Program Structure for Fourth Year Information Technology
Semester VII & VIII
UNIVERSITY OFMUMBAI
(With Effect from2022-2023)
Semester VIII

Course Code	Course Name	Teaching Scheme (Contact Hours)			Credits Assigned		
		Theory	Pract. Tut.	Theory	Theory	Pract.	Total
ITC801	Blockchain and DLT	3	--	3	3	--	3
ITDO801 X	Department Optional Course – 5	3	--	3	3	--	3
ITDO802 X	Department Optional Course – 6	3	--	3	3	--	3
ITIO801X	Institute Optional Course – 2	3	--	3	3	--	3
ITL801	Blockchain Lab	--	2	--	--	1	1
ITL802	Cloud computing	--	2	--	--	1	1
ITP801	Major Project II	--	12#	--	--	6	6
Total		12	16	12	12	8	20

Course Code	Course Name	Examination Scheme							
		Theory					Term Work	Prac /oral	Total
		Internal Assessment			End Sem Exam	Exam. Duration (in Hrs)			
		Test1	Test2	Avg					
ITC801	Blockchain and DLT	20	20	20	80	3	--	--	100
ITDO801 X	Department Optional Course – 5	20	20	20	80	3	--	--	100
ITDO802 X	Department Optional Course – 6	20	20	20	80	3	--	--	100
ITIO801X	Institute Optional Course – 2	20	20	20	80	3	--	--	100
ITL801	Blockchain Lab	--	--	--	--	--	25	25	50
ITL802	Cloud computing	--	--	--	--	--	25	25	50
ITP801	Major Project II	--	--	--	--	--	100	50	150
Total		--	--	80	320	--	150	100	650

# indicates work load of Learner (Not Faculty), for Major Project

Students group and load of faculty per week.

Mini Project 1 and 2 :
Students can form groups with minimum 2 (Two) and not more than 4 (Four)

Faculty Load : 1 hour per week per four groups

Major Project 1 and 2 :
Students can form groups with minimum 2 (Two) and not more than 4 (Four)
Faculty Load : In Semester VII – ½ hour per week per project group
             In Semester VIII – 1 hour per week per project group

ITDO801X	Department Optional Course – 5
ITDO8011	Big Data Analytics
ITDO8012	Reinforcement learning
ITDO8013	Simulation and Modeling
ITDO8014	Knowledge management

ITDO802X	Department Optional Course –6
ITDO8021	User Interface Design
ITDO8022	Robotics
ITDO8023	ERP
ITDO8024	Cloud computing and Services

ILO801X	Institute Optional Course – 2 (Common for all branches will be notified)
ILO8011	Project Management
ILO8012	Finance Management
ILO8013	Entrepreneurship Development and Management
ILO8014	Human Resource Management
ILO8015	Professional Ethics and CSR
ILO8016	Research Methodology
ILO8017	IPR and Patenting
ILO8018	Digital Business Management
ILO8019	Environmental Management

Course Code	Course Name	Theory	Practical	Tutorial	Theory	Practical/ Oral	Tutorial	Total
ITC801	Blockchain and DLT	03	--	--	03	--	--	03

Course Code	Course Name	Examination Scheme							
		Theory Marks				Term Work	Practical	Oral	Total
		Internal assessment			End Sem. Exam				
		Test1	Test 2	Avg. of 2 Tests					
ITC801	Blockchain and DLT	20	20	20	80	--	--	--	100

Course Objectives:

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.

Course Outcomes:

Sr. No	Course Outcomes	Cognitive levels of attainment as per Bloom's Taxonomy
	On successful completion, of course, learner/student will be able to:	
1	Describe the basic concept of Blockchain and Distributed Ledger Technology.	L1,L2
2	Interpret the knowledge of the Bitcoin network, nodes, keys, wallets and transactions	L1,L2,L3
3	Implement smart contracts in Ethereum using different development frameworks.	L1,L2,L3
4	Develop applications in permissioned Hyperledger Fabric network.	L1,L2,L3
5	Interpret different Crypto assets and Crypto currencies	L1,L2,L3
6	Analyze the use of Blockchain with AI, IoT and Cyber Security using case studies.	L1,L2,L3,L4

Prerequisite: Cryptography and Distributed Systems.

DETAILED SYLLABUS:

Sr. No.	Module	Detailed Content	Hours	CO Mapping
0	Cryptography and Distributed Systems (prerequisite)	Hash functions, Public – Private keys, SHA, ECC, Digital signatures, Fundamental concepts of Distributed systems	**02**	—-

I	Introduction to DLT and Blockchain	Introduction to Blockchain: Technical definition of Blockchain. Elements of a blockchain Features of Blockchain Type of Blockchain, What is DLT . DLT V/S BlockchainCAP theorem Byzantine Generals Problem Consensus Mechanism and its TypeCryptographic primitives and data structure used in blockchain **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	**04**	CO1
II	Bitcoin	What is Bitcoin and the history of Bitcoin, Bitcoin Transactions, Bitcoin Concepts: keys, addresses and wallets, Bitcoin Transactions, UTXO. validation of transactions, Bitcoin Keys , Addresses, ECC , Base58 , BIP-38 , Pay-to Script and Multisig Addresses, Vanity Addresses , Concept of Wallet, Wallet Technologies in Bitcoin HD wallet from Seed. Transaction Scripts and Scripts address,BitcoinMining and Difficulty levels Structure of Blocks and Blockheader and Genesis Block , linking of Block. **Bitcoin Network**: Bitcoin Core node and API, 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 Bitcoin TestnetBasics of Bitcoin Forensics: Analysis of Address and Wallet , Clustering of Addresses following Money **Self-learning Topics:** Study and compare different consensus algorithms like PoA, PoS, pBFT	**08**	CO2
III	Permissionless Blockchain: Ethereum	Introduction to Ethereum, Ethereum 1.0 and 2.0 , Turing completeness EVM and compare with bitcoinBasics of Ether Units, Ethereum Wallets Working with Metamask EOA and Contracts Transaction:: Structure of Transaction, Transaction Nonce, Transaction GAS, Recipient, Values and Data, Transmitting Values to EOA and Contracts **Smart Contracts and Solidity** Development environment and client , Basic of Solidity and Web 3Life cycle of Smart contract, Smart Contract programming using solidity, Metamask (Ethereum Wallet), Setting up development environment, Use cases	**10**	CO3

		of Smart Contract, Smart Contracts: Opportunities and Risk. **Smart Contract Deployment**: Introduction to Truffle, Use of Remix and test networks for deployment **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, RAFTDesigning Hyperledger BlockchainOther Challenges : Interoperability and Scalability of blockchain **Self-learning Topics:** Fundamentals of Hyperledger Composer	**07**	CO4
V	Crypto assets and Cryptocurrencies	ERC20 and ERC721 Tokens, comparison between ERC20 & ERC721, NFT, ICO, STO, Different Crypto currencies **Self-learning Topics:** Defi, Metaverse, Types of cryptocurrencies	**04**	CO5
VI	Blockchain Applications & case studies	Blockchain in IoT, AI, Cyber Security **Self-learning Topics:** Applications of Blockchain in various domains Education, Energy, Healthcare, real-estate, logistics, supply chain	**04**	CO6

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 TechnologyChandramouli Subramanian, Asha 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 (IA) for 20 marks:

IA will consist of Two Compulsory Internal Assessment Tests. Approximately 40% to 50% of syllabus content must be covered in First IA Test and remaining 40% to 50% of syllabus content must be covered in Second IA Test

□ **Question paper format**

Question Paper will comprise of a total of **six questions each carrying 20 marks Q.1** will be **compulsory** and should **cover maximum contents of the syllabus**

Remaining questions will be **mixed in nature** (part (a) and part (b) of each question must be from different modules. For example, if Q.2 has part (a) from Module 3 then part (b) must be from any other Module random selected from all the modules)

A total of **four questions** need to be answered.

		Teaching Scheme (Contact Hours)			Credits Assigned			
Course Code	Course Name	Theory	Practical	Tutorial	Theory	Practical & Oral	Tutorial	Total
ITL801	Blockchain Lab	--	2	--	--	1	--	01

		Examination Scheme						
Course Code	Course Name	Theory Marks				Term Work	Practical/ Oral	Total
		Internal assessment			End Sem. Exam			
		Test1	Test 2	Avg. of 2 Tests				
ITL801	Blockchain Lab	--	--	--	--	25	25	50

Lab Objectives:

Sr.No	Lab Objectives
1	To develop and deploy smart contracts on local Blockchain.
2	To deploy the smart contract on test networks.
3	To deploy and publish smart contracts on Ethereum test network.
4	To design and develop crypto currency.
5	To deploy chain code on permissioned Blockchain.
6	To design and develop a Full-fledged DApp using Ethereum/Hyperledger.

Lab Outcomes:

Sr.No	Lab Outcomes	Cognitive levels of attainment as per Bloom's Taxonomy
1	Develop and test smart contract on local Blockchain.	L3,L4
2	Develop and test smart contract on Ethereum test networks.	L3,L4
3	Write and deploy smart contract using Remix IDE and Metamask.	L4
4	Design and develop Cryptocurrency.	L4
5	Write and deploy chain code in Hyperledger Fabric.	L4
6	Develop and test a Full-fledged DApp using Ethereum/Hyperledger.	L5

Prerequisite: Programming Langauges.

DETAILED SYLLABUS:

Sr. No.	Module	Detailed Content	Hours	LO Mapping
0	Prerequisite	Java, Python, JavaScript	**02**	—
I	Local Blockchain	Introduction to Truffle, establishing local Blockchain using Truffle Mini Project: Allocation of the groups	**02**	LO1
II	Smart contracts and	Solidity programming language, chain code (Java/JavaScript/Go), deployment on Truffle local	**04**	LO2

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		Chain code	Blockchain Mini Project: Topic selection		
III	Deployment and publishing smart contracts on Ethereum test network	Ethereum Test networks (Ropsten/Gorelli/Rinkeby), deployment on test networks, Web3.js/Web3.py for interaction with Ethereum smart contract Mini Project: Topic validation and finalizing software requirements		**04**	LO3
IV	Remix IDE and Metamask	Smart contract development and deployment using Metamask and Remix Design and develop Crypto currency Mini Project: Study the required programming language for smart contract		**04**	LO4
V	Chain code deployment in Hyperledger Fabric	Chain code deployment in Hyperledger fabric Mini project: Study required front end tools		**04**	LO5
VI	Mini-project on Design and Development of a DApps using Ethereum/Hyperledger Fabric	Implementation of Mini Project 1. Design, configure and testing of mini project 2. Report submission as per guidelines		**06**	LO6

Mini project:

1. Students should carry out mini-project in a group of three/four students with a subject In-charge
2. The group should meet with the concerned faculty during laboratory hours and the progress of work discussed must be documented.
3. Each group should perform a detailed literature survey and formulate a problem statement.
4. Each group will identify the hardware and software requirement for their defined mini project problem statement.
5. Design, develop and test their smart contract/chain code.
6. Each group may present their work in various project competitions and paper presentations

Documentation of the Mini Project

The Mini Project Report can be made on following lines:
1. Abstract
2. Contents
3. List of figures and tables
4. Chapter-1 (Introduction, Literature survey, Problem definition, Objectives, Proposed Solution, Technology/platform used)
5. Chapter-2 (System design/Block diagram, Flow chart, Software requirements, cost estimation)
6. Chapter-3 (Implementation snapshots/figures with explanation, code, future directions)
7. Chapter-4 (Conclusion)
8. References

Text Books:

1. Ethereum Smart Contract Development, Mayukh Mukhopadhyay, Packt publication.
2. Solidity Programming Essentials: A Beginner's Guide to Build Smart Contracts for Ethereum and Blockchain, Modi, Packt publication.

3. Hands-on Smart Contract Development with Hyperledger Fabric V2, Matt Zand, Xun Wu and Mark Anthony Morris, O'Reilly.

References Books:

1. Mastering Blockchain, Imran Bashir, Packt Publishing
2. Introducing Ethereum and Solidity, Chris Dannen, APress.
3. Hands-on Blockchain with Hyperledger, Nitin Gaur, Packt Publishing.

Online References:

1. https://trufflesuite.com/
2. https://metamask.io/
3. https://remix.ethereum.org/
4. https://www.hyperledger.org/use/fabric

Term-Work: Term-Work shall consist of 5 experiments and Mini-Project on above guidelines/syllabus. Also, Term-work mu include at least 2 assignments and Mini-Project report.

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

(Attendance)

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

Course Code	Course Name	Teaching Scheme (Contact Hours)			Credits Assigned			
		Theory	Practical	Tutorial	Theory	Practical & Oral	Tutorial	Total
ITL802	Cloud Computing	--	2	--	--	1	--	01

Course Code	Course Name	Examination Scheme						
		Theory Marks				Term Work	Practical/ Oral	Total
		Internal assessment			End Sem. Exam			
		Test1	Test 2	Avg. of 2 Tests				
ITL802	Cloud Computing	--	--	--	--	25	25	50

Lab Objectives:

Sr.No	Lab Objectives
1	Tomakestudents familiarwith keyconceptsof virtualization.
2	Tomakestudentsfamiliarwithvariousdeploymentmodelsofcloudsuchasprivate,public,hybridandcommunity.
3	To understand the usingandadoptingappropriatetypeofcloudfor theirapplication.
4	TomakestudentsfamiliarwithvariousservicemodelssuchasIaaS,SaaS,PaaS,Securityas aService(SECaaS)andDatabaseasaService.
5	Apply the different service models for the application.
6	Tomakestudents familiar with securityand privacyissues in cloudcomputingandhow to addressthem.

Lab Outcomes:

Sr.No	Lab Outcomes	Cognitive levels of attainment as per Bloom's Taxonomy
1	Implementdifferenttypesofvirtualizationtechniques.	L1,LL3,L4
2	Analyzevariouscloudcomputingservicemodelsandimplementthemtosolvethegivenproblems.	L1,L2,L3,L4
3	Design anddeveloprealworldwebapplicationsanddeploythemoncommercialcloud(s).	L6
4	Explainmajorsecurityissues in thecloud and mechanisms toaddress them.	L1,L2,L3
5	Explorevariouscommerciallyavailablecloudservicesandrecommendtheappropriateoneforthegivenapplication.	L1,L2,L3
6	Implementtheconceptofcontainerization.	L1,L2,L3

Prerequisite: Programming Langauges, DBMS.

DETAILED SYLLABUS:

Sr. No.	Module	Detailed Content	Hours	LO Mapping
0	Prerequisite	DBMS, Programming Language.	**02**	—
I	Overview& Virtualization.	Introductionandoverviewofcloudcomputing. HostedVirtualizationusingKVM. Lab1: TostudyandimplementHostedVirtualizationusingVirtual Box &KVM. Lab2: To study and Implement Bare-metal Virtualization usingXen,HyperVor VMwareEsxi.	**04**	LO1
II	Infrastructure Services.	To study the infrastructure services using different cloud platform Lab3: To study and Implement Infrastructure as a Service usingAWS/MicrosoftAzure/Google cloud platform	**04**	LO2
III	Platform Services	To study the different platform services. Lab4: To study and Implement Platform as a Service usingAWSElasticBeanstalk/Microsoft AzureApp Service.	**03**	LO3
IV	Cloud Services	IaaS,PaaS,STaaS,DbaaS,IAMandSecurity as a Service on AWS andAzure. Lab5: Tostudyand Implement SecurityasaServiceonAWS/Azure. Lab6: TostudyandimplementIdentityandAccessManagement(IAM)practices onAWS/Azurecloud.	**04**	LO4
V	Storage Services	To study the storage services using Docker. Lab7: To study and Implement Storage as a Service using OwnCloud/AWSS3, Glaciers/ AzureStorage. Lab8: Tostudyand Implement DatabaseasaServiceonSQL/NOSQLdatabaseslike AWSRDS,AZURESQL/MongoDBLab/Firebase. Lab9: To study and Implement Containerization using Dockeron AWS/Azure/Google cloud platform**.**	**04**	LO5
VI	Kubermetes	Introduction and overview of Kubernetes. Lab10: To study and implement container orchestration usingKubernetes on AWS/Azure/Google cloud platform	**05**	LO6

Textbooks:	
1	BernardGolden,—AmazonWeb ServicesforDummies‖,JohnWiley&Sons,Inc.
2	MichaelCollier,RobinShahan,—Fundamentalsof Azure,MicrosoftAzureEssentials‖, MicrosoftPress.
3	RajkumarBuyya,ChristianVecchiola,SThamaraiSelvi,—MasteringCloudComputing‖, TataMcGraw-HillEducation.
4	BarrieSosinsky, —CloudComputingBible‖,Wileypublishing.
5	JohnPaulMueller,—AWSforAdminsfor Developers‖,JohnWiley&Sons,Inc.
6	KenCochrane,JeevaS.Chelladhurai,NeependraKhare, —DockerCookbook-Second Edition‖,Packtpublication
7	JonathanBaier,—GettingStartedwithKubernetes-SecondEdition‖,PacktPublication.

Online References:

1. https://phoenixnap.com/kb/ubuntu-install-kvm\
2. NIST Cloud Computing Security Reference Architecture
3. https://docs.citrix.com/en-us/xenserver/7-1/install.html
4. https://docs.aws.amazon.com
5. https://docs.microsoft.com/en-us/azure
6. https://docs.docker.com/get-started/
7. https://kubernetes.io/docs/home/

Term-Work: Term-Work shall consist of 10 experiments on above guidelines/syllabus. Also, Term-work must include at lea assignments.
Term Work Marks: 25 Marks (Total marks) =15 Marks (Experiments) + 5 Marks (Assignments) + 5 Marks (Attendance)

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

Course Code	Course Name	Teaching Scheme (Contact Hours)			Credits Assigned			
		Theory	Practical	Tutorial	Theory	Practical	Tutorial	Total
ITM701	Major Project – II	--	12	--	--	06	--	06

Course Code	Course Name	Examination Scheme						
		Theory Marks				Term Work	Pract. /Oral	Total
		Internal assessment			End Sem. Exam			
		Test1	Test 2	Avg.				
ITM701	Major Project – II	--	--	--	--	100	50	150

Course Objectives
1. To acquaint with the process of identifying the needs and converting it into the problem.
2. To familiarize the process of solving the problem in a group.
3. To acquaint with the process of applying basic engineering fundamentalsto attempt solutions to the problems.
4. To inculcate the process of self-learning and research.

Course Outcome: Learner will be able to…
1. Identify problems based on societal /research needs.
2. Apply Knowledge and skill to solve societal problems in a group.
3. Develop interpersonal skills to work as member of a group or leader.
4. Draw the proper inferences from available results through theoretical/ experimental/simulations.
5. Analyse the impact of solutions in societal and environmental context for sustainable development.
6. Use standard norms of engineering practices
7. Excel in written and oral communication.
8. Demonstrate capabilities of self-learning in a group, which leads to life long learning.
9. Demonstrate project management principles during project work.

Guidelines for Major Project

Students shall form a group of 3 to 4 students, while forming a group shall not be allowed less than three or more than four students, as it is a group activity.

Students should do survey and identify needs, which shall be converted into problem statement for mini proje in consultation with faculty supervisor/head of department/internal committee of faculties.

Students shall submit implementation plan in the form of Gantt/PERT/CPM chart, which will cover weekly activity of major project-I and major project-II.

A log book to be prepared by each group, wherein group can record weekly work progress, guide/supervisor can verify and record notes/comments.

Faculty supervisor may give inputs to students during major project -I & II activity;however, focus shall be o self-learning.

Students in a group shall understand problem effectively, propose multiple solution and select best possible solution in consultation with guide/ supervisor.

Students shall convert the best solution into working model using various components of their domain areas and demonstrate.

The solution to be validated with proper justification and report to be compiled in standard format University of Mumbai.

With the focus on the self-learning, innovation, addressing societal problems and entrepreneurship qu development within the students through the Major Project, it is preferable that a single project of appropriate level and quality to be carried out in two semesters by all the groups of the students. i.e. Major Project-I in semester VIIand Major Project-II in semesters VIII.

However, based on the individual students or group capability, with the mentor's recommendations, proposed Major Project adhering to the qualitative aspects mentioned above gets completed in odd semester, then that group can be allowed to Scopus paper publications in Journal/Conference or Copyright or Patent as an extension of the Major Project-1 with suitable improvements/modifications after testing and analysis in ev semester. This policy can be adopted on case by case basis.

Guidelines for Assessment of Major Project:
Term Work

1. The review/ progress monitoring committee shall be constituted by head of departments of eac institute. The progress of major project to be evaluated on continuous basis, minimum two reviews in each semester VII and VIII.
2. In continuous assessment focus shall also be on each individual student, assessment based on individual contribution in group activity, their understanding and response to questions.
3. Distribution of Term work marks for both semesters shall be as below;
   a. Marks awarded by guide/supervisor based on log book : 10
   b. Marks awarded by review committee : 10
   c. Quality of Project report : 05

Review/progress monitoring committee may consider following points for assessment based on either one yea major project as mentioned in general guidelines.

One-year project:

In semester VII entire theoretical solution shall be ready, including components/system selection and co analysis, building of working prototype. Two reviews will be conducted based on presentation given by students group.

☐ First shall be for finalization of problem and proposed solution of the problem
☐ Second shall be on readiness of working and testing of prototypeto be conducted.

In semester VIII expected work shall be procurement of testing and validation of results based on work completed in an odd semester.

☐ First review is based on improvements in testing and validation results cum demonstration for publication to be conducted.
☐ Second review shall be based on paper presentation in conference/journal or motivate fo copyright or Indian patent in last month of the said semester.

Assessment criteria of Major Project.

Major Project shall be assessed based on following criteria;

14. Quality of survey/ need identification
15. Clarity of Problem definition based on need.
16. Innovativeness in solutions
17. Feasibility of proposed problem solutions and selection of best solution
18. Cost effectiveness
19. Societal impact
20. Innovativeness
21. Cost effectiveness and Societal impact
22. Full functioning of working model as per stated requirements
23. Effective use of skill sets
24. Effective use of standard engineering norms
25. Contribution of an individual's as member or leader
26. Clarity in written and oral communication

In **one year, project**, first semester evaluation may be based on first six criteria's and remaining may be used for second semester evaluation of performance of students in mini project.

Guidelines for Assessment of Major Project Practical/Oral Examination:

Report should be prepared as per the guidelines issued by the University of Mumbai.

Major Project shall be assessed through a presentation and demonstration of working model by the project group to a panel of Internal and External Examiners preferably from industry or research organization having experience of more than five years approved by head of Institution.

Students shall be motivated to publish a paper based on the work in Scopus Conferences/Journals or copy rig or Indian Patent.

Major Project shall be assessed based on following points;

1. Quality of problem and Clarity
2. Innovativeness in solutions
3. Cost effectiveness and Societal impact
4. Full functioning of working model as per stated requirements
5. Effective use of skill sets
6. Effective use of standard engineering norms
7. Contribution of an individual's as member or leader
8. Clarity in written and oral communication
9. Publications in Sem VIII.

Course Code	Course Name	Theory	Practical	Tutorial	Theory	Practical/ Oral	Tutorial	Total
ITDO8011	Big Data Analytics	03	--	--	03	--	--	03

Course Code	Course Name	Examination Scheme							
		Theory Marks				Term Work	Practical	Oral	Total
		Internal assessment			End Sem. Exam				
		Test1	Test 2	Avg. of 2 Tests					
ITDO8011	Big Data Analytics	20	20	20	80	--	--	--	100

Course Objectives:

Sr.No	Course Objectives
1	To provide an overview of an exciting growing field of Big Data analytics.
2	To discuss the challenges traditional data mining algorithms face when analyzing Big Data.
3	To introduce the tools required to manage and analyze big data like Hadoop, NoSql MapReduce.
4	To teach the fundamental techniques and principles in achieving big data analytics with scalability and streaming capability.
5	To introduce to the students several types of big data like social media, web graphs and data streams.
6	To enable students to have skills that will help them to solve complex real-world problems in decision support.

Course Outcomes:

Sr. No	Course Outcomes	Cognitive levels of attainment as per Bloom's Taxonomy
On successful completion, of course, learner/student will be able to:		
1	Explain the motivation for big data systems and identify the main sources of Big Data in the real world.	L1,L2,L3
2	Demonstrate an ability to use frameworks like Hadoop, NOSQL to efficiently store, retrieve and process Big Data for Analytics.	L1,L2,L3
3	Implement several Data Intensive tasks using the Map Reduce Paradigm.	L1,L2,L3
4	Apply several newer algorithms for Clustering Classifying and finding associations in Big Data.	L1,L2,L3
5	Design algorithms to analyze Big data like streams, Web Graphs and Social Media data.	L6
6	Design and implement successful Recommendation engines for enterprises.	L6

Prerequisite: AI and DS

DETAILED SYLLABUS:

Sr. No.	Module	Detailed Content	Hours	CO Mapping

0	Prerequisite	Data Mining, Data Science	**02**	
I	Introduction to Big Data	Introduction to Big Data, Big Data characteristics, types of Big Data, Traditional vs. Big Data business approach, Big Data Challenges, Examples of Big Data in Real Life, Big Data Applications **Self-learning Topics:** Identification of Big Data applications and its solutions	**03**	CO1
II	Introduction to Big Data Frameworks	What is Hadoop? Core Hadoop Components; Hadoop Ecosystem; Working with Apache Spark What is NoSQL? NoSQL data architecture patterns: Key-value stores, Graph stores, Column family (Bigtable) stores, Document stores, MongoDB **Self-learning Topics:**HDFS vs GFS, MongoDB vs other NoSQL system, Implementation of Apache Spark	**06**	CO2
III	MapReduce Paradigm	MapReduce: The Map Tasks, Grouping by Key, The Reduce Tasks, Combiners, Details of MapReduce Execution, Coping With Node Failures. Algorithms Using MapReduce: Matrix-Vector Multiplication by MapReduce , Relational-Algebra Operations, Computing Selections by MapReduce, Computing Projections by MapReduce, Union, Intersection, and Difference by MapReduce, Computing Natural Join by MapReduce, Grouping and Aggregation by MapReduce, Matrix Multiplication, Matrix Multiplication with One MapReduce Step . Illustrating use of MapReduce with use of real life databases and applications. **Self-learning Topics:**Implementation of MapReduce algorithms like Word count, Matrix-Vector and Matrix-Matrix algorithm	**07**	CO3
IV	Mining Big Data Streams	The Stream Data Model: A DataStream-Management System Examples of Stream Sources, Stream Queries, Issues in Stream Processing. Sampling Data in a Stream : Sampling Techniques. Filtering Streams: The Bloom Filter Counting Distinct Elements in a Stream : The Count-Distinct Problem, The Flajolet-Martin Algorithm, Combining Estimates, Space Requirements . Counting Ones in a Window: The Cost of Exact Counts, The Datar-Gionis-Indyk, Motwani Algorithm, Query Answering in the DGIM Algorithm. **Self-learning Topics:** Streaming services like Apache Kafka/Amazon Kinesis/Google Cloud DataFlow. Standard spark streaming library. Integration with IOT devices to capture real time stream data.	**07**	CO4
V	Big Data Mining Algorithms	Frequent Pattern Mining : Handling Larger Datasets in Main Memory Basic Algorithm of Park, Chen, and Yu. The SON Algorithm and MapReduce. Clustering Algorithms: CURE Algorithm. Canopy Clustering, Clustering with MapReduce Classification Algorithms: Overview SVM classifiers, Parallel SVM, KNearest Neighbor classifications for Big Data, One Nearest Neighbour. **Self-learning Topics:** Standard libraries included with spark like graphX, MLlib	**07**	CO5

VI	Big Data Analytics Applications	**Link Analysis :** PageRank Definition, Structure of the web, dead ends, Using Page rank in a search engine, Efficient computation of Page Rank: PageRank Iteration Using MapReduce, Topic sensitive Page Rank, link Spam, Hubs and Authorities, HITS Algorithm. **Mining Social- Network Graphs :** Social Networks as Graphs, Types , Clustering of Social Network Graphs, Direct Discovery of Communities, Counting triangles using Map-Reduce. **Recommendation Engines:** A Model for Recommendation Systems, Content-Based Recommendations, Collaborative Filtering **Self-learning Topics:** Sample applications like social media feeds, multiplayer game interactions, retail industry, financial data analysis. Use case like location data, real-time stock trades, log monitoring etc	**07**	CO6

Text Books:

1. Anand Rajaraman and Jeff Ullman ―Mining of Massive Datasets‖, Cambridge University Press.
2. Alex Holmes ―Hadoop in Practice‖, Manning Press, Dreamtech Press.
3. Professional NoSQL Paperback, by Shashank Tiwari, Dreamtech Press
4. Rajkumar Buyya, ,Rodrigo N. Calheiros and Amir Vahid Dastjerdi, ―Big Data Principles and Paradigms‖, Morgan Kaufm

References Books:

1. Analytics in a Big Data World: The Essential Guide to Data Science and its Applications, Bart Baesens , WILEY Big Data Series.
2. Big Data Analytics with R and Hadoop by Vignesh Prajapati Paperback, Packt Publishing Limited
3. Hadoop: The Definitive Guide by Tom White, O'Reilly Publications

Online References:

1. https://nptel.ac.in/courses/106/104/106104189/
2. https://nptel.ac.in/courses/106106142/
3. https://nptel.ac.in/courses/106105186/

Assessment:

Internal Assessment (IA) for 20 marks:

  IA will consist of Two Compulsory Internal Assessment Tests. Approximately 40% to 50% of syllabus content must be covered in First IA Test and remaining 40% to 50% of syllabus content must be covered in Second IA Test

   Question paper format

  Question Paper will comprise of a total of **six questions each carrying 20 marks Q.1** will be **compulsory** and should **cover maximum contents of the syllabus**

  Remaining questions will be **mixed in nature** (part (a) and part (b) of each question must be from different modules. For example, if Q.2 has part (a) from Module 3 then part (b) must be from any other Module randomly selected from all the modules)

A total of **four questions** need to be answered.

Course Code	Course Name	Theory	Practical	Tutorial	Theory	Practical/Oral	Tutorial	Total
ITDO8012	Reinforcement Learning	03	--	--	03	--	--	03

Course Code	Course Name	Examination Scheme							
		Theory Marks				Term Work	Practical	Oral	Total
		Internal assessment			End Sem. Exam				
		Test1	Test 2	Avg. of 2 Tests					
ITDO8012	Reinforcement Learning	20	20	20	80	--	--	--	100

Course Objectives:

Sr.No	Course Objectives
1	Define the key features of reinforcement learning that distinguishes it from AI and non-interactive machine learning.
2	Introduce to statistical learning techniques where an agent explicitly takes actions and interacts with the world.
3	Implement in code common RL algorithms.
4	Describe multiple criteria for analyzing RL algorithms & evaluate algorithms on these metrics: e.g. regret, sample complexity, computational complexity, empirical performance, convergence, etc.
5	Know how to implement dynamic programming as an efficient solution approach to an industrial control problem.
6	Explore solutions to the Exploration-Exploitation Dilemma.

Course Outcomes:

Sr. No	Course Outcomes	Cognitive levels of attainment as per Bloom's Taxonomy
On successful completion, of course, learner/student will be able to:		
1	Learn how to define RL tasks and the core principles behind the RL, including policies, value functions, deriving Bellman equations.	L1,L2
2	Evaluate work with tabular methods to solve classical control problems.	L1,L2,L3
3	Apply Markov Decision Processes to solve real-world problems.	L1,L2,L3
4	Understand the dynamic programming for policy Evaluation.	L1,L2
5	Implement reinforcement learning problems based on averaging sample returns using Monte Carlo method.	L1,L2,L3
6	Recognize current advanced techniques and applications in RL.	L1,L2,L3

DETAILED SYLLABUS:

Sr. No.	Module	Detailed Content	Hours	CO Mapping

0	Prerequisite	Probability distributions and expected values, and basic linear algebra (e.g., inner products).	**02**	
I	Introduction to Reinforcement Learning	**Reinforcement Learning**: Key features and Elements of RL, Types of RL, rewards. **Reinforcement Learning Algorithms**: Q-Learning, State Action Reward State Action (SARSA), **Self-learning Topics:** Deep Q Neural Network (DQN)**,** Applications of RL	**04**	CO1
II	Bandit problems and online learning:	An n-Armed Bandit Problem, Action-Value Methods Tracking a Nonstationary Problem, Optimistic Initial Values Upper-Confidence-Bound Action Selection Gradient Bandits **Self-learning Topics:** Associative Search (Contextual Bandits)	**07**	CO2
III	Markov Decision Processes:	The Agent–Environment Interface, Goals and Rewards, Returns, Markov properties, Markov Decision Process, Value Functions and Optimal Value Functions, **Self-learning Topics:** Optimality and Approximation	**07**	
IV	Dynamic Programming:	Policy Evaluation (Prediction), Policy Improvement, Policy Iteration, Value Iteration, Asynchronous Dynamic Programming, Generalized Policy Iteration **Self-learning Topics:**	**07**	CO4
V	Monte Carlo Methods and Temporal-Difference Learning	Monte Carlo Prediction, Monte Carlo Estimation of Action Values, Monte Carlo Control, TD Prediction, TD control using Q-Learning **Self-learning Topics:** Off -policy Prediction via Importance Sampling	**07**	CO5
VI	Applications and Case Studies	Elevator Dispatching, Dynamic Channel Allocation, Job-Shop Scheduling **Self-learning Topics:** Study of applications.	**05**	CO6

Text Books:

1. Reinforcement Learning: An Introduction, by Richard S. Sutton and Andrew G. Barto
2. Alessandro Palmas, Dr. Alexandra Galina Petre, Emanuele Ghelfi, The Reinforcement Learning Workshop: Learn how to Apply Cutting-edge Reinforcement Learning Algorithms to a Wide Range of Control Problems, 2020 Packt publishing.
3. Phil Winder, Reinforcement Learning Industrial Applications with Intelligent Agents, O'Reilly
4. Dr Engr S M Farrukh Akhtar, Practical Reinforcement Learning, Packt Publishing, 2017.

References Books:

1. Maxim Lapan, Deep Reinforcement Learning Hands-On: Apply modern RL methods, with deep Q-networks, iteration, policy gradients, TRPO, AlphaGo Zero.
2. Csaba Szepesv´ari, Algorithms for Reinforcement Learning, Morgan & Claypool Publishers
3. Alberto Leon-Garcia, Probability, Statistics and Random Processes for Electrical Engineering, Third Edition, Education, Inc.

Assessment:
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A total of **four questions** need to be answered.

Course Code	Course Name	Theory	Practical	Tutorial	Theory	Practical/ Oral	Tutorial	Total
ITDO8013	Theory Course	03	--	--	03	--	--	03

Course Code	Course Name	Examination Scheme							
		Theory Marks				Term Work	Practical	Oral	Total
		Internal assessment			End Sem. Exam				
		Test 1	Test 2	Avg. of 2 Tests					
ITDO8013	Simulation and Modeling	20	20	20	80	--	--	--	100

Course Objectives:

Sr.No	Course Objectives
1	To introduce the discrete event simulation systems.
2	To discuss the modeling techniques of entities, queues, resources and entity transfers in the discrete event environment.
3	To formulate and apply the statistical models in simulation and queuing theory.
4	To gain knowledge of random numbers, random variates and various statistical tests on random numbers.
5	To formulate and build valid models and perform simulation analysis of the system and analyze results properly.
6	To familiarize with various applications of Simulation.

Course Outcomes:

Sr. No	Course Outcomes	Cognitive levels of attainment as per Bloom's Taxonomy
On successful completion, of course, learner/student will be able to:		
1	Understand the meaning of simulation and Identify the common applications of discrete-event system simulation.	L1,L2
2	Practice formulation and modeling skills.	L1,L2,L3
3	Analyze events and inter-arrival time, arrival process, queuing strategies, resources, and disposal of entities using statistical models.	L1,L2,L3,L4
4	Understand pseudo-random numbers and perform statistical tests to measure the quality of pseudo-random numbers.	L1,L2
5	Apply different distributions to fit the collected data and describe the process verification and validation of simulation models.	L1,L2,L3
6	Describe various applications of simulation.	L1,L2

Prerequisite: Probability and Statistics

DETAILED SYLLABUS:

Sr. No.	Module	Detailed Content	Hours	CO Mapping
0	Prerequisite	Concepts of Probability: Probability mass function, Probability density function, Mean, Variance, Median, Mode	**02**	-
I	Introduction to Simulation	Simulation Definition, When Simulation is an appropriate tool and when it is not, Advantages and disadvantages of simulation, Areas of application of simulation, System and its types, Models and its types, Steps in simulation study **Self-learning Topics:** Monte Carlo simulation	**04**	CO1
II	Simulation Examples and General Principles	Simulation Process, Simulation of Single-server and multi-server queueing systems, Simulation of (M, N) Inventory and Newspaper Seller Problem, Simulation of Lead-time Demand Concepts in Discrete Event Simulation, Event Scheduling Algorithm, Manual Simulation of Single Server and Dump Truck Problem using Event Scheduling Algorithm **Self-learning Topics:** Simulation of Reliability Problem, Process Interaction Approach in Simulation.	**08**	CO2
III	Mathematical ,Statistical and Queueing Models in Simulation	Statistical Models: Terminology and concepts, Useful statistical models, Discrete Distributions (Bernoulli's trial, Binomial and Negative Binomial, Poisson Distributions), Continuous Distributions (Exponential, Uniform, Erlang, Triangular and Normal Distributions), Poisson Process, Queueing Models: Queuing Notations, Long Run Performance Measures, M/M/1 and M/G/1 Queueing Systems **Self-learning Topics:**	**08**	CO3
IV	Random Numbers and Variates	Random Number Generation: Why are random numbers required in simulation? Properties of random numbers, Linear Congruential Method to generate Random Numbers, Test for Uniformity: Kolmogorov-Smirnov, Chi-Square, Test for Independence: Runs up and runs down, Runs above and below mean, Poker test), Random Variate Generation: Inverse Transform Technique, Direct Transformation for Normal and Lognormal distribution, Acceptance Rejection Technique **Self-learning Topics:** Tests for Autocorrelation	**08**	CO4
V	Analysis of Simulation Data	Steps in Input Modeling, Goodness-of-fit tests, Selecting Input Model without data, Multivariate and Time Series Models, Model Building verification and validation, Verification of simulation models, Naylor and Finger Approach for calibration and Validation of simulation models **Self-learning Topics:** Input-Output Validation: Using Historical Input Data	**06**	CO5

| VI | Applications of Simulation | High-Level Computer-System Simulation and Memory Simulation, Simulation of Manufacturing and Material Handling Systems
Self-learning Topics: Simulation of Computer Networks | **03** | CO6 |

Text Books:
1. J. Banks, J. S. Carson, B. L. Nelson and D. M. Nicol (2001), Discrete Event System Simulation, 3rd Edition, Prentice-Hall.
2. J. Banks, J. S. Carson, B. L. Nelson and D. M. Nicol (2001), Discrete Event System Simulation, 4th Edition, Prentice-Hall.

References Books:

1. A. M. Law and W. D. Kelton (2000), Simulation Modeling and Analysis, 4th Ed, McGraw Hill.
2. K. S. Trivedi (2001), Probability and Statistics with Reliability, Queuing and Computer Science Applications, Eastern Economy Edition, Prentice-Hall (India).
3. Banks C M, Sokolowski J A, Principles of Modeling and Simulation, Wiley
4. Geoffrey Gordon, System Simulation, EEE
5. Narsing Deo, System Simulation with Digital Computer; PHI

Online References:

1. https://www.udemy.com/course/discrete-event-system-simulation/
2. https://www.tutorialspoint.com/modelling_and_simulation/index.htm

Assessment:
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A total of **four questions** need to be answered.

Course Code	Course Name	Theory	Practical	Tutorial	Theory	Practical /Oral	Tutorial	Total
ITDO8014	Knowledge Management	03	--	--	03	--	--	03

Subject Code	Subject Name	Examination Scheme							
		Theory Marks				Term Work	Practical	Oral	Total
		Internal assessment			End Sem. Exam				
		Test1	Test 2	Avg. of 2 Tests					
ITDO8014	Knowledge Management	20	20	20	80	--	--	--	100

Course Objectives:

Sr.No	Course Objectives
1	Establish a foundation of key terms and concepts, historical events and contributions, organizational benefits, and guiding principles on which to build greater understanding of knowledge management.
2	Appreciate the role and use of knowledge for individuals, as well as organizations and institutions.
3	Increase information and understanding about knowledge transfer using low- and high technology strategies.
4	Explore the future of knowledge management and its influence on our jobs, communities, and society.
5	Explore different tools for knowledge codification and knowledge transfer.
6	Discuss impact of knowledge management on product, people and organization, etc. with qualitative and quantitative measures.

Course Outcomes:

Sr. No	Course Outcomes	Cognitive levels of attainment as per Bloom's Taxonomy
	On successful completion, of course, learner/student will be able to:	
1	Discuss KM, learning organizations, intellectual capital and related terminologies in clear terms and understand the role of knowledge management in organizations.	L1,L2,L3
2	Demonstrate an understanding of the history, concepts, and the antecedents of management of knowledge and describe several successful knowledge management systems.	L1,L2,L3
3	Evaluate the impact of technology including telecommunications, networks, and Internet/intranet role in managing knowledge.	L4,L5
4	Discuss new jobs, roles and responsibilities resulting from the New or Knowledge Economy Ponder KM's current and future impact on individuals, organizations and society at large.	L1,L2,L3
5	Apply different tools for knowledge transfer and Business Intelligence in knowledge sharing.	L1,L2,L3
6	Analyze different modes of knowledge conversion and testing tools for knowledge codification.	L1,L2,L3,L4

Prerequisite: An introductory course in IT/ IS

DETAILED SYLLABUS:

University of Mumbai, B. E. (Information Technology), Rev 2016   295

Sr. No.	Module	Detailed Content	Hours	CO Mapping
0	Prerequisite	Meaning of data, information, knowledge and expertise Meaning of epistemology, Types of Knowledge -Subjective & Objective views of knowledge, procedural Vs. declarative, tacit Vs. explicit, general Vs. specific.	**02**	
I	Introduction to Knowledge Management	What is Knowledge? Data, information and knowledge, Knowledge management process, Types of expertise – associational, motor skill, theoretical Characteristics of knowledge – explicitness, codifiability, teachability, specificity, Reservoirs of knowledge, Meaning of Knowledge Management, Forces Driving Organizational issues in KM, KM Systems & their role, Relevance of KM in today's dynamic & complex environment, Future of Knowledge Management **Self-Learning Topics:** Study the various KM process.	**07**	**CO1**
II	Knowledge management system life cycle	Challenges in Building KM Systems – Conventional versus KM System Life Cycle (KMSLS) – Knowledge Creation and Knowledge Architecture – Nonaka's Model of Knowledge Creation and Transformation, Knowledge Architecture. **Self-Learning Topics:** Case study for KMSLS.	**06**	**CO2**
III	KM Solutions for capture, sharing & applications	KM Processes, KM Systems, Mechanisms & Technologies, Knowledge Capturing Techniques: Brain Storming – Protocol Analysis – Consensus Decision Making – Repertory Grid- Concept Mapping –Blackboarding, Nominal Group Technique, Delphi method. **Self-Learning Topics:** Study various technologies used in KM in industry.	**06**	**CO5**
IV	Knowledge codification	Modes of Knowledge Conversion – Codification Tools and Procedures – Knowledge Developer's Skill Sets – System Testing and Deployment – Knowledge Testing –Approaches to Logical Testing, User Acceptance Testing – KM System Deployment Issues – User Training – Post implementation. **Self-Learning Topics:** Study different tools for testing for KM.	**06**	**CO6**
V	Knowledge transfer and sharing	Transfer Methods – Role of the Internet – Knowledge Transfer in e-world – KM System Tools – Neural Network – Association Rules – Classification Trees – Data Mining and Business Intelligence – Decision Making Architecture – Data Management – Knowledge Management Protocols – Managing Knowledge Workers. **Self-Learning Topics:** Case study for transfer methods in KM.	**06**	**CO3**
VI	KM Impact	Dimensions of KM Impact – People, Processes, Products & Organizational Performance Factors influencing impact – universalistic & contingency views Assessment of KM Impact – Qualitative & quantitative measures, Identification of appropriate	**06**	**CO4**

		KM solutions, Competing with Business Analytics, Caveats for managing Knowledge and Business Intelligence, Corporate social Responsibility, Ethical Legal and Managerial Issues: PAPA, Security and controls. **Self-Learning Topics:** Case study on KM impact.		

Text Books:

1. Irma Becerra-Fernandez, Avelino Gonzalez, Rajiv Sabherwal (2004). Knowledge Management Challenges, Solutions and Technologies. Prentice Hall. ISBN: 0-13-109931-0.
2. Elias M. Awad, Hassan M. Ghaziri (2004). Knowledge Management. Prentice Hall. ISBN: 0-13- 034820-1
3. Donald Hislop, Knowledge Management in Organizations, Oxford 2nd Edition. Ian Watson (2002).
4. Shelda Debowski, Knowledge Management, Wiley India Edition
5. Keri E Pearlson, Carol S. Saunders, Strategic Management of Information System, Wiley India Edition
6.

References Books:

1. Madanmohan Rao (2004). Knowledge Management Tools and Techniques: Practitioners and Experts Evaluate Solutions. Butterworth-Heinemann. ISBN: 0750678186.
2. Stuart Barnes (Ed.) (2002). Knowledge Management Systems Theory and Practice. Thomson Learning.
3. Kimiz Dalkir, Knowledge Management in Theory and Practice, Elsevier, Butterworth Hinemann.
4. Applying Knowledge Management: Techniques for Building Corporate Memories. Morgan Kaufmann. ISBN: 1558607609.

Online resources:

1. https://onlinecourses.nptel.ac.in/noc19_mg33/preview
2. https://www.udemy.com/course/knowledge-management/
3. https://www.coursehero.com/file/70272191/km-pdf-imppdf/
4. http://cs.unibo.it/~gaspari/www/teaching/slides_KM6.pdf

Assessment:
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A total of **four questions** need to be answered.

Course Code	Course Name	Theory	Practical	Tutorial	Theory	Practical /Oral	Tutorial	Total
ITDO8021	User Interface Design	03	--	--	03	--	--	03

Course Code	Course Name	Examination Scheme							
		Theory Marks				Term Work	Practical	Oral	Total
		Internal assessment			End Sem. Exam				
		Test1	Test 2	Avg. of 2 Tests					
ITDO8021	User Interface Design	20	20	20	80	--	--	--	100

Course Objectives:

Sr.No	Course Objectives
1	To stress the importance of good interface design.
2	To understand the importance of human psychology as well as social and emotional aspect in designing good interfaces.
3	To learn the techniques of data gathering, establishing requirements, analysis and data interpretation.
4	To learn the techniques for prototyping and evaluating user experiences.
5	To understand interaction design process and evaluate design.
6	To bring out the creativity in each student – build innovative applications that are usable, effective and efficient for intended users.

Course Outcomes:

Sr. No	Course Outcomes	Cognitive levels of attainment as per Bloom's Taxonomy
On successful completion, of course, learner/student will be able to:		
1	Identify and criticize bad features of interface designs.	L1,L2,L3
2	Predict good features of interface designs.	L1,L2,L3
3	Illustrate and analyze user needs and formulate user design specifications.	L1,L2,L3
4	Interpret and evaluate the data collected during the process.	L1,L2,L3
5	Evaluate designs based on theoretical frameworks and methodological approaches.	L1,L2,L3,L4,L5
6	Apply better techniques to improve the user interaction design interfaces.	L1,L2,L3

Prerequisite: Software Engineering.

DETAILED SYLLABUS:

Sr. No.	Module	Detailed Content	Hours	CO Mapping
0	Prerequisite	Software Engineering concepts and any programming Language **Self-learning Topics:** Web design languages	02	NA
I	Introduction to Interaction Design	Good and Poor Design, What is Interaction Design, The User Experience, The Process Interaction Design, Interaction Design and User Experience, Necessity of UI/UX **Self-learning Topics:** Study of Various interactive day to day application	05 Of the	CO1
II	Understanding and Conceptualizing Interaction Cognitive aspects and Social, Emotional Interaction	Understanding the Problem Space and Conceptualizing Design, Conceptual Model, Interface Types, Cognitive aspects, Social Interaction and the Emerging Social Phenomena, Emotions and the User Experience, Expressive and Frustrating Interfaces, Persuasive Technologies **Self-learning Topics:** Study of Various interactive Interface Types	05	CO2
III	Data Gathering, Establishing Requirements, Analysis, Interpretation and Presentation	Establishing Requirements, Five Key Issues, Techniques for Data Gathering, Data Analysis Interpretation and Presentation, Task Description and Task Analysis **Self-learning Topics:** Any case study of how to gather requirements .(eq.BE Project)	08	CO3
IV	Process of Interaction Design, Prototyping, Construction.	Interaction Design Process, Prototyping and Conceptual Design, Interface Metaphors and Analogies **Self-learning Topics:** Study of two websites with usability concepts.	07	CO4 / CO5
V	Design rules and Industry standards	Design principles, Principles to support Usability, Standards and Guidelines, Golden rules and Heuristics, ISO/IEC standards .The 15 Rules Every UI/UX Designer Should Know . **Self-learning Topics:** Study experiments on industry standards and design principles. principles.https://xd.adobe.com/ideas/career-tips/15-rules-every-ux-designer-know/	07	CO5

| VI | Evaluation Techniques and Framework | The Why, What, Where and When of Evaluation, Types of Evaluation, case studies, DECIDE Framework, Usability Testing, conducting experiments, Field studies, Heuristic Evaluation and walkthroughs, Predictive models. **Self-learning Topics:** Evaluation of any GUI with usability principles. | 05 | CO5/ CO6 |

Text Books:

1. Interaction Design, by J. Preece, Y. Rogers and H. Sharp. ISBN 0-471-49278-7.
2. Human Computer Interaction, by Alan Dix, Janet Finlay, Gregory D Abowd, Russell Beale
3. Alan Cooper, Robert Reimann, David Cronin, ―About Face3: Essentials of Interaction design‖, Wiley publication.
4. Wilbert O. Galitz, ―The Essential Guide to User Interface Design‖, Wiley publication.

References Books:

1. The UX Book, by Rex Hartson and Pardha S Pyla
2. Donald A. Norman, ―The design of everyday things‖, Basic books.
3. Jeff Johnson, ―Designing with the mind in mind‖, Morgan Kaufmann Publication.
4. UI Design: Key to captivate User Understanding, by Nilakshi Jain, Dhananjay Kalbande

Online References:

1. https://onlinecourses.nptel.ac.in/noc21_ar05/preview
2. https://nptel.ac.in/courses/124/107/124107008/
3. https://nptel.ac.in/noc/courses/noc19/SEM1/noc19-ar10/
4. https://nptel.ac.in/courses/107/103/107103083/
5. https://www.youtube.com/watch?v=6C2Ye1makdY&list=PLW-zSkCnZ-gD5TDfs1eL5EnH2mQ0f9g6B
6. https://xd.adobe.com/ideas/process/

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A total of **four questions** need to be answered.

Course Code	Course Name	Theory	Practical	Tutorial	Theory	Practical/ Oral	Tutorial	Total
ITDO8022	Robotics	03	--	--	03	--	--	03

Course Code	Course Name	Examination Scheme							
		Theory Marks				Term Work	Practical	Oral	Total
		Internal assessment			End Sem. Exam				
		Test1	Test 2	Avg. of 2 Tests					
ITDO8022	Robotics	20	20	20	80	--	--	--	100

Course Objectives:

Sr.No.	Course Objectives
1	Learn the basic concepts of Robot.
2	Learn the concepts of Kinematics of Robotics.
3	Learn the different types of Actuators and Sensors in Robot Designing.
4	Learn the concepts of Motions, Velocities and Dynamic Analysis of Force.
5	Learn the concepts of Trajectory and Motion Planning.
6	Learn the different Programming Languages to program Robot.

Course Outcomes:

Sr. No	Course Outcomes	Cognitive levels of attainment as per Bloom's Taxonomy
On successful completion, of course, learner/student will be able to:		
1	Understand different types of robot, its characteristics and applications.	L1,L2
2	Analyse kinematics parameters of robotic manipulator.	L1,L2,L3,L4
3	Identify actuators, sensors and control of a robot for different applications.	L1,L2,L3
4	Apply the differential relationships of motion, velocities and dynamic analysis of force.	L1,L2,L3
5	Apply the concept of trajectory and motion planning in robot programming.	L1,L2,L3
6	Use robot programming languages and acquire skills to program robots.	L1,L2,L3

Prerequisite: Mathematical concepts of Geometry, Linear Algebra, Calculus, Basic Electronics

DETAILED SYLLABUS:

Sr. No.	Module	Detailed Content	Hours	CO Mapping
0	Prerequisite	Homogenous Coordinate System, Matrix Representation and its Operations, Vector	**02**	--

		Algebra: Dot and Cross Products, Orthogonal and Orthonormal Vectors		
I	Introduction and Fundamentals of Robotics	Automation and its types, definition of Robotics and a Robot, History of Robotics, Advantages and Disadvantages of Robot, Robotic Manipulators, Robot Motions, Robot Anatomy, Links and Joints, Classification of Robots, Specification of Robot, Applications of Robots **Self-learning Topics:** Robot Coordinate System, Economic and Social Aspects of Robotics	04	CO1
II	Direct and Inverse Kinematics	Homogeneoustransformationmatrices, Inverse transformationmatrices, Forward and inverse kinematic equations for position and orientation, Denavit-HartenbergRepresentationof Forward Kinematic Equations of Robots, The Inverse Kinematic Solution of Robots, Case Studies: Three Axes Planar Articulated Robot Arm (Mini-Drafter) and Four Axes Adept-1 SCARA robot **Self-learning Topics:** Study of Five Axes Rhino XR- Robot Arm and Six Axes Articulated Intelledex 660 Robot Arm	08	CO2
III	Actuators and Sensors	Characteristics of Actuating Systems, Comparison of Actuating Systems, Hydraulic Devices, Pneumatic Devices, Electric Motors, Magnetostrictive Actuators, Sensor Characteristics, Position Sensors, Velocity Sensors, Acceleration Sensors, Force and Pressure Sensors, Torque Sensors, Light and Infrared Sensors, Touch and Tactile Sensors, Proximity Sensors, Sniff Sensors, Vision Systems, Voice Synthesizer **Self-learning Topics:** Microprocessor Control of Electric Motors, Microswitches, Range Finders, Voice Recognition Devices	06	CO3
IV	Motions, velocities and dynamic analysis of force	Differential relationship, Jacobian, Differential motions of a frame and robot, Inverse Jacobian, Lagrangian mechanics, Moments of Inertia, Dynamic equations of robots, Transformation of forces and moment between coordinate frames **Self-learning Topics:** Static Force Analysis of Robots	08	CO4
V	Trajectory and Motion Planning	Trajectory planning, Joint-space trajectory planning, Cartesian-space trajectories, Concept of motion planning, Bug Algorithms – Bug1, Bug2, Tangent Bug **Self-learning Topics:** Case Study based on real life application of motion planning (eg. Chess Game, Robotic Race, etc.)	05	CO5
VI	Introduction to Robot Programming	Definition of Robot Program, Robot Programming Techniques like Online programming, Lead-through programming, Walk-through programming, Offline programming, Task programming, Motion Programming, Robotic Programming Language: Overview, Requirements for Standard Robot Language, Introduction to Robot Languages like AL, AML,	06	CO6

		RAIL, RPL, VAL, etc. **Self-learning Topics:** Example of Robot Program using VAL.		

Text Books:

1. Robert Shilling, ―Fundamentals of Robotics-Analysis and control‖, PHI, 2003.
2. Saeed B. Niku, ―Introduction to Robotics Analysis, Systems, Applications‖, 3rd Edition, Wiley, 2019.
3. Saha, S.K., ―Introduction to Robotics‖, 2nd Edition, McGraw-Hill Higher Education, New Delhi, 2014.
4. Ashitava Ghoshal, ―Robotics-Fundamental Concepts and Analysis‖, Oxford University Press, Sixth impression, 2010
5. Mukherjee S., ―Robotics Process Automation‖, 1st Edition, Khanna Publishing House, New Delhi, 2020.

References Books:

1. John J. Craig, ―Introduction to Robotics – Mechanics & Control‖, 3rd Edition, Pearson Education, India, 2009
2. Mark W. Spong & M. Vidyasagar, ―Robot Dynamics & Control‖, Wiley India Pvt. Ltd., 2004
3. Aaron Martinez & Enrique Fernandez, ―Learning ROS for Robotics Programming‖, 1st Edition, Shroff Publishers, 2013
4. Howie Choset, Kevin M. Lynch, Seth Hutchinson, George Kantor, Wolfram Burgard, Lydia E. Kavraki and Sebastian Thrun, ―Principles of Robot Motion –Theory, Algorithms and Implementations‖, Prentice-Hall of India, 2005
5. Fu, Gonzalez, Lee, ―Robotics: Control, Sensing, Vision and Intelligence‖, 3rd Edition, Mc Graw Hill, India.

Online References:

1. https://swayam.gov.in/nc_details/NPTEL
2. https://www.udemy.com/course/robotics-course/
3. https://www.coursera.org/courses?query=robotics

Assessment:
Internal Assessment (IA) for 20 marks:

      IA will consist of Two Compulsory Internal Assessment Tests. Approximately 40% to 50% of syllabus content must be covered in First IA Test and remaining 40% to 50% of syllabus content must be covered in Second IA Test

   Question paper format

      Question Paper will comprise of a total of **six questions each carrying 20 marks Q.1** will be **compulsory** and should **cover maximum contents of the syllabus**

      Remaining questions will be **mixed in nature** (part (a) and part (b) of each question must be from different modules. For example, if Q.2 has part (a) from Module 3 then part (b) must be from any other Module randomly selected from all the modules)

A total of **four questions** need to be answered.

Course Code	Course Name	Theory	Practical	Tutorial	Theory	Practical/ Oral	Tutorial	Total
ITDO8023	ERP	03	--	--	03	--	--	03

Course Code	Course Name	Examination Scheme							
		Theory Marks				Term Work	Practical	Oral	Total
		Internal assessment			End Sem. Exam				
		Test1	Test 2	Avg. of 2 Tests					
ITDO8023	ERP	20	20	20	80	--	--	--	100

Course Objectives:

Sr.No.	Course Objectives
1	To learn the basic concepts of ERP.
2	To learn different technologies used in ERP.
3	To learn the concepts of ERP Manufacturing Perspective and ERP Modules.
4	To learn what are the benefits of ERP.
5	To study and understand the ERP life cycle.
6	To learn the different tools used in ERP.

Course Outcomes:

Sr. No	Course Outcomes	Cognitive levels of attainment as per Bloom's Taxonomy
On successful completion, of course, learner/student will be able to:		
1	Understand the basic concepts of ERP.	L1,L2
2	Identify different technologies used in ERP.	L1,L2,L3
3	Understand and apply the concepts of ERP Manufacturing Perspective and ERP Modules.	L1,L2
4	Discuss the benefits of ERP.	L1,L2,L3
5	Understand and implement the ERP life cycle.	L1,L2
6	Apply different tools used in ERP.	L1,L2,L3

Prerequisite: Basics of software**.**

DETAILED SYLLABUS:

Sr. No.	Module	Detailed Content	Hours	CO Mapping
0	Prerequisite	Basics of software.	**02**	--

I	Introduction to ERP	Enterprise – An OverviewIntegrated Management Information, Business Modeling,Integrated Data Model **Self-Learning Topics:** Study of advantages of ERP.	**04**	CO1
II	ERP Technologies	Business ProcessingReengineering(BPR), Data Warehousing, Data Mining, On-lineAnalytical Processing(OLAP),SupplyChain Management (SCM),Customer RelationshipManagement(CRM), MIS - Management Information System,DSS - Decision Support System,EIS - Executive InformationSystem **Self-Learning Topics:** Study different ERP technologies.	**06**	CO2
III	ERP Manufacturing Perspective and ERP Modules	MRP - Material Requirement Planning, BOM - Bill Of Material, MRP - Manufacturing Resource Planning, DRP – Distributed Requirement Planning, PDM - Product Data Management. Finance, Plant Maintenance, Quality Management, Materials Management. **Self-Learning Topics:** Study different ERP modules.	**08**	CO3
IV	Benefits of ERP	Reduction of Lead-Time, On-timeShipment, Reduction in CycleTime, Improved Resource Utilization, Better CustomerSatisfaction, Improved SupplierPerformance, Increased Flexibility,Reduced Quality, Costs, Improved Information Accuracy and Design-making Capability. **Self-Learning Topics:** Study of benefits of ERP for real time application.	**08**	CO4
V	ERP Life cycle	Pre-evaluation Screening, PackageEvaluation, Project Planning Phase,Gap Analysis, Reengineering,Configuration, Implementation Team Training, Testing, GoingLive, End-user Training, Post-implementation (Maintenance mode). **Self-Learning Topics:** ERP testing tools.	**05**	CO5
VI	E-Commerce to E-business	E-Business structural transformation,Flexible Business Design, CustomerExperience,Create the new techo enterprise,New generation e-business leaders, memo to CEO, Empower your customer, Integrate Sales and Service, Integrated Enterprise applications. Enterprise resource planning the E-business Backbone Enterprise architecture, planning, ERP usage in Real world, ERP Implementation. **Self-Learning Topics:** ERP Applications.	**06**	CO6

Text Books:

1. Enterprise Resource Planning - Alexis Leon, Tata McGraw Hill.
2. Enterprise Resource Planning – Diversified by Alexis Leon, TMH.
3. Enterprise Resource Planning - Ravi Shankar & S. Jaiswal , Galgotia.

References Books:

1. Guide to Planning ERP Application, Annetta Clewwto and Dane Franklin, McGRaw-Hill,1997
2. The SAP R/3 Handbook, Jose Antonio, McGraw – Hill
3. E-Business Network Resource planning using SAP R/3 Baan and Peoplesoft : A PracticalRoadmap For Success By Dr. Rav Kalakota

Online References:

1. https://www.udemy.com/
2. https://www.sap.com/
3. www.oracle.com

Assessment:
Internal Assessment (IA) for 20 marks:

IA will consist of Two Compulsory Internal Assessment Tests. Approximately 40% to 50% of syllabus content must be covered in First IA Test and remaining 40% to 50% of syllabus content must be covered in Second IA Test

 Question paper format

Question Paper will comprise of a total of **six questions each carrying 20 marks Q.1** will be **compulsory** and should **cover maximum contents of the syllabus**

Remaining questions will be **mixed in nature** (part (a) and part (b) of each question must be from different modules. For example, if Q.2 has part (a) from Module 3 then part (b) must be from any other Module random selected from all the modules)

A total of **four questions** need to be answered.

Course Code	Course Name	Theory	Practical	Tutorial	Theory	Practical /Oral	Tutorial	Total
ITDO8024	Cloud Computing and Services	03	--	--	03	--	--	03

Course Code	Course Name	Examination Scheme							
		Theory Marks				Term Work	Practical	Oral	Total
		Internal assessment			End Sem. Exam				
		Test1	Test 2	Avg. of 2 Tests					
ITDO8024	Cloud Computing and Services	20	20	20	80	--	--	--	100

Course Objectives:

Sr.No	Course Objectives
1	Understand and analyze the basics of cloud computing, service models, deployment models and architecture.
2	Define and understand the concept of virtualization and related technologies.
3	Understand the different cloud computing services and their relevance's.
4	Describe the various services provided by Amazon Web Services cloud platform.
5	Understand and analyze the functionality of Openstack cloud platform & Severless computing.
6	Describe the aspects of Security & Privacy in cloud computing.

Course Outcomes:

Sr. No	Course Outcomes	Cognitive levels of attainment as per Bloom's Taxonomy
On successful completion, of course, learner/student will be able to:		
1	Explain the basics concepts of cloud computing like service models, deployment models and its architecture.	L1,L2,L3
2	Describe and apply virtualization in cloud computing.	L1,L2,L3
3	Use and Analyze different cloud computing services.	L1,L2,L3,L4
4	Understand and apply various services provided by Amazon Web Services cloud platform.	L1,L2,L3
5	Discuss the functionality of Openstack cloud platform & Severless computing.	L1,L2,L3
6	Recognize and examine the security and privacy concerns in cloud computing.	L1,L2,L3

Prerequisite: Computer Network, Operating System.

DETAILED SYLLABUS:

Sr. No.	Module	Detailed Content	Hours	CO Mapping
0	Prerequisite	Concepts of Computer Network, Network Security and Operating System.	**02**	
I	Introduction to cloud computing	Introduction to cloud computing, need for cloud computing and its components, cloud & other similar configurations, cloud types: NIST and Cloud Cube Model, characteristics of cloud computing, deployment models, service models, advantages and disadvantages of Cloud Computing. **Self-learning Topics:** Study the recent trends in cloud computing architectures and related technologies.	**06**	**CO 1**
II	Virtualization	Characteristics of virtualized environment, structures of virtualization, implementation levels of virtualization, mechanisms of virtualization, pros and cons of virtualization, virtualization vs cloud computing, Xen and KVM architecture. **Self-learning Topics:** Comparison between different virtualization platforms.	**06**	**CO 2**
III	Cloud Computing Services	SPI Model of Cloud computing, Everything as a Service (XaaS): Database as a Service, Storage as a Service, Security as a Service, Collaboration as a Service, Monitoring as a Service, Network as a Service, Disaster Recovery as a service, Identity management as a Service, Analytics as a Service and Backup as a Service. **Self-learning Topics:** Study of different cloud computing platforms providing XaaS services.	**04**	**CO 3**
IV	Amazon Web Service Cloud Platform	Introduction to the AWS Cloud, AWS core services by categories. Compute Service: Introduction to EC2, EC2 Instances, EC2 Amazon Machine Images, Instance Types, Instance Lifecycle. Storage Service: Introducing S3, working with Buckets, setting bucket security, S3 event and notification, bucket properties, working with Elastic Block Store Volumes, Object Storage Vs Block Storage, Archives versus backups, Introduction to Glacier. Virtual Private Cloud: Introduction, Subnet, Elastic Network Interfaces, Internet Gateways, Route Tables, Security Groups. CloudWatch:Introduction, CloudWatch Metrics, CloudWatch Alarms. Database as a Service: Introduction to Amazon Relational Database Service (RDS), Database Engines, Database Instance Classes, Backup and Recovery, Non-relational (No-SQL) Databases, Types of Non relational Databases, Introduction to DynamoDB, Features, Partition and Hash	**09**	**CO 4**

		Keys. **Self-learning Topics:** Comparison of AWS services with other cloud service platforms like Azure and GCP.		
V	Openstack Cloud platform & Severless Computing	Open source Cloud Platform: Introductionto Openstack cloud platform, Components and modes of Operations, Architecture of Openstack cloud platform. Mobile Cloud Computing: Definition, architecture, benefits and challenges of mobile cloud computing. Serverless Computing: Introduction, Working with Serverless environment, Basics of severless events and functions, AWS Lambda. **Self-learning Topics:** To study different open source cloud computing platforms and compare them based on different XaaS services provided by them.	**05**	**CO 5**
VI	Cloud Security & Privacy	What is security, why is it required in cloud computing, Different types of security in cloud, attacks, and vulnerabilities, IaaS security, PaaS security, SaaS security, trust boundary, Audit and reporting. Introduction to Identity and access Management (IAM), IAM Challenges, IAM Definition, IAM Architecture and Practice, Relevant IAM Standards and Protocols for Cloud Services. Privacy: What Is Privacy? What Are the Key Privacy Concerns in the Cloud?, Legal and Regulatory Implications: Laws and Regulations, Governance, Risk, and Compliance (GRC). **Self-learning Topics:** To assess and analyze how the security and privacy is maintained in different cloud computing platforms.	**07**	**CO 6**

Text Books:

1. Cloud computing Bible, Barrie Sosinsky, Wiley publication.
2. Cloud Computing Black Book, Kailash Jayaswal, Jagannath Kallalurchi, Donald J. Houde, Dr. Deven Shah, Dreamtech Pre
3. Mastering Cloud Computing, Rajkumar Buyya, MGH publication
4. AWS certified solution Architect, Joe Baron et.al, Cybex publication
5. Cloud Security and Privacy, Tim Mather, Subra Kumaraswamy, and Shahed Latif, O'Reilly Publication.
6. Cloud security: A comprehensive guide to secure cloud computing by ronold L Krutz and Russell Dean Vines, W publication.

Reference Books:

1. Distributed and Cloud Computing From Parallel Processing to the Internet of Things, Kai Hwang, Geoffrey C. F Dongarra, Morgan Kaufmann Publication
2. Cloud Computing for Dummies, Judith Hurwitz, Wiley Publication
3. Cloud Application Architectures: Building Applications and Infrastructure in the Cloud, George Reese, O'Reilly Publicatio
4. Cloud computing security: foundation and challenges, John R Vecca, CRC Press

Online References:

1. https://www.aws.amazon.com
2. https://www.nttel.ac.in

Assessment:
Internal Assessment (IA) for 20 marks:

IA will consist of Two Compulsory Internal Assessment Tests. Approximately 40% to 50% of syllabus content must be covered in First IA Test and remaining 40% to 50% of syllabus content must be covered in Second IA Test

  Question paper format

Question Paper will comprise of a total of **six questions each carrying 20 marks Q.1** will be **compulsory** and should **cover maximum contents of the syllabus**

Remaining questions will be **mixed in nature** (part (a) and part (b) of each question must be from different modules. For example, if Q.2 has part (a) from Module 3 then part (b) must be from any other Module randomly selected from all the modules)

A total of **four questions** need to be answered.

Course Code	Course Name	Credits
ILO8011	**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 throughclosure.

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 onit.
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 theproject.
5. Capture lessons learned during project phases and document them for futurereference

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. PMknowledge 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 ProjectManagement Information System (PMIS).	8
04	**Planning Projects:** 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

| 05 | **5.1 Executing Projects:** Planning monitoring and controlling cycle. Information needs and reporting, | 8 |

	engaging with all stakeholders of the projects. Team management, communication and project meetings. **Monitoring and ControllingProjects:** Earned Value Management techniques for measuring value of work completed; Using milestones for measurement; change requests and scope creep. Project audit. **ProjectContracting** Project procurement management, contracting and outsourcing,	
06	**Project Leadership andEthics:** Introduction to project leadership, ethics in projects. Multicultural and virtual projects. **Closing theProject:** 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

REFERENCES:

1. Jack Meredith & Samuel Mantel, Project Management: A managerial approach, Wiley India, 7 th Ed.
2. A Guide to the Project Management Body of Knowledge (PMBOK® Guide), 5 th Ed,Project Management Institute PA,USA
3. Gido Clements, Project Management, CengageLearning.
4. Gopalan, Project Management, , WileyIndia
5. Dennis Lock, Project Management, Gower Publishing England, 9 thEd.

<u>Assessment</u>**:**

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 sixquestion
2. All question carry equalmarks
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 module3)
4. Only Four question need to besolved.

Course Code	Course Name	Credits
ILO8012	**Finance Management**	**03**

Objectives:
1. Overview of Indian financial system, instruments andmarket
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, dividendpolicy

Outcomes: Learner will be able to…
1. Understand Indian finance system and corporatefinance
2. Take investment, finance as well as dividenddecisions

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)	10

	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.	
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, andModigliani- Miller Approach	03

REFERENCES:

1. FundamentalsofFinancialManagement,13thEdition(2015)byEugeneF.BrighamandJoelF. Houston; Publisher: Cengage Publications, NewDelhi.
2. Analysis for Financial Management, 10th Edition (2013) by Robert C. Higgins; Publishers: McGraw Hill Education, NewDelhi.
3. Indian Financial System, 9th Edition (2015) by M. Y. Khan; Publisher: McGraw Hill Education, NewDelhi.
4. Financial Management, 11th Edition (2015) by I. M. Pandey; Publisher: S. Chand (G/L) & Company Limited, NewDelhi.

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 sixquestion
2. All question carry equalmarks
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 module3)
4. Only Four question need to besolved.

Course Code	Course Name	Credits
ILO8013	Enterpreneurship Development and Management	03

Objectives:

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

Outcomes: Learner will be able to…

1. Understand the concept of business plan andownerships
2. Interpret key regulations and legal aspects of entrepreneurship inIndia
3. Understand government policies forentrepreneurs

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 theEntrepreneur **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 forSMEs, case studies, exercises	05
04	**Indian Environment forEntrepreneurship:**key regulationsand 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 management, credit availability, technology innovation, supply chain management, linkage with large industries), exercises,e-Marketing	08
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

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 McGrawHillCompany
3. Dr TN Chhabra, Entrepreneurship Development, Sun India Publications, NewDelhi
4. Dr CN Prasad, Small and Medium Enterprises in Global Perspective, New century Publications, NewDelhi
5. Vasant Desai, Entrepreneurial development and management, Himalaya PublishingHouse
6. Maddhurima Lall, Shikah Sahai, Entrepreneurship, Excel Books
7. Rashmi Bansal, STAY hungry STAY foolish, CIIE, IIMAhmedabad
8. Law and Practice relating to Micro, Small and Medium enterprises, Taxmann PublicationLtd.
9. Kurakto, Entrepreneurship- Principles and Practices, ThomsonPublication
10. Laghu UdyogSamachar
11. www.msme.gov.in
12. www.dcmesme.gov.in
13. www.msmetraining.gov.in

Assessment:

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

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

1. Question paper will comprise of total sixquestion
2. All question carry equalmarks
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 module3)
4. Only Four question need to besolved.

Course Code	Course Name	Credits
ILO8014	**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 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.

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, HRMfunctions. Human resource development (HRD): changing role of HRM – Human resource Planning, Technological change, Restructuring andrightsizing, Empowerment, TQM, Managing ethicalissues.	5
02	**Organizational Behavior (OB)** Introduction to OB Origin, Nature and Scope of Organizational Behavior, Relevance to Organizational Effectiveness and Contemporary issues Personality: Meaning and Determinants of Personality, Personality development, Personality Types, Assessment of Personality Traits for Increasing SelfAwareness Perception: Attitude and Value, Effect of perception on Individual Decision-making, Attitude andBehavior. Motivation: Theories of Motivation and their Applications for Behavioral Change (Maslow, Herzberg,McGregor); Group Behavior and Group Dynamics: Work groups formal and informal groups and stages of group development. Team Effectiveness: High performing teams, Team Roles, cross functional and self-directedteam. Casestudy	7
03	**Organizational Structure &Design** Structure, size, technology, Environment of organization; Organizational Roles & conflicts: Concept of roles; role dynamics; role conflictsand	6

		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 atworkplace, Tactics andstrategies.	
04	**Human resource Planning** Recruitment and Selection process, Job-enrichment, Empowerment - Job-Satisfaction, employeemorale. Performance Appraisal Systems: Traditional & modernmethods, Performance Counseling, CareerPlanning. 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 serviceindustries **Strategic HRM** Role of Strategic HRM in the modern business world, Concept of Strategy, Strategic ManagementProcess, Approachesto 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	

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

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.

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

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2. All question carry equalmarks
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4. Only Four question need to besolved.

Course Code	Course Name	Credits
ILO8015	**Professional Ethics and Corporat Social Responsibility (CSR)**	**03**

Objectives:

1. To understand professional ethics inbusiness
2. To recognized corporate socialresponsibility

Outcomes: Learner will be able to…

1. Understand rights and duties ofbusiness
2. Distinguish different aspects of corporate socialresponsibility
3. Demonstrate professionalethics
4. Understand legal aspects of corporate socialresponsibility

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

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, NewDelhi.
4. Corporate Social Responsibility in India (2015) by BidyutChakrabarty, Routledge, NewDelhi.

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4. Only Four question need to besolved.

Course Code	Course Name	Credits
ILO8016	**Research Methodology**	**03**

Objectives:

1. To understand Research and ResearchProcess
2. To acquaint students with identifying problems for research and develop researchstrategies
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 matterareas
2. Accurately collect, analyze and reportdata
3. Present complex data or situationsclearly
4. Review and analyze researchfindings

Module	Detailed Contents	Hrs
01	**Introduction and Basic Research Concepts** Research – Definition; Concept of Construct, Postulate, Proposition, Thesis, Hypothesis, Law, Principle.Research methods vsMethodology Need of Research in Business and SocialSciences Objectives ofResearch **Issues** and Problems inResearch Characteristics of Research:Systematic, Valid, Verifiable, Empirical and Critical	**09**
02	**Types of Research** Basic Research AppliedResearch Descriptive Research Analytical Research EmpiricalResearch 2.6 Qualitative and Quantitative Approaches	**07**
03	**Research Design and Sample Design** Research Design – Meaning, Types andSignificance Sample Design – Meaning and Significance Essentials of a good sampling Stages in Sample Design Sampling methods/techniques SamplingErrors	**07**
04	**Research Methodology** 4.1 Meaning of Research Methodology 4.2. Stages in Scientific Research Process: **a.** Identification and Selection of ResearchProblem **b.** Formulation of ResearchProblem **c.** Review ofLiterature **d.** Formulation ofHypothesis **e.** Formulation of researchDesign **f.** Sample Design **g.** Data Collection **h.** Data Analysis **i.** Hypothesis testing and Interpretation ofData	**08**

	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** Preparation of the report on conclusionreached Validity Testing & EthicalIssues Suggestions andRecommendation	**04**

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 EasternLimited.
3. Kumar, Ranjit, 2005, Research Methodology-A Step-by-Step Guide for Beginners, (2nd ed.), Singapore, Pearson Education

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4. Only Four question need to besolved.

Course Code	Course Name	Credits
ILO8017	IPR and Patenting	03

Objectives:

1. To understand intellectual property rights protectionsystem
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 andapplications

Outcomes: Learner will be able to…

1. understand Intellectual Propertyassets
2. assist individuals and organizations in capacitybuilding
3. work for development, promotion, protection, compliance, and enforcement of Intellectual Property andPatenting

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 technologyetc. **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) activein 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 Publicationetc, Time frameand cost, Patent Licensing, Patent Infringement	07

REFERENCE BOOKS:

1. Rajkumar S. Adukia, 2007, A Handbook on Laws Relating to Intellectual Property Rights in India, The Institute of Chartered Accountants ofIndia
2. Keayla B K, Patent system and related issues at a glance, Published by National Working Group on PatentLaws
3. T Sengupta, 2011, Intellectual Property Law in India, Kluwer LawInternational
4. Tzen Wong and Graham Dutfield, 2010, Intellectual Property and Human Development: Current Trends and Future Scenario, Cambridge UniversityPress
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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
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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 PropertyRights,
12. Mathew Y Maa, 2009, Fundamentals of Patenting and Licensing for Scientists and Engineers, World Scientific PublishingCompany
13. N S Rathore, S M Mathur, Priti Mathur, Anshul Rathi**,** IPR: Drafting,Interpretation of Patent Specifications and Claims**,** New India PublishingAgency
14. Vivien Irish, 2005, Intellectual Property Rights forEngineers,IET
15. Howard B Rockman, 2004, Intellectual Property Law for Engineers and scientists, Wiley-IEEE Press

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4. Only Four question need to besolved.

Course Code	Course Name	Credits
ILO8018	**Digital Business Management**	**03**

Objectives:

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

Outcomes: The learner will be able to …..

1. Identify drivers of digitalbusiness
2. Illustrate various approaches and techniques for E-business andmanagement
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-productsand 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 ofEC	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 ofstrategy, E-business strategy into Action, challenges and E-Transition (Process of DigitalTransformation)	04
6	**Materializing e-business: From Idea to Realization**-Business plan preparation **Case Studies and presentations**	08

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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, August2014
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, VinocenzoMorabito,Springer
7. Digital Business Discourse Erika Darics, April 2015, PalgraveMacmillan
8. E-Governance-Challenges and Opportunities in : Proceedings in 2nd International Conference theory and practice of ElectronicGovernance
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

Assessment:

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Course Code	Course Name	Credits
ILO8019	**Environmental Management**	**03**

Objectives:

1. Understand and identify environmental issues relevant to India and global concerns
2. Learn concepts ofecology
3. Familiarise environment relatedlegislations

Outcomes: Learner will be able to…

1. Understand the concept of environmentalmanagement
2. Understand ecosystem and interdependence, food chainetc.
3. Understand and interpret environment relatedlegislations

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 & 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

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 ElgarPublishing
3. Environmental Management,**T V Ramachandra and Vijay Kulkarni, TERIPress**
4. Indian Standard Environmental Management Systems — Requirements With Guidance For Use, Bureau Of Indian Standards, February2005
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
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