Sardar Patel Institute of Technology

Bhavan's Campus, Munshi Nagar, Andheri (West), Mumbai-400058-India
(Autonomous Institute Affiliated to University of Mumbai)

List of Open Electives for UG Programs (w.e.f. Sept. 2021)
For students admitted to First Year in AY 2019 Onwards

List of Courses to be "Conducted by the Departments":

Open Electives I and II

Course Code	Name of the Course	Restrictions if any
OECS1	Cloud Computing	**Not for COMP/IT if completed as a Program Elective**
OECS2	Artificial Intelligence and Machine learning	**Not for COMP/IT if completed as a core** **Not for Students Completing minor in Comp. Engg.**
OEIT1	Block chain Technology and Applications	**Not for IT if completed as a Program Elective**
OEET3	Consumer Electronics	--
OEET4	Robotic & Machine Vision Intelligence	--
OEEC1	IoT and I^{2}oT	**Not for Students Completing minor in IIoT.**
OEEC2	Cyber Security & Digital Forensics	**Not for COMP/IT if completed as a Program Elective**
OECS3	Data Structures and Algorithms	**Not for COMP/IT** **Not for Students Completing minor in Comp. Engg.**
OECS4	Human Machine Interaction	--
OECS5	User Experience Design	**Not for Students Completing Minor in UXD**

OEIT2	Software Engineering	**Not for COMP/IT**
OEIT3	Software Testing	**Not for COMP/IT**
OEIT4	Data Base Management Systems	**Not for COMP/IT,** **Not for Students Completing minor in Comp. Engg.**
OEIT5	Internet Technology	**Not for COMP/IT** **Not for Students Completing minor in Comp. Engg.**
OEIT6	Data Analytics	**Not for COMP/IT if completed in Program Elective**

Open Elective III-Basic Science Electives

Nil

Open Elective III-Engineering Science Electives

Nil

Open Elective IV: Humanities and Management Related

Course Code	Name of the Course	**Restrictions if any**
OEHM3	IPR & Technology Entrepreneurship	--

List of Courses to be taken from MOOCs :

Open Electives I and II

Course Code	Name of the Course	Restrictions if any
OECS1	Cloud Computing	**Not for COMP/IT if completed as a Program Elective**
OEET1	Industrial Automation and Control	**--**
OECS2	Artificial Intelligence and Machine learning	**Not for COMP/IT if completed as a core** **Not for Students Completing minor in Comp. Engg.**
OEIT1	Block chain Technology and Applications	**Not for IT if completed as a Program Elective**
OEET2	Smart Grid	**--**
OEET3	Consumer Electronics	**--**
OEET4	Computer Vision	**--**
OEEC1	IoT and I^{2}oT	**Not for Students Completing minor in IIoT.**
OEEC2	Cyber Security & Digital Forensics	**Not for COMP/IT if completed as a Program Elective**
OECS3	Data Structures and Algorithms	**Not for COMP/IT** **Not for Students Completing minor in Comp. Engg.**
OECS4	Human Machine Interaction	**--**
OECS5	User Experience Design	**Not for Students Completing Minor in UXD**
OEIT2	Software Engineering	**Not for COMP/IT**
OEIT3	Software Testing	**Not for COMP/IT**

OEIT4	Data Base Management Systems	**Not for COMP/IT,** **Not for Students Completing minor in Comp. Engg.**
OEIT5	Internet Technology	**Not for COMP/IT** **Not for Students Completing minor in Comp. Engg.**
OEIT6	Data Analytics	**Not for COMP/IT if completed in Program Elective**

Open Elective III-Basic Science Electives

Course Code	Name of the Course	Restrictions if any
OEMA1	Descriptive Statistics with R Software	--
OEAS2	Climate and Earth Science	--
OEMA2	Engineering Optimization	--
OEAS3	Environment and Development	--
OEAS4	Optical Engineering	--
OEMA3	Numerical Methods for Engineers	--

Open Elective III-Engineering Science Electives

Course Code	Name of the Course	Restrictions if any
OEES1	Fluidization Engineering	--
OEES2	Fundamentals of manufacturing processes	--

Course Code	Name of the Course	Restrictions if any
OEES3	Electric Drives	--
OEES4	Introduction to Biomedical Imaging Systems	--
OEES5	Sensors and Actuators	--

Open Elective IV: Humanities and Management Related

Course Code	Name of the Course	Restrictions if any
OEHM1	Principles of Management	--
OEHM2	Development Research Methods	--
OEHM3	Entrepreneurship and IP Strategy	--
OEHM4	Patent Law for Engineers and Scientists	--
OEHM5	Organizational Behavior	--
OEHM6	Innovation, Business Models and Entrepreneurship	--
OEHM7	Project Management	--
OEHM8	Economics and Finance	--

Course (Category) Code	Course Name	Teaching Scheme (Hrs/week)					Credits Assigned			
		L	T	P	O	E	L	T	P	Total
(OE)	Cloud Computing	2	0	2	5	10	2	0	1	3
		Examination Scheme								
		Component		ISE		MSE		ESE		Total
OECS1		Theory		50		50		100		200
		Laboratory		50		--		50		100

Pre-requisite Course Codes, if any.	CS206: Operating Systems, CS207: Computer Communications and Networks, CS304: Distributed Computing
Course Objective: To get the knowledge of Basics of cloud computing, Key concepts of virtualization, Different Cloud Computing services, Cloud Implementation, Programming and Mobile cloud computing	
Course Outcomes (CO): *At the End of the course students will be able to*	
OECS1.1	Illustrate cloud service models, deployment models and mobile cloud computing.
OECS1.2	Compare different virtualization technologies.
OECS1.3	Use different cloud computing services for a given scnerios.
OECS1.4	Analyze the components of open stack and Google Cloud platform.

CO-PO Correlation Matrix (3-Strong, 2-Moderate, 1-Weak Correlation)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
OECS1.1		3								2		
OECS1.2			2		3							
OECS1.3			2							2		2
OECS1.4					2							

CO-PEO/PSO Correlation Matrix (3-Strong, 2-Moderate, 1-Weak Correlation)

	PEO1	PEO2	PEO3	PSO1	PSO2
OECS1.1	2				
OECS1.2					
OECS1.3	2				

| OECS1.4 | | | 2 | | 2 | |

BLOOM'S Levels Targeted (Pl. Tick appropriate)

Remember	Understand	Apply	Analyze ✓	Evaluate	Create

Theory Component

Module No.	Unit No.	Topics	Ref.	Hrs.
1	Title	**Introduction to Distributed and Cloud Computing**	1,2,4	8
	1.1	Distributed Computing: Definition, Models, Goals, Hardware and Software concepts, Client-Server models.		
	1.2	Defining Cloud Computing, Cloud and other similar configurations, Components of Cloud Computing, Cloud types: NIST and Cloud Cube Models, Cloud Deployment Models and Service Models		
	1.2	Cloud computing architecture, Advantages and Disadvantages of Cloud Computing.		
2	Title	**Virtualization**	1,2	8
	2.1	Virtualization: Characteristics of virtualized environment, Understanding the importance of Hypervisors, Type I & Type II Hypervisors.		
	2.2	Taxonomy of virtualization, Implementation Levels of Virtualization, Virtualization of CPU, Memory and I/O Devices , Virtualization and Cloud Computing		
	2.3	Pros and Cons of virtualization, Technology Examples: KVM, Xen, Vmware and HyperV, VirtualBox, Containers/docker, image building registry ,volumes secrets, networks		
3	Title	**Cloud Computing Services**	1,2,3	6
	3.1	Exploring Cloud Computing Services: SPI Model: Software as a service, Platform as a service, and Infrastructure as a service.		
	3.2	Anything as a service or Everything as a service (XaaS): Security as a Service, Identity management as a Service, Database as a Service, Storage as a Service, Collaboration as a Service		
	3.3	Compliance as a Service, Monitoring as a Service, Communication as a Service, Network as a Service		
4	Title	**Cloud Implementation, Programming**	2,3,5	6
	4.1	Open Stack Cloud Architecture: Feature of Open stack, Components of Open stack, mode of operations		
	4.2	Programming support for Google apps engine GFS, Bigtables, Chubby, Google APIs.		
5	Self Study	AWS cloud computing Platform, a) Elastic Compute Cloud(EC2): Compute Basics, Instance types, Life cycle of instances.	1 to 6	5*

		b) Simple Storage Service (S3): Basics and Operations, Features, Amazon Glacier, Glacier vs S3. c) Elastic Block Storage (EBS):Basics and Types of EBS Volumes d)Amazon Virtual Private Cloud (Amazon VPC): Subnets, Route tables, Elastic IP Addresses (EIP).		
			Total	**28**

Laboratory Component, if any. (Minimum 10 Laboratory experiments are expected)

Sr. No	Title of the Experiment
1	Creating and running virtual machines on Hosted Hypervisors like KVM Type1. Vmware Workstation, Oracle Virtualbox
2	Creating and running virtual machines on Bare-Metal Hypervisors Type 0 like Xen,Vmware ESXI or HyperV
3	Implement IaaS using your resources. Technology: OpenStack / Eucalyptus
4	Installation and Configuration of Ulteo to demonstrate on demand Application delivery over web browser to explore SaaS Environment.
5	To demonstrate installation and Configuration of Open stack Private cloud.(MS AZ and Google Cloud)
6	Create IAM role in AWS
7	Create EC2 instance How to connect with the instance
8	Demonstrate Platform as a Service using Google app Engine/IBM Blue Mix/t Suru
9,10	Title: Mini Project Objective: Using the concepts studied throughout the semester students shall be able to 1. Create their private cloud for the institute using the available resources. 2. Apply security concepts to secure a private cloud. 3. Implement efficient load balancing. 4. Compare various virtualization technologies with given resources. 5. Create cloud applications such as messenger, photo editing website, your own social media etc.

Text Books

Sr. No	Title	Edition	Authors	Publisher	Year
1	Enterprise Cloud Computing	First	Gautam Shroff	Cambridge	2010
2	Cloud Computing Principles and Paradigms	Second	Rajkumar Buyya, James Broberg, Andrzej Goscinski	Wiley	2013
3	Distributed and Cloud Computing	First	Kai Hwang Geoffrey C. Fox Jack J. Dongarra	Morgan Kofmann	2012
4	Distributed Systems Principles and Paradigms	Second	Andrew S. Tanenbaum and marten Van Steen	PHI	2004

Reference Books

Sr. No	Title	Edition	Authors	Publisher	Year
5	Cloud Computing: Web Based Applications that Change the Way You Work and Collaborate Online	First	Miller Michael	Pearson Education India	2008
6	Cloud Computing – A practical Approach	First	Velte T., Velte A., Elsenpeter R.	Tata McGrawHill	2017

Course (Category) Code	Course Name	Teaching Scheme (Hrs/week)					Credits Assigned			
		L	T	P	O	E	L	T	P	Total
Open Elective	Artificial Intelligence and Machine Learning	2	0	2	4	8	2	0	1	3
		Examination Scheme								
		Component		ISE		MSE		ESE		Total
OECS2		Theory		50		50		100		200
		Laboratory		50		--		50		100

Pre-requisite Course Codes, if any.	MA203: Probability and Stochastic Processes

Course Objective: This course covers the fundamental concepts of Artificial Intelligence and machine learning.

Course Outcomes (CO): *At the End of the course students will be able to*

OECS2.1	Understand AI building blocks presented in intelligent agents
OECS2.2	Solve the problems using suitable searching methods.
OECS2.3	Solve the problems using suitable reasoning and knowledge representation methods.
OECS2.4	Apply suitable machine learning technique for a given problem
OECS2.5	Design an intelligent system using different AIML techniques for real life problems.

CO-PO Correlation Matrix (3-Strong, 2-Moderate, 1-Weak Correlation)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
OECS2.1	2	3	-	-	2	-	-	-	-	-	2	-
OECS2.2	2	3	2	2	-	-	-	-	-	-	2	-
OECS2.3	2	3	2	2	-	-	-	-	-	1	2	-
OECS2.4	2	3	-	-	2	-	-	-	-	2	2	-
OECS2.5	2	3	2	2	2	-	-	-	-	2	2	2

BLOOM'S Levels Targeted (Pl. Tick appropriate)

Remember	Understand	Apply	Analyze	Evaluate ✓	Create

Theory Component

Module No.	Unit No.	Topics	Ref.	Hrs.
1	**Title**	**Introduction to Artificial Intelligence**	1	04
	1.1	Definition of AI, History and Future of AI, Problem solving Approach to Typical AI problem.		
	1.2	**Intelligent Agents and Environment** What is an Intelligent Systems, Types of Agents, structure of agent.		
	1.3	Environments and Its Properties, PEAS Representation for an Agent		
2	**Title**	**Problem solving by Searching**	1	05
	2.1	Searching: characteristics and issues in the design of search programs		
	2.2	**Uninformed search techniques:** State Space Search, Depth First Search , Breadth-First Search, Iterative Deepening		
	2.3	**Informed Search methods:** Heuristic Search.		
3	**Title**	**Knowledge Representation and Reasoning**	1	05
	3.1	Reasoning: Representing and Reasoning with Uncertain Knowledge		
	3.2	Knowledge representation: A Knowledge-Based Agent, The Wumpus World.		
	3.3	Propositional Logic, First-order predicate logic		
4	**Title**	**Introduction to Machine Learning**	2,3	10
	4.1	Introduction: What is Machine Learning, History, and overview of machine learning,		
	4.2	Types of Machine Learning – Supervised, Unsupervised Semi-Supervised Learning.		
	4.3	Evaluating a hypothesis: Model selection, training/validation/testing procedures, diagnosing bias versus variance and vice versa, regularization and bias/variance, learning curves		
5	**Title**	**Linear Models for Regression**	4	**04**
	5.1	Two Simple Approaches to Prediction: Least Squares and Nearest Neighbors		
	5.2	Linear Regression		
6	**Self-Study**	**Linear model for Classification**: Logistic Regression, Multivariate Regression, Subset Selection, Shrinkage Methods, Linear Discriminant Analysis, Perceptron, Support Vector Machines, PCA,	3,4	**4***
		Total		**28**

Laboratory Component.

Sr. No	Title of the Experiment
1	Implement an Intelligent agent.
2	Implement a given problem using the searching technique.

3	Implement a given problem using knowledge representation and reasoning rules.
4	To design and implement an intelligent system, incorporating the matching algorithm and the rule language. 1. It should provide a fact base updating function. 2. It should provide a function that checks the rules' LHS and return which rules were matched. 3. It should support firing RHS according to matches. Using SWISH Prolog or Java or Python or any other open-source tool
5	Implement supervised learning algorithms.
6	Minor project covering the concepts of AIML on the real-life problem statements.

Text Books

Sr. No	Title	Edition	Authors	Publisher	Year
1	Artificial Intelligence: A Modern Approach	3rd Edition	Stuart Russell and Peter Norvig	Prentice-Hall	2009
2	Machine Learning A Probabilistic Perspective	First edition	Kevin P. Murphy	Massachusetts Institute of Technology	2012
3	Machine Learning,	First edition	Tom.M.Mitchell	McGraw Hill International Edition	1997
4	The Elements of Statistical Learning	2nd edition	Trevor Hastie Robert Tibshirani Jerome Friedman	Springer	2009

Reference Books

Sr. No	Title	Edition	Authors	Publisher	Year
1	Artificial Intelligence: Making a System Intelligent	First	Nilakshi Jain	Wiley Publication	2019
2	Pattern Recognition and Machine Learning,	1st Edition	C. M. Bishop	Springer	2013

Course (Category) Code	Course Name	Teaching Scheme (Hrs/week)					Credits Assigned			
		L	T	P	O	E	L	T	P	Total
(PE)	Blockchain Technology and Applications	2	0	2	5	10	3	0	1	3
		Examination Scheme								
		Component		ISE		MSE		ESE		Total
		Theory		50		50		100		200
IT424		Laboratory		50		--		50		100

Pre-requisite Course Codes, if any.	IT206:Operating systems
	IT207:Computer Communications and Networks
Course Objective: To understand and use the blockchain technology	
Course Outcomes (CO): *At the End of the course students will be able to*	
IT424.1	Explain the basic concepts of blockchain technology, Bitcoin and Ethereum.
IT424.2	Apply a smart contract on the Ethereum test network
IT424.3	Build a Decentralized Application running on a decentralized peer-to-peer network
IT424.4	Explain the General Data Protection Regulation for relevant blockchain application

CO-PO Correlation Matrix (3-Strong, 2-Moderate, 1-Weak Correlation)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
IT424.1	2	-	-	-	-	-	-	-	-	-	-	2
IT424.2	-	2	-	-	2	2	1	-	-	-	-	2
IT424.3	-	-	3	2	3	2	1	-	-	-	-	2
IT424.4	-	-	-	-	-	2	1	2	-	-	-	2

CO-PEO/PSO Correlation Matrix (3-Strong, 2-Moderate, 1-Weak Correlation)

	PEO1	PEO2	PEO3	PEO4	PSO1	PSO2	PSO3
IT424.1	-	-	-	-	-	-	-
IT424.2	2	2	2	2	-	2	2
IT424.3	2	2	2	2	-	2	2
IT424.4	2	-	-	2	-	2	-

BLOOM'S Levels Targeted (Pl. Tick appropriate)

Remember	Understand	Apply	Analyze	Evaluate	Create
		✔	✔	✔	✔

Theory Component

Module No.	Unit No.	Topics	Ref.	Hrs.
1	Title	**Introduction to Blockchain**	1,2	6
	1.1	The consensus problem - Asynchronous Byzantine Agreement - AAP protocol and its analysis - Nakamoto Consensus on permission-less, nameless, peer-to-peer network - Abstract Models for BLOCKCHAIN - GARAY model - RLA Model		
	1.2	Proof of Work (PoW) as random oracle - formal treatment of consistency, liveness and fairness - Proof of Stake (PoS) based Chains - Hybrid models (PoW + PoS).		
2	Title	**Consensus**	1,2	8
	2.1	Bitcoin - Wallet - Blocks – Merkle Tree - hardness of mining - transaction verifiability - anonymity - forks - double spending - mathematical analysis of properties of Bitcoin.		
	2.2	Permissioned Blockchain: Basics, Distributed consensus, RAFT Consensus, Byzantine General Problem, Practical Byzantine Fault Tolerance.		
3	Title	**Hyperledger Fabric**	1,2	8
	3.1	Transaction Flow. Hyperledger Fabric Details, Fabric - Membership and Identity Management, Hyperledger Fabric Network Setup, Fabric Demo on IBM Blockchain Cloud.		
	3.2	Hyperledger Composer - Application Development. Hyperledger Composer - Network Administration, Ethereum - Ethereum Virtual Machine (EVM) - Wallets for Ethereum - Solidity - Smart Contracts - some attacks on smart contracts. Blockchain: Enterprise use cases.		
4	Title	**Data Protection and applications of blockchain**	1,2,3	6
	4.1	General Data Protection Regulation (GDPR) and its relevance for Indian businesses, Internal Policy on management and sharing data, GDPR compliance between multiple organizations. Liability and indemnity under GDPR, GDPR		

		for Entrepreneurs.		
	4.2	Applications of blockchain - Uses of Blockchain in E-Governance, Land Registration, Medical Information Systems, and smart cities, smart industries, anomaly detections, FinTech, Shaping the Financial World, IoT.		
6	**Self-study**	Scaling the blockchain: payment channels and state channels Scaling the blockchain using optimism and using SNARK Privacy in public blockchain: deanonymizing the blockchain and mixing.		**6***
Total				**28**

Laboratory Component, if any (Minimum 10 Laboratory experiments are expected)

Sr. No.	Title of the Experiment
1	Implementation of symmetric key cryptosystems – I
2	Implementation of asymmetric key cryptosystems – I
3	To implement Merkle Tree and genesis block
4	Demonstration of Bootstrapping
5	Demonstration of Hyperledger Fabric
6	Demonstration of Hyperledger Fabric – Ethereum
7	Implementation of Bitcoin
8	To implement the application: Land Registration
9	To implement the application: Smart Contract
10	To implement the application: FinTech

Text Books

Sr. No.	Title	Edition	Authors	Publisher	Year
1	Bitcoin and Cryptocurrency Technologies: A Comprehensive Introduction	Illustrated	Arvind Narayanan, Joseph Bonneau, Edward Felten, Andrew Miller and Steven Goldfeder	Princeton University Press	2016
2	Blockchain: Blueprint for a New Economy	First Edition	Melanie Swa	O′Reilly	2015
3	Building-Blocks of a Data Protection Revolution: The Uneasy Case for Blockchain Technology to Secure Privacy and Identity	First Edition	Shraddha Kulhari	Nomos	2018

Reference Books

Sr. No.	Title	Edition	Authors	Publisher	Year
1	The Bitcoin Standard: The Decentralized Alternative to Central Banking	First	Saifedean Ammous	Wiley	2018
2	Blockchain For Dummies	Second	Tiana Laurence	Wiley	2019

Course (Category) Code	Course Name	Teaching Scheme (Hrs/week)					Credits Assigned			
		L	T	P	O	E	L	T	P	Total
OEET3	Consumer Electronics	2	-	2	3	7	2	-	1	3
		Examination Scheme								
		Component		ISE		MSE		ESE		Total
		Theory		50		50		100		200
		Laboratory		50		--		50		100

Pre-requisite Course Codes	Basics of Electrical and Electronics Engineering	
Course Outcomes	At the end of the successful completion of the course students will be able to	
	OEET3.1	List and classify devices used in consumer products based on their specifications,identify sub-systems of consumer electronic products, also choose and use proper interface standard for a given consumer electronic product
	OEET3.2	Illustrate working principle of consumer electronic products and carry out basic tests to identify their correct operation
	OEET3.3	Experiment with Haptics, Multitouch devices, Device interconnects and peripherals and also suggest modification in consumer electronic product using modern tools to enhance user experience
	OEET3.4	Assemble subsystem of Television set and analyze technology used in audio systems.
	OEET3.5	Demonstrate working principal of Healthcare and home electronics consumer products.
	OEET3.6	Demonstrate working principal consumer electronic products used in Occupational safety.

Theory Component

Module No.	Unit No.	Topics	CO	Ref.	Total Hrs.
1	1.1 1.2	**Introduction to consumer Electronic** Haptics and Multi-touch Devices: Introduction to Touch panel, Capacitive Touch screen, Light pen. Displays for Consumer Electronics: OLED Display, Alphanumeric Display, LED Display, LCD Display.	CO1, CO3	4	04
2	2.1 2.2	**Device Interconnects and Peripherals** Introduction to Serial Interfaces, RS-232, I2C, SPI, USB. Introduction to ZIG-BEE Standards, WI-FI, Bluetooth, Thunderbolt, JTAG and various Interconnection standards	CO3	3	04
3	3.1 3.2	**Interactive and Immersive TV** Introduction to PAL TV System, NTSC TV System, SECAM TV System. Advanced Television System: High Definition TV, 3D TV.	CO4	1	04
4	4.1 4.2	**Audio System Technologies and Home electronics** Introduction to Audio system and major components of Audio System. Introduction to Home Electronics, Microwave Oven, Refrigerator, AirConditioning System, Washing Machine.	CO2, CO4	1	04
5	5.1 5.2 5.3	**Healthcare Electronics** Wearable Devices: Activity Trackers Smart Watch, Smart Glass. Fitness Devices: Blood Pressure Monitor, Digital Weighing Scale,Digital Glucometer. Biomedical Devices: ECG Sensor, EKG Sensor, EMG Sensor, Respirators.	CO5	5	06
6	6.1 6.2 6.3	**Consumer Electronics used in Occupational Safety** Printers, Scanners, Projection System. Bio-metric Devices: Finger Print Scanner, IRIS Scanner. Security Devices: CCTV, Electronics Lock, Video Intercom System, Doorbell.	CO6	2	06
	*Self study	**Study of** Virtual Reality**,** Digital Satellite TV, 4K TV, Microphone, Loudspeaker, Noise Cancelling Headphones.			
				Total (*Not included)	28

Teaching Learning Methodology in Laboratory: Role Play Model

a)   **Instructor:**

Responsibilities: Explanation of theoretical background
To provide required sample formats
To guide students in identification of appropriate online material.
Supervision and assessment of the overall activity

b)   **First Group of students : Customer**

Responsibilities:	To finalize specifications of instrument to be purchased Prepare request for quotations
	Prepare the comparative statement
	Preparation for purchase order

c) Second Group of students: Manufacturer/Vendor

Responsibilities:	To maintain the specifications of the manufactured instruments To submit quotations including all applicable taxes
	To prepare Invoice as per purchase order

d) Third Group of Students: Sales/Service Engineer

Responsibilities:	To demonstrate capabilities of various instruments and convince customer to purchase a particular instrument
	To prepare Delivery Challan
	Install the instruments and prepare Installation Report, Demonstrate all the functions and uses of the instrument

Expt. No.	Suggested list of Experiments
1	Experiment on Haptics and Multi-touch devices.
2	Experiment on Device interconnects and Peripherals (USB and Bluetooth).
3	Experiment on assembly of parts used in Television set.
4	Experiment on Audio system technology.
5	Experiment on Home electronics Consumer products.
6	Experiment on Wearable and fitness devices.
7	Experiment on Biomedical data acquisition devices.
8	Experiment on occupational safety in electronic devices.

References:

1.   S. P. Bali, "Consumer Electronics", Pearson Education, 1st Edition, 2005.
2.   Peter H. Gregory, "*Biometrics for Dummies*", Wiley Publishing Inc., 2008.
    3. N. Mathivanan, "*PC Based Instrumentation: Concepts and Practices*", Prentice Hall Learning India Pvt. Ltd., 1st Edition, 2007.
    4. Deborah Morley, "*Understanding Computers: Today and Tomorrow*", Course

Technology,16th Edition, 2016.

5. Sanjay Mishra, "Wearable Android: Android Wear and Google FIT App Development" ,Wiley Blackwell publication, 1st Edition, 2015.

Course(Category) Code	Course Name	Teaching Scheme (Hrs/week)					Credits Assigned			
		L	T	P	O	E	L	T	P	Total
(OE)	Robotics & Machine Vision Intelligence	2	0	2	4	8	2	0	1	3
		Examination Scheme								
		Component		ISE		MSE		ESE		Total
OEET4		Theory		50		50		100		200
		Laboratory		50		--		50		100

Pre-requisite Course Codes, if any.	Microprocessor

Course Outcomes (CO):*At the End of the course students will be able to*
CO.1	Classify different types of robot and evaluate coordinate frame transformation
CO.2	Perform direct kinematics analysis of Robot Systems.
CO.3	Relate the electric drive system and smart sensors
CO.4	Extract object features for Representation& Description
CO.5	Demonstrate Vision Guided System

CO-PO Correlation Matrix (3-Strong, 2-Moderate, 1-Weak Correlation)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO.1	2	2										
CO.2	3	3										
CO.3				2								
CO.4	3	3										
CO.5			3						2	2		1

CO-PEO/PSO Correlation Matrix (3-Strong, 2-Moderate, 1-Weak Correlation)

	PEO1	PEO2	PEO3	PEO4	PSO1	PSO2	PSO3
CO.1							

CO.2							
CO.3							
CO.4							
CO.5							

BLOOM'S Levels Targeted (Pl. Tick appropriate)

Remember	Understand	✓ Apply	✓ Analyze	✓ Evaluate	Create

Theory Component

Module No.	Unit No.	Topics	Ref.	Hrs.
1	**Title**	**Fundamentals of Robotics**	1	**04**
	1.1	Robot Classification, Robot Components, Degrees of freedom		
	1.2	Coordinate frames Fundamental rotation Matrices. Coordinate Frames Transformation, Screw Transformation		
2	**Title**	**Direct Kinematics Analysis**	1	**08**
	2.1	Description of links and joints, Link co-ordinates, Kinematic Modeling of the manipulator, Denavit- Hartenberg Parameters, Manipulator Transformation Matrix :The Arm Matrix.		
	2.2	Direct kinematic analysis of Two axis, Three axis and Four Axis articulated Robots.		
3	**Title**	**Electric Drives and Sensors**	1	**04**
	3.1	Electric Drives: Introduction, Types, DC electric motor, AC electric motor, stepper motors, half step mode operation, micro step mode. Types of stepper motors, Direct drive actuation.		
	3.2	Sensors: Introduction: An Introduction to sensors and transducers, Need of sensors in Robotics, Position sensors - optical, non-optical, Velocity sensors, Accelerometers, Proximity Sensors - Contact, non-contact, Range Sensing, touch and Slip Sensors, Force and Torque Sensors.		
4	**Title**	Image Formation and Camera Models	2	**04**
	4.1	Pinhole camera model, Perspective projection, Camera model, Camera Calibration, Stereo Vision.		
	4.2	3D reconstruction: Active Method, Passive Method, Stereo vision, Epipolar geometry.		

5	Title	Object Representation and Description	2	**04**
	5.1	Feature Extraction from images Interest points * Harris detector, Hessian detector, Histogram of Gradient (LoG), Local Binary Pattern(LBP).		
	5.2	Projection vectors, Edge features, Boundary detection, Boundary Descriptors, Regional Descriptors, Chain Code, Fourier descriptors, Statistical Features.		
6	**Title**	Design of Vision Guided System	2	**04**
	6.1	Industrial applications of Vision-controlled robotic systems.		
	6.2	Object Detection, Object Classification, Object Recognition, Surveillance, Real Time Monitoring, Human Motion Recognition and Tracking.		
7	**Self Study**	Direct Kinematics of SCARA Robot, Inverse Kinematics, Robotic operating System (ROS)		
			Total	**28**

Laboratory Component

Sr. No	Title of the Experiment
1	Coordinate frame transformation
2	Obstacle detection and avoidance*
3	Direct Kinematics
4	Motion Planning*
5	Boundary feature descriptors
6	Hybrid Feature Descriptor : HOG, LBP
7	Sensor based robot system development*
8	Object Detection &Recognition*
9	Object Classification*
10	Guided Vision System Development*

*Real time implementation using Microcontroller Based System/ TI DSP Boards/Rasberry Pi Boards/ e-Yantra Boards.

Text Books :

Sr. No	Title	Edition	Authors	Publisher	Year
1	Fundamentals of Robotics Analysis and Control	1st	Robert J. Schilling	PHI Learning	1990
2	Computer Vision Algorithm and Applications	1st	Richard Szeliski	Springer	2010

Reference Books :

Sr. No	Title	Edition	Authors	Publisher	Year
1	Robotics Engineering an, Integrated Approach	1st	Richard D. Klafter, Thomas. A, Chmielewski, Michael Negin	Prentice Hall of India Pvt. Ltd.,	1989
2	Engineering foundation of Robotics	1st	DFrancis N-Nagy AndrasSiegler	Prentice Hall Inc.	1987
3	Robotics and Image Processing an Introduction	1st	P.A. Janaki Raman	Tata McGraw Hill Pblishing company Ltd.	1995
4	Robot Operating System for Absolute Beginners: Robotics Programming Made Easy	1st	Lentin Joseph	Apress	2018

Course (Category) Code	Course Name	Teaching Scheme (Hrs/week)					Credits Assigned			
		L	T	P	O	E	L	T	P	Total
Open Elective	**Cyber Security and Digital Forensics**	2	0	2	2	6	2	0	1	3
		Examination Scheme								
		Component		ISE		MSE		ESE		Total
OEEC2		Theory		50		50		100		200
		Laboratory		50		--		50		100

Pre-requisite Course Codes, if any.	
Course Objective: Perform end to end forensic investigations, Collect evidence from log files, Understand the importance of time synchronization, How to use typical forensic investigation tools, Follow a scientific approach to investigate network security events and incidents	
Course Outcomes (CO): *At the End of the course students will be able to*	
OEEC2.1	Classify different cybercrimes and cyber attacks
OEEC2.2	Analyze the risk involved in the critical infrastructures.
OEEC2.3	Create evidence centric procedures and processes To analyze the hardware, software, firmware and tools etc for forensic investigation processes.
OEEC2.4	Develop digital forensics is part of the incident response (IR) capability, as an integral part of information Assurance (IA) and Forensic readiness.

CO-PO Correlation Matrix (3-Strong, 2-Moderate, 1-Weak Correlation)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
OEEC2.1	2		2									
OEEC2.2			2									
OEEC2.3					3							
OEEC2.4					3							

CO-PEO/PSO Correlation Matrix (3-Strong, 2-Moderate, 1-Weak Correlation)

	PEO1	PEO2	PEO3	PEO4	PSO1	PSO2	PSO3
OEEC2.1							
OEEC2.2							
OEEC2.3							
OEEC2.4							

BLOOM'S Levels Targeted (Pl. Tick appropriate)

Remember	Understand	Apply	Analyze	Evaluate	Create ✓

Theory Component

Module No.	Unit No.	Topics	Ref.	Hrs.
1	Title	**Fundamentals of Cybersecurity**	1,2,3	7
	1.1	Introduction to cyber security - Tenets of Cybersecurity-CIA, Cybercrime, classification of cybercrimes, cyber criminals, various cybercrimes - Phishing, DoS/DDoS, Malware, Ransomware,Virus, Website defacement, scanning & sniffing , SQL injection, Buffer overflow, Session Hijacking, evil twin, wardriving, bluesnarfing, bluebugging, insecure cloud API, Data Breaches in cloud, Abuse of Cloud Services, cyber terrorism etc.		
	1.2	Introduction to critical infrastructure and protection. Classical and Modern Cryptography, Hash functions, MAC, HMAC, Digital Signature, PKI and use cases, Identity and Access Management (IAM), Biometric security, Multi factor authentication. Intrusion detection and prevention - IDS, IPS, Honeypots, Firewall		
2	Title	**Cybersecurity Risk Assessment and Management**	1,2,3	7
	2.1	Defining security risk, Security risk, Vulnerability assessment (VA), Penetration testing (PT), Network VAPT, Web VAPT, Cloud VAPT.		
	2.2	IT infrastructure and inventory management, threats analysis, risk residue, Risk appetite, computation of risk matrix, Use cases		
3	Title	**Introduction to Digital Forensics**	4	7
	3.1	Digital Forensics Science (DFS), Forensics and Legal perspective, Phases of Digital Forensics, Cardinal rules of forensics, Chain of custody (CoC), Forensic standards and guidelines,		
	3.2	Computer/Host Forensics, Network Forensics, Memory Forensics (Hard drives, RAM, flash memory, diskettes etc), Mobile/Portable Device Forensics (PDAs, Servers etc.), Live forensics Vs. Traditional forensics, Write blocking, Data imaging and hashing, Device and data acquisition guidelines and best practices, Code Analysis: Review of software for malicious signatures, Network Analysis: Scrutinize network traffic and logs to identify and locate.		

4	**Title**	**Advance Forensics: Incident Response Methodology and advance network forensic**	4	**7**
	4.1	Preparation, Detection, Containment, Analysis, Eradication, Recovery and Follow up. Evidence Acquisition and Preservation, Drive and partition recognition in Linux, Maintaining evidence integrity,		
	4.2	Cloud forensics: Access control within three cloud computing service models, Methodology and Evaluation Criteria Catalogue for Digital Forensics in SaaS, PaaS and IaaS, Cloud forensic challenges and Law enforcement (All these contents should be covered through published research papers)		
6	**Self Study**	Cybersecurity and Digital Forensic Standards		**4***
			Total	**28**

- **Hrs are not counted in total**

Laboratory Component, if any (Minimum 10 Laboratory experiments are expected)

Sr. No.	Title of the Experiment
	Preparatory Laboratory: [a] Install and configure Virtual Environment- **Virtual Box** [b] Select Intrusion Dataset
1	**Lab-1A:** Network Scanning (**nmap**), Web Server Vulnerability Scanning (**Nikto**) and Host scanning (**fping**) **Lab-1B:** Network Sniffing (**TCPDUMP/Wireshark/tshark/Ettercap**), Vulnerability Scanning (nmap ad CVE) and Security Visualization (**Etherape**)
2	**Lab-2A:** Infosec Coding using **Python Network Socket Programming** (Build the port scanner) **Lab-2B:** Network Scanning, Packet manipulation, Network Attacks using **Scapy**
3	**Lab-3: Backdoor-** Network Socket/ File Transfer and Reverse Shell using **Netcat**
4	**Lab-4:** Vulnerability Assessment and System Hacking (VAPT) **VA-Nessus/OpenVAS** and **Penetration Testing using Metasploit**
5	**Lab-5A:** Cyber Security and Machine Learning-Intrusion Detection **KDDCUP99/NSL-KDD/CIC-IDS2017 dataset** **Lab5B:** Anomaly detection- **network traffic analysis using tshark**
6	**Lab-6:** Cryptosystems- **PKI using Openssl and pycrypto**
7	**Lab-7A:** Intrusion Detection System (IDS) and Firewalls **Snort-NIDS, Logwatch-HIDS, Design and Development Anomaly detection using Simple Event Correlator (SEC) and Integration with Email (Postfix/Sendmail Server)** **Lab-7B:** Security Operation Center (SOC) and Security Event Information Event Management (SIEM): **Prelude-SIEM, Snort-NIDS, Suricata-NIDS, Logwatch-HIDS, OSSEC-HIDS, IPTABLES-Firewall and Syslog**
8	**Digital Forensics: Part-I** **Lab-8A:** Network Forensics using **Xplico and tshark** **Lab-8B:** Digital Forensics (Host/Disk) with **TCT/Sleuthkit**

9	**Digital Forensics: Part-II** **Lab-9A:** Memory Forensics using **Volatility** **Lab-9B:** Email Forensics using **Online utilities**
10	**Incident Handling and Threat Hunting using ELK**

Text Books

Sr. No.	Title	Edition	Authors	Publisher	Year
1	Security in Computing	Fifth	Charles Pfleeger Shari Pfleeger Jonathan Margulies	Prentice-Hall	2015
2	Effective Cybersecurity Understanding and Using Standards and Best Practices	First	William Stallings	Addison-Wesley	2019
3	Cybersecurity – Attack and Defense Strategies	Second	Yuri Diogenes Erdal Ozkaya	Packt Publications	2019
4	Digital Forensics with Kali Linux Second Edition	Second	Shiva V. N. Parasram	Packt Publications	2020

Reference Books

Sr. No.	Title	Edition	Authors	Publisher	Year
1	Digital Forensics and Incident Response Second Edition	Second	Gerard Johansen	Packt Publications	2020
2	A Practical Guide to Digital Forensics Investigations	Second	Darren R. Hayes	Pearson	2020

Course (Category) Code	Course Name	Teaching Scheme (Hrs/week)					Credits Assigned			
		L	**T**	**P**	**O**	**E**	**L**	**T**	**P**	**Total**
OE	**Data Structures and Algorithms**	**2**	**0**	**2**	**5**	**9**	**2**	**0**	**1**	**3**
		Examination Scheme								
		Component	**ISE**		**MSE**		**ESE**		**Total**	
OECS3		**Theory**	**50**		**50**		**100**		**200**	
		Laboratory	**50**		**-----**		**50**		**100**	

Pre-requisite Course Codes, if any.	1. Problem-solving using imperative programming

Course Objective:

Course Outcomes (CO): *At the End of the course students will be able to*

OECS3.1	Apply various operations of linear and non-linear data structures to given problems.
OECS3.2	Apply the concepts of Trees and Graphs to a given problem.
OECS3.3	Analyze the algorithm for given Problem statement
OECS3.4	Apply the Divide and Conquer, Greedy method, Dynamic Programming strategy to solve given problems.

CO-PO Correlation Matrix (3-Strong, 2-Moderate, 1-Weak Correlation)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
OECS3.1	1	2	2					2				2
OECS3.2	1	2	2					2				2
OECS3.3	1	2	2					2				2
OECS3.4	1	2	2					2				2

CO-PEO/PSO Correlation Matrix (3-Strong, 2-Moderate, 1-Weak Correlation)

	PEO1	PEO2	PEO3	PEO4	PSO1	PSO2	PSO3

	EXTC	ETRX	EXTC	ETRX	EXTC	ETRX	EXTC	ETRX	EXTC	ETRX	EXTC	ETRX	EXTC	ETRX
OECS3.1	1	1			1	1					1	1		
OECS3.2	1	1			1	1					1	1		
OECS3.3	1	1			1	1					1	1		
OECS3.4	1	1			1	1					1	1		

BLOOM'S Levels Targeted (Pl. Tick appropriate)

Remember	Understand	Apply	Analyze ✓	Evaluate	Create

Theory Component

Module No.	Unit No.	Topics	Ref.	Hrs.
1	Title	**Introduction to Data Structures**		**8**
	1.1	Concept of Linear and Non-linear Data Structures **Stack:** Stack as ADT, operations on the stack, **Queue:** Queue as ADT, Operations on Queue,	1,2	4
	1.2	**Linked List:** Linked List as ADT, Operations on Singly Linked List. Types of the linked list- Linear and circular linked lists, Doubly Linked List	1,2	4
2	Title	**Trees**		**4**
	2.1	Trees as ADT, General tree v/s Binary Tree Terminology, Traversal of Binary Tree, Operations on Binary tree, Binary Search Tree and its operations	1,2	4
3	Title	**Graphs**		**3**
	3.1	Graph as ADT, Introduction To Graph, Representation of Graph- Adjacency Matrix, Adjacency List, Graph Traversal Technique	1,2	3
4		**Introduction to Analysis of algorithm**		**7**
	4.1	Role of Algorithms in Computing, Performance analysis-space and time complexity, Growth of Functions: Asymptotic Notation, Analysis of sorting algorithms Such as Selection sort and insertion sort.	1,2	**3**
	4.2	**Divide and Conquer Approach –** General Method, Analysis of Merge Sort, Analysis of Quick sort, Analysis of Binary search, Master Method	1,2	**4**
5		**Greedy and Dynamic Programming Approach**		**6**
	5.1	**Greedy Approach:** Basic strategy, Knapsack problem, single-source shortest path-Dijkstra's algorithm. Minimum cost spanning trees-Kruskal algorithm	1,2	**3**

	5.2	**Dynamic Programming:** Assembly-line scheduling, Longest common subsequence	1,2	**3**
6	**Self Study topic**	**Hashing** Introduction to Hash Table, Hash functions, Collision Resolution Technique **Backtracking and Branch-and-bound:** General Method 8 queen problem (N-queen problem) Sum of subsets. Traveling Salesman proble		**5**
			Total	**28**

Laboratory Component, if any (Minimum 10 Laboratory experiments are expected)

Sr. No.	Title of the Experiment
1	Implement a given problem statement using Stack.
2	Implement a given problem statement using Queue
3	Implement a given problem statement using Linked List.
4	Implement a given problem statement using Doubly Linked List.
5	Implement a given problem statement using Binary Trees.
6	Apply Graph Traversal Technique on a given problem statement to solve the problem
7	Implement and analyze insertion sort selection sort
8	Implement and analyze problem based on Divide and Conquer strategy - Merge and Quick sort
9	Implement a given problem statement using Greedy Strategy.
10	Implement a given problem statement using Dynamic Programming.

Text Books

Sr. No.	Title	Edition	Authors	Publisher	Year
1	Introduction to Algorithms	Third Edition	Thomas H. Cormen, Charles E. Leiserson, Ronald L Rivest, Clifford Stein	MIT Press	2009
2	Fundamentals of Computer Algorithms	Second Edition	Horowitz E, Sahni S and S.Rajasekaran	Galgotia Publications	2010

Reference Books

Sr. No.	Title	Edition	Authors	Publisher	Year
1	Classic Data Structures	Second	Samanta Debasis	PHI	2009
2	Data Structures With C	First	Seymour Lipschutz	Schaum's Outline Series	2010

Course (Category) Code	Course Name	Teaching Scheme (Hrs/week)					Credits Assigned			
		L	T	P	O	E	L	T	P	Total
Open Elective	Human Machine Interaction (HMI)	2	0	2	4	8	2	0	1	3
		Examination Scheme								
		Component	ISE		MSE		ESE		Total	
		Theory	50		50		100		200	
OECS4		Laboratory	50		--		50		100	

Pre-requisite Course Codes, if any.	CS302,CS305
Course Objective:	
Course Outcomes (CO): *At the End of the course students will be able to*	
OECS4.1	Identify the various design principles used for interacting between human and machine.
OECS4.2	Apply human psychology of everyday actions and UI design process for real world applications.
OECS4.3	Implement mobile, windows, and web-based application
OECS4.4	Evaluate and justify UI design
OECS4.5	Create application for social and technical task.

CO-PO Correlation Matrix (3-Strong, 2-Moderate, 1-Weak Correlation)

	PO1	PO2	PO3	PO5
OECS4.1	2	-	2	**-**
OECS4.2	2	-	2	**-**
OECS4.3	2	3	-	**2**
OECS4.4	2	-	2	**-**
OECS4.5	2	3	-	**-**

CO-PEO/PSO Correlation Matrix (3-Strong, 2-Moderate, 1-Weak Correlation)

	PEO1	PEO2	PEO3	PSO1	PSO2
OECS4.1	**1**	-	-	-	-
OECS4.2	**1**	-	-	-	-
OECS4.3	-	**2**	-	**2**	-
OECS4.4	-	**2**	-	-	-
OECS4.5	-	**2**	-	**2**	-

BLOOM'S Levels Targeted (Pl. Tick appropriate)

Remember	Understand	Apply ✓	Analyze	Evaluate	Create

Theory Component

Module No.	Unit No.	Topics	Ref.	Hrs.
1	**Title**	**Introduction**	1-6	**06**
	1.1	Introduction to Human Machine Interface, Hardware, software and operating environment to use HMI in various fields.		
	1.2	The psychopathology of everyday things – complexity of modern devices; human-centered design; fundamental principles of interaction;		
	1.3	Psychology of everyday actions- how people do things; the seven stages of action and three levels of processing; human error;		
2	**Title**	**Understanding Goal Directed Design**	1-6	**06**
	2.1	Goal directed design; Implementation models and mental models; Beginners, experts and intermediates – designing for different experience levels		
	2.2	Understanding users; Modeling users – personas and goals.		
3	**Title**	**Design Guidelines**	1-6	**04**
	3.1	perception, Gesalt principles, visual structure, reading is unnatural, color, vision, memory, six behavioral patterns, recognition and recall, learning, factors affecting learning, time.		
4	**Title**	**Graphical User Interface and Web Interface**	2,4	**06**
	4.1	The Graphical User Interface: Popularity of graphics, the concept of direct manipulation, characteristics of GUI,		
	4.2	Web user Interface: Interface popularity, characteristics. Principles of user interface design.		
5	**Title**	**Interaction Styles and Communication:**	2,4	**06**

	5.1	**Interaction Styles:** Menus, Windows, Device-based and Screen-based Controls.		
	5.2	**Communication:** Text messages, Feedback and Guidance, Icons, Multimedia and colors.		
	Self Study	UX tools: Figma, Just In Mind and any open source tool for prototype designing Mobile Ecosystem: Platforms, Application frameworks: Types of Mobile Applications: Widgets, Applications.		
			Total	**28**

Laboratory Component, if any. (Minimum 10 Laboratory experiments are expected)

Sr. No.	Title of the Experiment
1	To Study of open source UX tools (Just in mind Prototype, Pidoco, Marvel Prototype) and create a simple design for a given problem definition.

2	**Know your client**
	
	    a. Design an app that can teach mathematics to children of 4-5 years age in schools in Rural Sector.
	    b. Design an app that can teach mathematics to children of 4-5 years age in schools in Urban Sector.
	    c. Design a site that can help people to sell their handmade products in metro cities.
	    d. Design a site that can connect housewives and keep them engaged.

3	**Goal oriented design** - Design an experience for passengers whose flight /train is delayed.
4	**Design Principles** - Understand principles of good UI design by heuristic evaluation. Design UI that would connect all college students to the online events happening on-campus during the college festival. User should be able to browse all events sorted on time, category and place. The user should also be able to subscribe to events and get notified about their start time and also be able to send invites to friends to attend an event with them
5	**Menus & Navigation** – Redesign of a user interface (Suggest and implement changes in Existing User Interface)

6	**Windows & Screen controls** –
	    a. Design a navigator for a student new in your Institute.
	    b. Design a navigator for a person new in tourist city/ village.
	    c. Motor paralysis for differently able people.
	    d. Vaccination App design with localization

7	**Icons** - Design appropriate icons pertaining to a given domain.(Eg. Greeting cards)
8	**Colors** – Design a personal website for any socio technical problem Use statistical graphics for better visualization.
9	Design a Map based UI(Web User) for Mumbai Dabbawalas with localization feature.
10	To calculate screen complexity of existing Graphical User Interface and redesign the interface to minimize the screen complexity.

Text Books

Sr. No.	Title	Edition	Authors	Publisher	Year
1	Human Computer Interaction	3rd	Alan Dix, J. E. Finlay, G. D. Abowd, R. Beale	Peason, Prentice Hall	2003
2	The Essential Guide to User Interface Design	3rd	Wilbert O. Galitz,	Wiley publication	2007
3	Design of everyday things	2nd	Donald A. Normann	Basic Books; Reprint edition	2013
4	Galitz's Human Machine Interaction	1st	Kalbande,Kanade,Iyer	Wiley Publications	2015

Reference Books

Sr. No.	Title	Edition	Authors	Publisher	Year
5	Interaction Design: Beyond Human Computer Interaction	5th	Rogers Sharp Preece	Wiley publications	2019
6	Mobile Design and Development	1st	Brian Fling	O'Reilly Media Inc.,	2009

Course (Category) Code	Course Name	Teaching Scheme (Hrs/week)					Credits Assigned			
		L	T	P	O	E	L	T	P	Total
Open Elective	**User Experience Design**	**2**	**0**	**2**	**4**	**8**	**2**	**0**	**1**	**3**
		Examination Scheme								
		Component	ISE		MSE		ESE		Total	
OECS5		**Theory**	**50**		**50**		**100**		**200**	
		Laboratory	**50**		**--**		**50**		**100**	

Pre-requisite Course Codes	Software Engineering
Course Outcomes : At the End of the course students will be able to	
OECS5.1	Analyze UX design life cycle and its process for users.
OECS5.2	Apply UX design process for the given scenario
OECS5.3	Create real life application with end-to-end understanding of User experience practices.
OECS5.4	Evaluate UX design process for best experience.

Module No.	Unit No.	Topics	Ref.	Hrs.
1		**UX Design and Life Cycle**	1,2	4
	1.1	What is UX (User Experience), Ubiquitous interaction, A UX process lifecycle template, The system complexity space, Meet the user interface team		
2		**The UX Design Process – Understand Users**	1	8
	2.1	**Contextual Inquiry:** Introduction, the system concept statement, User work activity gathering, Abridged contextual inquiry process		

	2.2	**Contextual analysis:** Introduction, Creating and managing work activity notes, Constructing your WAAD (Work Activity Affinity Diagram)		
	2.3	**Extracting Design Interaction requirements:** Formal Requirements Extraction, Abridged method for requirement extraction		
	2.4	**Design Informing Model:** User Model (Social Model), Usage Model (Flow Model, Task Interaction Model), Work Environment Model.		
3		**The UX Design Process-Design Thinking, Ideation and Sketching**	1,3	8
	3.1	Design Paradigm, Design thinking, Design perspective, User personas, Ideation, Sketching		
	3.2	Mental Models and Conceptual Design		
	3.3	Storyboards, Wireframes		
4		**The UX Design Process- Prototyping, Evaluation and Agile development**	1,3, 5	8
	4.1	Fidelity of Prototype, To make effective paper prototype,		
	4.2	UX Evaluation and Improve UX Goals, Metrics and Targets		
	4.3	UX Evaluation Techniques- Formative vs Summative		
	4.4	UX Method for Agile Development: Introduction, Basics of agile SE methods, drawbacks of agile SE methods from UX perceptive.		
5		**Self-Learning**		4
	5.1	Affordance, Integration of UX into agile SE methods		
			Total	**28**

Laboratory Component, if any. (Minimum 10 Laboratory experiments are expected)

Sr. No.	Title of the Experiment
1	To Study of open source UX tools (Justinmind Prototype, Pidoco, Marvel Prototype) and create UX design for a given problem definition.
2	Design Mobile/Web UI for your own Travelling agent considering adding map and localization feature along with descriptions if required. (e.g, Make my Trip,Tripadvisor,thrillophilia etc.)
3	Design a Map based UI(Web User) for Mumbai Dabbawalas with localization feature.
4	Pick a website/app that you use on a daily basis (eg. facebook, gmail, whatsapp, zomato, etc). Evaluate the product based on user experience principles and give suggestions for improvement. Explain usability testing process for the same.
5	Analyze and redesign the (IRCTC/Indian Rail) website for better User Experience and create the heuristic report using Nielsen's Heuristic
6	Design UI for student to teach mathematics in rural areas/ to sell the products of farmers directly to consumers.
7	Design UI for student to sell the products of farmers directly to consumers.
8	Design UI/UX Mobile App along with making logo for the same for your own newly opened restaurant. (Consider all the UX Parameters while designing).
9	Design UI for any differently abled users.

10	Design UI for analysis of number of children suffering from juvenile diabetic children in India. The design aims at providing solutions for improving quality treatment and making the treatment affordable.

Note: All the experiments need to be tested for usability.

Text Books

Sr. No.	Title	Edition	Authors	Publisher	Year
1	The UX Book	1st	Rex Hartson and Pardha Pyla	MK Publication	2012
2	A Project Guide to UX Design: For user experience designers in the field or in the making.	2nd	Russ Unger and Carolyn Chandler	O'reilly, Series Editor	2012
3	UI Design: Key to captivate user understanding	1st	Jain, Kalbande,	SybGen Publications	2021

Reference Books

Sr. No.	Title	Edition	Authors	Publisher	Year
4	Smashing UX Design	1st	Jesmond Allen and James Chudley	John Wiley & Sons	2012
5	Agile Experience Design	1st	Brian Fling	O'Reilly Media Inc	2009

Course (Category) Code	Course Name	Teaching Scheme (Hrs/week)					Credits Assigned			
		L	T	P	O	E	L	T	P	Total
Open Elective	**Software Engineering**	2	0	2	4	8	2	0	1	3
		Examination Scheme								
		Component	**ISE**		**MSE**		**ESE**		**Total**	
OEIT2		**Theory**	50		50		100		200	
		Laboratory	50		--		50		100	

Pre-requisite Course Codes, if any.	CS102: Problem Solving using OOP
Course Objective: To understand the best practices in software engineering and develop the necessary skills to handle projects.	
Course Outcomes (CO): *At the end of the course students will be able to*	
OEIT2.1	Illustrate various software process models
OEIT2.2	Analyze software requirements
OEIT2.3	Design system models with respect to function and object oriented approach.
OEIT2.4	Apply the basics of software testing methods for the given scenario.

CO-PO Correlation Matrix (3-Strong, 2-Moderate, 1-Weak Correlation)

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2
OEIT2. 1	2											
OEIT2. 2	1	2							1			
OEIT2. 3	1	2	2		2				1			
OEIT2. 4					2				1			

CO-PEO/PSO Correlation Matrix (3-Strong, 2-Moderate, 1-Weak Correlation)

	PEO1	PEO2	PEO3	PEO4	PSO1	PSO2	PSO3
OEIT2.1							
OEIT2.2							
OEIT2.3							
OEIT2.4							

BLOOM'S Levels Targeted (Pl. Tick appropriate)

Remember	Understand	Apply	Analyze✓	Evaluate	Create

Theory Component

Module No.	Unit No.	Topics	Ref.	Hrs.
1	**Title**	**Introduction**	1,2	**5**
	1.1	Software Life Cycle models and Processes: Waterfall model and its Extensions, Rapid Application Development, Spiral Model,		
	1.2	Agile Development Models		
	1.3	Requirement Analysis and Specification		
2	**Title**	**Software Design**	2	**4**
	2.1	Overview of the Design Process		
	2.2	Cohesion and Coupling		
	2.3	Approaches to Software Design: Function Oriented Design, Object Oriented Design		
3	**Title**	**Function Oriented Software Design**	1,2	**4**
	3.1	Overview of Structured Analysis and Structured Design Methodology		
	3.2	Developing the DFD Model of the System		

	3.3	Structured Design		
4	**Title**	**Object Modeling Using UML**	3,4	**8**
	4.1	Use Case Model		
	4.2	Class Diagram		
	4.3	Interaction Diagram		
	4.4	Activity Diagram		
	4.5	State Chart Diagram		
5	**Title**	**Software Testing**	1,2	**7**
	5.1	Testing : Basic Concepts and Terminologies		
	5.2	Unit Testing, Integration Testing, System Testing		
	5.3	Black-Box Testing, White-Box Testing		
	5.4	Testing Object Oriented Programs		
6	**Self Study**	**Software Project Management:** Project Planning, Project Estimation Techniques		**5***
Total (*Not included)				**28**

Laboratory Component, if any. (Minimum 10 Laboratory experiments are expected)

Sr. No.	Title of the Experiment
1	Gather requirements and write a project proposal for case study. Prepare SRS document. (Use IEEE template)
2	Prepare User Stories
3	Design Use Case model and prepare its specification
4	Design Data flow diagram for the case study.
5	Design Class diagram
6	Draw Activity diagram
7	Draw State Chart diagram
8	Design UML diagram -Interaction diagrams
9	Study Selenium automation tool and run the test cases
10	To execute different Selenium commands –selenese and matching text pattern

Text Books

Sr. No.	Title	Edition	Authors	Publisher	Year
1	Software Engineering: A Practitioner's Approach	9th	Roger S. Pressman and Bruce Maxim	McGraw-Hill	2019
2	Fundamentals of Software Engineering	5th	Rajib Mall	PHI Learning	2018

Reference Books

Sr. No.	Title	Edition	Authors	Publisher	Year

| 3 | UML for Java Programmers | -- | Robert C. Martin | Pearson | 2006 |
| 4 | UML Distilled: A Brief Guide to the Standard Object Modeling Language | 3 rd | Martin Fowler | Addition Wesley | 2003 |

Course (Category) Code	Course Name	Teaching Scheme (Hrs/week)					Credits Assigned			
		L	**T**	**P**	**O**	**E**	**L**	**T**	**P**	**Total**
Open Elective	**Software Testing**	**2**	**0**	**2**	**4**	**8**	**2**	**0**	**1**	**3**
		Examination Scheme								
		Component	**ISE**		**MSE**		**ESE**		**Total**	
OEIT3		**Theory**	**50**		**50**		**100**		**200**	
		Laboratory	**50**		**--**		**50**		**100**	

Pre-requisite Course Codes, if any.	--
Course Objective: To understand the best practices of Industry in Software Testing	
Course Outcomes (CO): *At the end of the course students will be able to*	
OEIT3.1	Illustrate the role of Testing Lifecycle and Testing types
OEIT3.2	Apply Static and dynamic Testing techniques to find bugs in the Software
OEIT3.3	Make use of Test management to improve Test strategy
OEIT3.4	Categorize the different test cases suitable in testing.

CO-PO Correlation Matrix (3-Strong, 2-Moderate, 1-Weak Correlation)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12

OEIT3.1	1												
OEIT3.2	2		1	1							1		
OEIT3.3		1	1	1	2						1		
OEIT3.4		2		1	2								

CO-PEO/PSO Correlation Matrix (3-Strong, 2-Moderate, 1-Weak Correlation)

	PEO1	PEO2	PEO3	PEO4	PSO1	PSO2	PSO3
OEIT3.1							
OEIT3.2							
OEIT3.3							
OEIT3.4							

BLOOM'S Levels Targeted (Pl. Tick appropriate)

Remember	Understand	Apply ✓	Analyze ✓	Evaluate	Create

Theory Component

Module No.	Unit No.	Topics		Ref.	Hrs.
1	Title	**Fundamentals of Software Testing**		1,2	4
	1.1	Evolution of Software Testing			
	1.2	Principles of Software Testing			
	1.3	Testing and Debugging			
	1.4	Errors & Testing			
2	Title	**Software Testing Methodology and Levels**		1,2	6
	2.1	Software Testing Lifecycle			
	2.2	Verification & Validation			
	2.3	Unit Testing, Integration Testing			
	2.4	System Testing			
	2.5	Non -Functional Testing and its types			
3	Title	**Static Testing Techniques**		2.3	4
	3.1	Structured Group Examinations – Reviews, types of reviews			
	3.2	General process, Roles and responsibilities			
	3.3	Selection criteria. The compiler as a static analysis tool			
4	Title	**Dynamic Testing Techniques**		2,3,4	8
	4.1	Equivalence Class Partitioning & Boundary Value Analysis			
	4.2	Decision Table Technique			
	4.3	Cause Effect Graphing			
	4.4	Basis Path Testing			
	4.5	Graph Matrices			
	4.6	Loop Testing			
5	Title	**Test Management**		1,2	6
	5.1	Test organization, Test Planning, Test plan hierarchy			
	5.2	Detailed test design and test specifications.			
	5.3	Incident Management – Test Log, Incident Reporting			
	5.4	Test Classification , Status, Test Cases			
6	Self Study	**Software Quality Assurance:** Role of SQA Team , difference between Quality Assurance and Software Testing**.**			5*
Total (*Not included)					28

Laboratory Component, if any. (Minimum 10 Laboratory experiments are expected)

Sr. No.	Title of the Experiment
1	Write and test a program using Equivalence Partitioning and Boundary value Analysis
2	Write and test a program using Decision Tree Table Testing
3	Write and test a program using Path Coverage
4	Perform Static Testing on given Scenario
5	Study of Test automation tool (Selenium)
6	Run test cases and use Base URL to run test cases in different domains, Cross Browser Testing
7	Perform Web Driver Implicit & Explicit Wait with help of Test tool
8	Perform Load Testing for any given website with automated tool
9	Use of Test Management tool
10	Use of Mobile Apps testing tool

Text Books

Sr. No.	Title	Edition	Authors	Publisher	Year
1	Software Testing Foundations	Fourth edition	Andreas Spillner	Shoff	2014
2	Software Testing :Principles and Practices	First edition	Naresh Chauhan	Oxford University Press	2010

Reference Books

Sr. No.	Title	Edition	Authors	Publisher	Year
3	Foundations of Software Testing	Second edition	Aditya P. Mathur	Pearson Education	2013
4	Software Testing: A Craftsman's Approach	Fourth Edition	Paul C. Jorgensen	CRC Press	2013

Course (Category) Code	Course Name	Teaching Scheme (Hrs/week)					Credits Assigned			
		L	T	P	O	E	L	T	P	Total
Open Elective	**Database Management Systems**	**2**	**0**	**2**			**2**	**0**	**1**	**3**
		Examination Scheme								
		Component	**ISE**		**MSE**		**ESE**		**Total**	
		Theory	**50**		**50**		**100**		**200**	
OEIT4		**Laboratory**	**50**		**--**		**50**		**100**	

Pre-requisite Course Codes, if any.	---
Course Objective: To understand the fundamentals of database systems.	
Course Outcomes (CO): *At the end of the course students will be able to*	
OEIT4.1	Analyze given system to construct a database model.
OEIT4.2	Apply various SQL commands for data manipulation.
OEIT4.3	Apply normalization on relational database.
OEIT4.4	Illustrate transaction processing and query processing techniques on a database.

CO-PO Correlation Matrix (3-Strong, 2-Moderate, 1-Weak Correlation)

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2
OEIT4. 1	1	2	2									
OEIT4. 2		1			2							
OEIT4. 3			2		2							
OEIT4. 4			2		2							

CO-PEO/PSO Correlation Matrix (3-Strong, 2-Moderate, 1-Weak Correlation)

	PEO1	PEO2	PEO3	PEO4	PSO1	PSO2	PSO3
OEIT4.1							
OEIT4.2							
OEIT4.3							
OEIT4.4							

BLOOM'S Levels Targeted (Pl. Tick appropriate)

Remember	Understand	Apply	Analyze✓	Evaluate	Create

Theory Component

Module No.	Unit No.	Topics	Ref.	Hrs.
1	Title	**Introduction and E R Modeling**	1,2	8
	1.1	Introduction to basic concept of Database, Characteristics of databases, File system V/s Database system, Users of Database system, Database Administrator, Data Independence, Codd's Rule, DBMS system architecture.		
	1.2	Introduction to ER model, Benefits of Data Modeling, Types of data Models, Phases of Database Modeling, The Entity-Relationship (ER) Model, Extended Entity-Relationship (EER) Model		
	1.3	Mapping the ER and EER Model to the Relational Model		
2	Title	**Structured Query Language**	3,4	8
	2.1	Overview of SQL, Data Definition Commands, Data Manipulation commands, Data Control commands, Set operations		
	2.2	Aggregate function, Null values, Views in SQL, Trigger		
3	Title	**Normalization**	1,2	4
	3.1	Design guidelines for relational schema, Functional dependencies, Properties of Decomposition		
	3.2	Normal Forms- 1NF, 2 NF, 3NF, BCNF		
4	Title	**Transaction Processing and Recovery**	1,2	5
	4.1	Transaction concept, Transaction states, ACID properties		

	4.2	Implementation of atomicity and durability, Concurrent Executions, Serializability		
	4.3	Recoverability		
5	Title	**Introduction to Query Processing**	1,2	3
	5.1	Basics of Query Processing, Phases of Query processing, Query Optimization		
6	*Self Study	1. NO SQL--Data type, Database creation, Basic command for creation, updating and querying the database.		5*
		Total (*Not included)		28

Laboratory Component, if any. (Minimum 10 Laboratory experiments are expected)

Sr. No.	Title of the Experiment
1	Formulate a case study and create an E-R Diagram. (Conceptual design for a relational database)
2	To create Logical design for a relational database.
3	To create a database using SQL commands (With constraints) • Data Definition Language- Create, Alter, Drop, Rename, Truncate Constraints-Not Null, Unique Key, Primary Key, Foreign Key, Check, Dropping a Constraint.
4	To populate and manipulate database using SQL commands. Data Manipulation Language- Insert, Update, Delete, Select
5	To perform DCL, TCL commands • Data Control Language: Grant, Revoke, Roles • Transaction Control Language: Commit, Rollback, Save point
6	To perform Date, Time, Arithmetic and Set operation on database.
7	To perform Aggregate function and Group by- Having clause on database
8	To perform Join operations on database. Equijoins, Non-Equijoins, Self Joins, Outer Join, cross Join
9	To Create a different view of database.
10	To examine integrity of database using Triggers.

Text Books

Sr. No.	Title	Edition	Authors	Publisher	Year
1	Database System Concepts	7th	Korth, Slberchatz, Sudarshan	McGraw – Hill	2019
2	Fundamentals of Database Systems	7th	Elmasri and Navathe	PEARSON Education	2015

Reference Books

Sr. No.	Title	Edition	Authors	Publisher	Year
3	"SQL & PL/SQL for Oracle 11g"	1st	Dr. P.S. Deshpande	Dreamtech Press	2011

4	SQL, PL/SQL programming language of ORACLE	4th	Ivan Bayross	BPB	2010

Course (Category) Code	Course Name	Teaching Scheme (Hrs/week)					Credits Assigned			
		L	T	P	O	E	L	T	P	Total
Open Elective		2	0	2	4	8	2	0	1	3
		Examination Scheme								
	Data Analytics	Component		ISE		MSE		ESE		Total
OEIT6		Theory		50		50		100		300
		Laboratory		50		--		50		100

	Pre-requisite Course Codes, if any.	

Course Objective: To bring the awareness about data processing and data analysis techniques

Course Outcomes (CO): *At the End of the course students will be able to*

OEIT6.1	Apply different techniques of data preprocessing.
OEIT6.2	Apply rules and theorems in statistics to analyze the data.
OEIT6.3	Apply different algorithms like regression, classification on a given data
OEIT6.4	Apply different algorithms like clustering and Association Rule Mining on a given data

CO-PO Correlation Matrix (3-Strong, 2-Moderate, 1-Weak Correlation)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
OEIT6.1			2		2							
OEIT6.2			2		2							
OEIT6.3			2		2							
OEIT6.4			2		2							

CO-PEO/PSO Correlation Matrix (3-Strong, 2-Moderate, 1-Weak Correlation)

	PEO1	PEO2	PEO3	PEO4	PSO1	PSO2	PSO3
OEIT6.1							
OEIT6.2							
OEIT6.3							
OEIT6.4							

BLOOM'S Levels Targeted (Pl. Tick appropriate)

Remember	Understand	Apply	Analyze √	Evaluate	Create

Theory Component

Module No.	Unit No.	Topics	Ref	Hrs
1	Title	**Data Preprocessing**	3	2
	1.1	Data Cleaning, Data Integration, Data Reduction: Attribute subset selection, Histograms, Clustering and Sampling		
	1.2	Data Transformation & Data Discretization: Normalization, Binning, Histogram Analysis and Concept hierarchy generation		
2	Title	**Test of Hypothesis and Significance**	1	7
	2.1	Statistical hypothesis, Null and Alternate hypothesis, test of hypothesis and significance, Type I and Type II errors, Level of Significance, Tests involving the Normal distribution, One-Tailed and Two-Tailed tests, P value.		
	2.2	Special tests of significance for Large samples and Small samples (F, chi- square, z, t- test), ANOVA.		
3	Title	**Correlation and Regression**	1	7
	3.1	Correlation, Rank correlation, Regression Analysis, Linear and Non-linear Regression, Multiple regressions, Curve fitting by method of least squares, fitting of straight lines, Polynomials, Exponential curves, Nearest neighbour- Linear Discriminant Analysis		
4	Title	**Classification and Association Rule Mining**	2	7
	4.1	Naive bayes classification, CART, Support Vector Machines, Bagging, Boosting, Random forests		
	4.2	Market Basket Analysis, Frequent Item sets, Closed Item sets, and Association Rules,The Apriori Algorithm, The FP Growth algorithm, Introduction to Mining Multilevel Association Rules and multidimensional Association Rules, Hidden Markov models		
5	Title	**Clustering**	2	5
		Introduction to unsupervised learning, Hierarchical Clustering : Agglomerative, Divisive, BIRCH partitioning methods : k means algorithm, K-Medoids Density-Based Methods: DBSCAN, OPTICS		
6	Self study	Applications of data analytics using Neural Networks, Deep Learning		4
		Total (*Not included)		**28**

Laboratory Component, if any. (Minimum 10 Laboratory experiments are expected)

Sr. No.	Title of the Experiment
1	Perform EDA such as number of data samples, number of features, number of classes, number of data samples per class, removing missing values, conversion to numbers, using seaborn library to plot different graphs.
2	Analyze statistical data using R programming
3	Use of SAS software to analyze statistical data
4	To perform classification on a dataset
5	To perform association rule mining on a dataset
6	To perform clustering on a dataset
7	Microsoft Excel Programming I - use of functions like vlookup, macros
8	Use of Google fusion tables for data analysis
9	Explore and present interactive data insights from real world dataset (Dashboards) using Power BI.
10	Explore and present interactive data insights from real world dataset (Dashboards) using Tableau

Text Books

Sr. No.	Title	Edition	Authors	Publisher	Year
1	Python Data Science Handbook: Essential Tools for Working with Data	1st	Jake VanderPlas	O'Reilly	2016
2	Learning From Data	1 st	Yaser S. Abu-Mostafa, Malik Magdon-Ismail, Husan-Tien Lin	AML Book	2012
3	Doing Data Science	1 st	First Cathy O'Neil, Rachel Schutt	O'Reilly	2013

Reference Books

Sr. No.	Title	Edition	Authors	Publisher	Year
1	Data streams: Algorithms and applications.	2nd	Muthukrishnan. S.	now publishers Inc	2005

Course (Category) Code	Course Name	Teaching Scheme (Hrs/week)					Credits Assigned			
		L	T	P	O	E	L	T	P	Total
Open Elective	IPR & Technology Entrepreneurship	2	-	2	5	8	2	-	1	3
		Examination Scheme								
		Component		ISE		MSE		ESE		Total
OEHM3		Theory		50		50		100		200
		Laboratory		50		--		50		100

Pre-requisite Course Codes, if any.	
Course Outcomes (CO): At the end of the successful completion of the course students will be able to	
OEHM3.1	Perform prior art and create intellectual asset
OEHM3.2	Validate idea and evaluate opportunity
OEHM3.3	Develop Budget and Profit and Loss Statement
OEHM3.4	Develop Business Model and Plan

CO-PO Correlation Matrix: (1-Weak, 2-Medium 3-Strong)

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
OEHM3.1				3								2
OEHM3.2		2	2									2
OEHM3.3				1							3	2
OEHM3.4			3									2

CO-PEO/PSO Correlation Matrix : (1-Weak, 2-Medium, 3-Strong)

CO/PEO/PSO	PEO1	PEO2	PEO3	PSO1	PSO2	PSO3
OEHM3.1						1
OEHM3.2						2
OEHM3.3						
OEHM3.4	1					2

Module No.	Unit No.	Topics	CO	Ref.	Total Hrs.
1		**Intellectual Property Rights(IPR)**	CO1	3	04
	1.1	Introduction, Types of IPR, Difference between Tangible property and Intangible property			
	1.2	Indian Copyright Laws, Indian Trademark Laws, Indian Patent Laws, Industrial Design Laws, Geographical Indications Laws of India			

2		**The Patents**	CO1	3	06
	2.1	Anatomy of Patents, Patent filing process, Overview of Requirements and Limitations of Patentability, Patent Infringement, Addressing Prior Art			
	2.2	Patent Drafting: Fundamental Principles of patent drafting, Introduction to detailed description, Drafting independent and dependent Claims, PCT filing.			
3	3.1	**Basics of Entrepreneurship** **Introduction to Business** Business basics, Components of a Business, Types of Business, Functions within a Business, Metrics of Successful Business, Difference between Entrepreneurship & Entrepreneurship.	CO2	1,2	4
	3.2	Myth of Entrepreneurship, What makes an Entrepreneur, Steps to starting a Business, Skills needed to be Successful in Business			
4		**Idea Validation & Opportunity Analysis**			04
	4.1	Idea Generation : Brainstorming, Focus Group, Checklist Methods, Problem Inventory Analysis, Scenario Thinking, Notebook Method, Reverse Brainstorming.	CO2	1,2	
	4.2	Opportunity Identification: Changing Demographics, Emerging Markets, New technologies, Social Changes, Opportunity Evaluation :Market Analysis, Competition Analysis, Technical Feasibility, Financial Viability, Risk Analysis, Resource Optimization			
5	5.1	**Financial Literacy** Business Finance and Arithmetic: Income and Expenditure Statement, Cash flow Projections, Break Even Analysis - for single product or service, Taxes, Budgeting and managing the finances, Computation of working capital, Financial Business Case Study	CO3	1,2	05
	5.2	Financing Stages; Sources of Finance; Venture Capital; Criteria for evaluating new-venture proposals & Capital-process			
6	6.1 6.2	**Venture Creation** Market Research, Feasibility Analysis, Developing the Business Model Business Plan : Purpose, Benefits, Essential components of Business plan , SWOT Analysis	CO4	1,2	05
	*Self Study	Managing and Growing the Venture, Social impact of the business, Social Entrepreneurship, Human Centered Design for business case, The need and Wants analysis by Mas Lows hierarchy			
		Total (*Not included)			**28**

Laboratory Assignment

Sr. No.	Title of the Experiment
1.	Case Study Analysis of Successful Business
2.	Case Study Analysis of Failed Business
3.	Idea Generation and opportunity evaluation
4.	Prior Art Search of emerging Technology Idea
5.	IPR Creation
6.	Financial Projection of a Venture
7.	Business Model Canvas
8.	Business Plan
9.	Making the Business case for Human Centered Design
10.	New Venture Creation

Text Book

Sr. No.	Title	Edition	Authors	Publisher	Year
1	Entrepreneurship: New venture creation	1st	David Holt,	Prentice Hall of India	
2	Entrepreneurship;	1st	Robert Hisrich, Michael Peters;	Tata McGraw Hill Publication	
3	Intellectual Property Rights in India	1st	Neeraj Pandy, Dharni Khushdeep	PHI	2014

Reference Books

Sr. No.	Title	Edition	Authors	Publisher	Year
1	Law relating to Intellectual Property Rights		V. K. Ahuja	LexisNexis	2017
2	Case Studies in International Entrepreneurship: Managing and Financing Ventures in the Global Economy.		Walter Kuemmerle,	McGraw-Hill/Irwin ,	2004
3	Business Driven Technology		Haag/Baltzan/Philips	Tata McGraw Hill Publication	