Research Agenda, Technical Report · October 2021

Online References:

1. **https://www.udemy.com/course/complete-metaverse-course-everything-about-ar-vr-and-nfts/**

Assessment:

Internal Assessment Test:

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:

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<tr><td rowspan="6">ME-CSL201</td><td rowspan="6">Computational Laboratory II</td><td>--</td><td>--</td><td>--</td><td>---</td><td>02</td><td>--</td><td>01</td></tr>
<tr><td colspan="7">Examination Scheme</td></tr>
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</table>

Module	Detailed Content	Lab Session
Cloud Computing & Services	Use Eucalyptus or open Nebula or equivalent to set up cloud, many virtual machine utilization, virtual machine migration at certain conditions, web applications on cloud. Demonstrate how to build ML/AL capabilities on cloud for mobile applications Explain how mobile offline data synchronization can be done using any cloud platform	05
Data Analytics and Visualization	For the following Experiments, use any available data set or download it from Kaggle/UCI or other repositories and use Python to solve each problem. 1. Data preparation using NumPy and Pandas 2. Data Visualization / Exploratory Data Analysis for the selected data set using Matplotlib and Seaborn 3. Data Modeling	05

	4. Implementation of Statistical Hypothesis Test using Scipy and Sci-kit learn 5. Regression Analysis a. Perform Logistic Regression to find out relation between variables. b. Apply regression Model techniques to predict the data on above dataset 6. Predictive data Analytics using open source tools like Rstudio, RWeka, RHadoop	

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<tr><td rowspan="6">ME-CSL102
ME-CSL202</td><td rowspan="6">Skill Based Lab I & II</td><td>--</td><td>--</td><td>--</td><td>---</td><td>02</td><td>--</td><td>02</td></tr>
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<tr><td colspan="9">Detailed Content

Skill Based Lab- I and II shall include activity / case study / project based learning like Mini project in engineering domains, related to the specialization or interdisciplinary domains, Product Design Application Software Development, Idea proposal and validation

Lab work/Case Study can also be conducted based on DLOC chosen by the student</td></tr>
</table>

Course Code	Course Name	Credits
ILO 2021	Project Management	03

Objectives:

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

Outcomes: Learner will be able to…

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

Module	Detailed Contents	Hrs
01	**Project Management Foundation:** Definition of a project, Project Vs Operations, Necessity of project management, Triple constraints, Project life cycles (typical & atypical) Project phases and stage gate process. Role of project manager, Negotiations and resolving conflicts, Project management in various organization structures, PM knowledge areas as per Project Management Institute (PMI)	5
02	**Initiating Projects:** How to get a project started, selecting project strategically, Project selection models (Numeric /Scoring Models and Non-numeric models), Project portfolio process, Project sponsor and creating charter; Project proposal. Effective project team, Stages of team development & growth (forming, storming, norming &performing), team dynamics.	6
03	**Project Planning and Scheduling:** Work Breakdown structure (WBS) and linear responsibility chart, Interface Co-ordination and concurrent engineering, Project cost estimation and budgeting, Top down and bottoms up budgeting, Networking and Scheduling techniques. PERT, CPM, GANTT chart, Introduction to Project Management Information System (PMIS).	8
04	**Planning Projects:** Crashing project time, Resource loading and levelling, Goldratt's critical chain, Project Stakeholders and Communication plan	6

	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	
05	**5.1 Executing Projects:** Planning monitoring and controlling cycle, Information needs and reporting, engaging with all stakeholders of the projects, Team management, communication and project meetings **5.2 Monitoring and Controlling Projects:** Earned Value Management techniques for measuring value of work completed; Using milestones for measurement; change requests and scope creep, Project audit **5.3 Project Contracting** Project procurement management, contracting and outsourcing,	8
06	**6.1 Project Leadership and Ethics:** Introduction to project leadership, ethics in projects, Multicultural and virtual projects **6.2 Closing the Project:** Customer acceptance; Reasons of project termination, Various types of project terminations (Extinction, Addition, Integration, Starvation), Process of project termination, completing a final report; doing a lessons learned analysis; acknowledging successes and failures; Project management templates and other resources; Managing without authority; Areas of further study.	6

Assessment:

Internal Assessment for 20 marks:

Consisting **Two Compulsory Class Tests**

First test based on approximately 40% of contents and second test based on remaining contents (approximately 40% but excluding contents covered in Test I)

End Semester Examination:

Weightage of each module in end semester examination will be proportional to number of respective lecture hours mentioned in the curriculum.

1. Question paper will comprise of total **six questions**, **each carrying 20 marks**
2. **Question 1** will be **compulsory** and should **cover maximum contents of the curriculum**
3. **Remaining questions will be mixed in nature** (for example if Q.2 has part (a) from module 3 then part (b) will be from any module other than module 3)
4. Only **Four questions need to be solved**

REFERENCES:

1. Project Management: A managerial approach, Jack Meredith & Samuel Mantel, 7th Edition, Wiley India
2. A Guide to the Project Management Body of Knowledge (PMBOK® Guide), 5th Ed,

Project Management Institute PA, USA
3. Project Management,Gido Clements, Cengage Learning
4. Project Management,Gopalan, Wiley India
5. Project Management,Dennis Lock, 9th Edition, Gower Publishing England

Course Code	Course Name	Credits
ILO 2022	Finance Management	03

Objectives:

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

Outcomes: Learner will be able to…

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

Module	Detailed Contents	Hrs
01	**Overview of Indian Financial System:** Characteristics, Components and Functions of Financial System. **Financial Instruments:** Meaning, Characteristics and Classification of Basic Financial Instruments — Equity Shares, Preference Shares, Bonds-Debentures, Certificates of Deposit, and Treasury Bills. **Financial Markets:** Meaning, Characteristics and Classification of Financial Markets — Capital Market, Money Market and Foreign Currency Market **Financial Institutions:** Meaning, Characteristics and Classification of Financial Institutions — Commercial Banks, Investment-Merchant Banks and Stock Exchanges	06
02	**Concepts of Returns and Risks:** Measurement of Historical Returns and Expected Returns of a Single Security and a Two-security Portfolio; Measurement of Historical Risk and Expected Risk of a Single Security and a Two-security Portfolio. **Time Value of Money:** Future Value of a Lump Sum, Ordinary Annuity, and Annuity Due; Present Value of a Lump Sum, Ordinary Annuity, and Annuity Due; Continuous Compounding and Continuous Discounting.	06
03	**Overview of Corporate Finance:** Objectives of Corporate Finance; Functions of Corporate Finance—Investment Decision, Financing Decision, and Dividend Decision. **Financial Ratio Analysis:** Overview of Financial Statements—Balance Sheet, Profit and Loss Account, and Cash Flow Statement; Purpose of Financial Ratio Analysis; Liquidity Ratios; Efficiency or Activity Ratios; Profitability Ratios; Capital Structure Ratios; Stock Market Ratios; Limitations of Ratio Analysis.	09

04	**Capital Budgeting:** Meaning and Importance of Capital Budgeting; Inputs for Capital Budgeting Decisions; Investment Appraisal Criterion—Accounting Rate of Return, Payback Period, Discounted Payback Period, Net Present Value(NPV), Profitability Index, Internal Rate of Return (IRR), and Modified Internal Rate of Return (MIRR) **Working Capital Management:** Concepts of Meaning Working Capital; Importance of Working Capital Management; Factors Affecting an Entity's Working Capital Needs; Estimation of Working Capital Requirements; Management of Inventories; Management of Receivables; and Management of Cash and Marketable Securities.	10
05	**Sources of Finance:** Long Term Sources—Equity, Debt, and Hybrids; Mezzanine Finance; Sources of Short Term Finance—Trade Credit, Bank Finance, Commercial Paper; Project Finance. **Capital Structure:** Factors Affecting an Entity's Capital Structure; Overview of Capital Structure Theories and Approaches— Net Income Approach, Net Operating Income Approach; Traditional Approach, and Modigliani-Miller Approach. Relation between Capital Structure and Corporate Value; Concept of Optimal Capital Structure	05
06	**Dividend Policy:** Meaning and Importance of Dividend Policy; Factors Affecting an Entity's Dividend Decision; Overview of Dividend Policy Theories and Approaches—Gordon's Approach, Walter's Approach, and Modigliani-Miller Approach	03

<u>Assessment</u>:

Internal Assessment for 20 marks:

Consisting **Two Compulsory Class Tests**

First test based on approximately 40% of contents and second test based on remaining contents (approximately 40% but excluding contents covered in Test I)

End Semester Examination:

Weightage of each module in end semester examination will be proportional to number of respective lecture hours mentioned in the curriculum.

1. Question paper will comprise of total **six questions**, **each carrying 20 marks**
2. **Question 1** will be **compulsory** and should **cover maximum contents of the curriculum**
3. **Remaining questions will be mixed in nature** (for example if Q.2 has part (a) from module 3 then part (b) will be from any module other than module 3)
4. Only **Four questions need to be solved**.

REFERENCES:

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

Course Code	Course Name	Credits
ILO2023	Entrepreneurship Development and Management	03

Objectives:

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

Outcomes: Learner will be able to…

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

Module	Detailed Contents	Hrs
01	**Overview Of Entrepreneurship:** Definitions, Roles and Functions/Values of Entrepreneurship, History of Entrepreneurship Development, Role of Entrepreneurship in the National Economy, Functions of an Entrepreneur, Entrepreneurship and Forms of Business Ownership Role of Money and Capital Markets in Entrepreneurial Development: Contribution of Government Agencies in Sourcing information for Entrepreneurship	04
02	**Business Plans And Importance Of Capital To Entrepreneurship:** Preliminary and Marketing Plans, Management and Personnel, Start-up Costs and Financing as well as Projected Financial Statements, Legal Section, Insurance, Suppliers and Risks, Assumptions and Conclusion, Capital and its Importance to the Entrepreneur **Entrepreneurship And Business Development:** Starting a New Business, Buying an Existing Business, New Product Development, Business Growth and the Entrepreneur Law and its Relevance to Business Operations	09
03	Women's Entrepreneurship Development, Social entrepreneurship-role and need, EDP cell, role of sustainability and sustainable development for SMEs, case studies, exercises	05
04	**Indian Environment for Entrepreneurship:** key regulations and legal aspects , MSMED Act 2006 and its implications, schemes and policies of the Ministry of MSME, role and responsibilities of various government organisations, departments, banks etc., Role of State governments in terms of infrastructure developments and support etc., Public private partnerships, National Skill development Mission, Credit Guarantee Fund, PMEGP, discussions, group exercises etc	08
05	**Effective Management of Business:** Issues and problems faced by micro and small enterprises and effective management of M and S enterprises (risk	08

	management, credit availability, technology innovation, supply chain management, linkage with large industries), exercises, e-Marketing	
06	**Achieving Success In The Small Business:** Stages of the small business life cycle, four types of firm-level growth strategies, Options – harvesting or closing small business Critical Success factors of small business	05

Assessment:

Internal Assessment for 20 marks:

Consisting **Two Compulsory Class Tests**

First test based on approximately 40% of contents and second test based on remaining contents (approximately 40% but excluding contents covered in Test I)

End Semester Examination:

Weightage of each module in end semester examination will be proportional to number of respective lecture hours mentioned in the curriculum.

1. Question paper will comprise of total **six questions**, **each carrying 20 marks**
2. **Question 1** will be **compulsory** and should **cover maximum contents of the curriculum**
3. **Remaining questions will be mixed in nature** (for example if Q.2 has part (a) from module 3 then part (b) will be from any module other than module 3)
4. Only **Four questions need to be solved**.

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
12. www.dcmesme.gov.in
13. www.msmetraining.gov.in

Course Code	Course Name	Credits
ILO2024	Human Resource Management	03

Objectives:

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

Module	Detailed Contents	Hrs
01	**Introduction to HR** • Human Resource Management- Concept, Scope and Importance, Interdisciplinary Approach Relationship with other Sciences, Competencies of HR Manager, HRM functions • Human resource development (HRD): changing role of HRM – Human resource Planning, Technological change, Restructuring and rightsizing, Empowerment, TQM, Managing ethical issues	5
02	**Organizational Behaviour (OB)** • Introduction to OB Origin, Nature and Scope of Organizational Behaviour, Relevance to Organizational Effectiveness and Contemporary issues • Personality: Meaning and Determinants of Personality, Personality development, Personality Types, Assessment of Personality Traits for Increasing Self Awareness • Perception: Attitude and Value, Effect of perception on Individual Decision-making, Attitude and Behaviour • Motivation: Theories of Motivation and their Applications for Behavioural Change (Maslow, Herzberg, McGregor);	7

	• Group Behaviour and Group Dynamics: Work groups formal and informal groups and stages of group development, Team Effectiveness: High performing teams, Team Roles, cross functional and self-directed team. • Case study	
03	**Organizational Structure &Design** • Structure, size, technology, Environment of organization; Organizational Roles & conflicts: Concept of roles; role dynamics; role conflicts and stress. • Leadership: Concepts and skills of leadership, Leadership and managerial roles, Leadership styles and contemporary issues in leadership. • Power and Politics: Sources and uses of power; Politics at workplace, Tactics and strategies.	6
04	**Human resource Planning** • Recruitment and Selection process, Job-enrichment, Empowerment - Job-Satisfaction, employee morale • Performance Appraisal Systems: Traditional & modern methods, Performance Counselling, Career Planning • Training & Development: Identification of Training Needs, Training Methods	5
05	**Emerging Trends in HR** • Organizational development; Business Process Re-engineering (BPR), BPR as a tool for organizational development, managing processes & transformation in HR. Organizational Change, Culture, Environment • Cross Cultural Leadership and Decision Making**:** Cross Cultural Communication and diversity at work**,** Causes of diversity, managing diversity with special reference to handicapped, women and ageing people, intra company cultural difference in employee motivation	6
06	**HR & MIS:** Need, purpose, objective and role of information system in HR, Applications in HRD in various industries (e.g. manufacturing R&D, Public Transport, Hospitals, Hotels and service industries **Strategic HRM:** Role of Strategic HRM in the modern business world, Concept of Strategy, Strategic Management Process, Approaches to Strategic Decision Making; Strategic Intent – Corporate Mission, Vision, Objectives and Goals **Labor Laws & Industrial Relations:** Evolution of IR, IR issues in organizations, Overview of Labor Laws in India; Industrial Disputes Act, Trade Unions Act, Shops and Establishments Act	10

Internal Assessment for 20 marks:

Consisting **Two Compulsory Class Tests**

First test based on approximately 40% of contents and second test based on remaining contents (approximately 40% but excluding contents covered in Test I)

End Semester Examination:

Weightage of each module in end semester examination will be proportional to number of respective lecture hours mentioned in the curriculum.

1. Question paper will comprise of total **six questions**, **each carrying 20 marks**

2. **Question 1** will be **compulsory** and should **cover maximum contents of the curriculum**
3. **Remaining questions will be mixed in nature** (for example if Q.2 has part (a) from module 3 then part (b) will be from any module other than module 3)
4. Only **Four questions need to be solved**.

REFERENCES:

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

Course Code	Course Name	Credits
ILO2025	Professional Ethics and Corporate Social Responsibility (CSR)	03

Objectives:

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

Outcomes: Learner will be able to…

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

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

Assessment:

Internal Assessment for 20 marks:

Consisting **Two Compulsory Class Tests**

First test based on approximately 40% of contents and second test based on remaining contents (approximately 40% but excluding contents covered in Test I)

End Semester Examination:

Weightage of each module in end semester examination will be proportional to number of respective lecture hours mentioned in the curriculum.

1. Question paper will comprise of total **six questions**, **each carrying 20 marks**
2. **Question 1** will be **compulsory** and should **cover maximum contents of the curriculum**
3. **Remaining questions will be mixed in nature** (for example if Q.2 has part (a) from module 3 then part (b) will be from any module other than module 3)
4. Only **Four questions need to be solved**.

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 Bidyut Chakrabarty, Routledge, New Delhi.

Course Code	Course Name	Credits
ILO2026	Research Methodology	03

Objectives:

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

Outcomes: Learner will be able to…

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

Module	Detailed Contents	Hrs
01	**Introduction and Basic Research Concepts** **1.1** Research – Definition; Concept of Construct, Postulate, Proposition, Thesis, Hypothesis, Law, Principle.Research methods vs Methodology **1.2** Need of Research in Business and Social Sciences **1.3** Objectives of Research **1.4 Issues** and Problems in Research **1.5** Characteristics of Research:Systematic, Valid, Verifiable, Empirical and Critical	**09**
02	**Types of Research** **2.1**. Basic Research **2.2**. Applied Research **2.3.** Descriptive Research **2.4.** Analytical Research **2.5**. Empirical Research **2.6** Qualitative and Quantitative Approaches	**07**
03	**Research Design and Sample Design** **3.1** Research Design – Meaning, Types and Significance **3.2** Sample Design – Meaning and Significance Essentials of a good sampling Stages in Sample Design Sampling methods/techniques Sampling Errors	**07**
04	**Research Methodology** **4.1** Meaning of Research Methodology **4.2**. Stages in Scientific Research Process: **a.** Identification and Selection of Research Problem **b.** Formulation of Research Problem **c.** Review of Literature **d.** Formulation of Hypothesis	**08**

	e. Formulation of research Design **f**. Sample Design **g.** Data Collection **h.** Data Analysis **i.** Hypothesis testing and Interpretation of Data **j.** Preparation of Research Report	
05	**Formulating Research Problem** **5.1** Considerations: Relevance, Interest, Data Availability, Choice of data, Analysis of data, Generalization and Interpretation of analysis	**04**
06	**Outcome of Research** **6.1** Preparation of the report on conclusion reached **6.2** Validity Testing & Ethical Issues **6.3** Suggestions and Recommendation	**04**

Assessment:

Internal Assessment for 20 marks:

Consisting **Two Compulsory Class Tests**

First test based on approximately 40% of contents and second test based on remaining contents (approximately 40% but excluding contents covered in Test I)

End Semester Examination:

Weightage of each module in end semester examination will be proportional to number of respective lecture hours mentioned in the curriculum.

1. Question paper will comprise of total **six questions**, **each carrying 20 marks**
2. **Question 1** will be **compulsory** and should **cover maximum contents of the curriculum**
3. **Remaining questions will be mixed in nature** (for example if Q.2 has part (a) from module 3 then part (b) will be from any module other than module 3)
4. Only **Four questions need to be solved**.

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, (2nd ed), Singapore, Pearson Education

Course Code	Course Name	Credits
ILO2027	IPR and Patenting	03

Objectives:

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

Outcomes: Learner will be able to…

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

Module	Detailed Contents	Hr
01	**Introduction to Intellectual Property Rights (IPR)**: Meaning of IPR, Different category of IPR instruments - Patents, Trademarks, Copyrights, Industrial Designs, Plant variety protection, Geographical indications, Transfer of technology etc. **Importance of IPR in Modern Global Economic Environment:** Theories of IPR, Philosophical aspects of IPR laws, Need for IPR, IPR as an instrument of development	05
02	**Enforcement of Intellectual Property Rights:** Introduction, Magnitude of problem, Factors that create and sustain counterfeiting/piracy, International agreements, International organizations (e.g. WIPO, WTO) active in IPR enforcement **Indian Scenario of IPR:** Introduction, History of IPR in India, Overview of IP laws in India, Indian IPR, Administrative Machinery, Major international treaties signed by India, Procedure for submitting patent and Enforcement of IPR at national level etc.	07
03	**Emerging Issues in IPR:** Challenges for IP in digital economy, e-commerce, human genome, biodiversity and traditional knowledge etc.	05
04	**Basics of Patents:** Definition of Patents, Conditions of patentability, Patentable and non-patentable inventions, Types of patent applications (e.g. Patent of addition etc), Process Patent and Product Patent, Precautions while patenting, Patent specification Patent claims, Disclosures and non-disclosures, Patent rights and infringement, Method of getting a patent	07

05	**Patent Rules:** Indian patent act, European scenario, US scenario, Australia scenario, Japan scenario, Chinese scenario, Multilateral treaties where India is a member (TRIPS agreement, Paris convention etc.)	08
06	**Procedure for Filing a Patent (National and International):** Legislation and Salient Features, Patent Search, Drafting and Filing Patent Applications, Processing of patent, Patent Litigation, Patent Publication, Time frame and cost, Patent Licensing, Patent Infringement **Patent databases:** Important websites, Searching international databases	07

Assessment:

Internal Assessment for 20 marks:

Consisting **Two Compulsory Class Tests**

First test based on approximately 40% of contents and second test based on remaining contents (approximately 40% but excluding contents covered in Test I)

End Semester Examination:

Weightage of each module in end semester examination will be proportional to number of respective lecture hours mentioned in the curriculum.

1. Question paper will comprise of total **six questions**, **each carrying 20 marks**
2. **Question 1** will be **compulsory** and should **cover maximum contents of the curriculum**
3. **Remaining questions will be mixed in nature** (for example if Q.2 has part (a) from module 3 then part (b) will be from any module other than module 3)
4. Only **Four questions need to be solved**.

REFERENCE BOOKS:

1. Rajkumar S. Adukia, 2007, A Handbook on Laws Relating to Intellectual Property Rights in India, The Institute of Chartered Accountants of India
2. Keayla B K, Patent system and related issues at a glance, Published by National Working Group on Patent Laws
3. T Sengupta, 2011, Intellectual Property Law in India, Kluwer Law International
4. Tzen Wong and Graham Dutfield, 2010, Intellectual Property and Human Development: Current Trends and Future Scenario, Cambridge University Press
5. Cornish, William Rodolph & Llewelyn, David. 2010, Intellectual Property: Patents, Copyrights, Trade Marks and Allied Right, 7th Edition, Sweet & Maxwell
6. Lous Harns, 2012, The enforcement of Intellactual Property Rights: A Case Book, 3rd Edition, WIPO
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
ILO 2028	**Digital Business Management**	**03**

Objectives:

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

Outcomes: The learner will be able to …..

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

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

5	**E-Business Strategy**-E-business Strategic formulation- Analysis of Company's Internal and external environment, Selection of strategy, E-business strategy into Action, challenges and E-Transition (Process of Digital Transformation)	04
6	**Materializing e-business: From Idea to Realization**-Business plan preparation **Case Studies and presentations**	08

Assessment:

Internal Assessment for 20 marks:

Consisting **Two Compulsory Class Tests**

First test based on approximately 40% of contents and second test based on remaining contents (approximately 40% but excluding contents covered in Test I)

End Semester Examination:

Weightage of each module in end semester examination will be proportional to number of respective lecture hours mentioned in the curriculum.

1. Question paper will comprise of total **six questions**, **each carrying 20 marks**
2. **Question 1** will be **compulsory** and should **cover maximum contents of the curriculum**
3. **Remaining questions will be mixed in nature** (for example if Q.2 has part (a) from module 3 then part (b) will be from any module other than module 3)
4. Only **Four questions need to be solved**.

References:

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

Course Code	Course Name	Credits
ILO2029	Environmental Management	03

Objectives:

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

Outcomes: Learner will be able to…

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

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

Assessment:

Internal Assessment for 20 marks:

Consisting **Two Compulsory Class Tests**

First test based on approximately 40% of contents and second test based on remaining contents (approximately 40% but excluding contents covered in Test I)

End Semester Examination:

Weightage of each module in end semester examination will be proportional to number of respective lecture hours mentioned in the curriculum.

1. Question paper will comprise of total **six questions**, **each carrying 20 marks**
2. **Question 1** will be **compulsory** and should **cover maximum contents of the curriculum**
3. **Remaining questions will be mixed in nature** (for example if Q.2 has part (a) from module 3 then part (b) will be from any module other than module 3)
4. Only **Four questions need to be solved**.

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 V Ramachandra and Vijay Kulkarni, TERI Press
4. Indian Standard Environmental Management Systems — Requirements With Guidance For Use, Bureau Of Indian Standards, February 2005
5. Environmental Management: An Indian Perspective, S N Chary and Vinod Vyasulu, Maclillan India, 2000
6. Introduction to Environmental Management, Mary K Theodore and Louise Theodore, CRC Press

   Environment and Ecology, Majid Hussain, 3rd Ed. Access Publishing.2015