Shri Vile Parle Kelavani Mandal's

Dwarkadas J. Sanghvi College of Engineering

(Autonomous College Affiliated to the University of Mumbai)

Scheme and Detailed Syllabus (DJ19)

Final Year B.Tech

in

Information Technology

(Semester VII and VIII)

Revision: 1 (2021)
With effect from the Academic Year: 2022-2023

1st July, 2023

Shri Vile Parle Kelavani Mandal's
DWARKADAS J. SANGHVI COLLEGE OF ENGINEERING
(Autonomous College Affiliated to the University of Mumbai)
NAAC Accredited with "A" Grade (CGPA : 3.18)

Scheme for Final Year Undergraduate Program in Information Technology: Semester VII (Autonomous)
(Academic Year 2022-2023)

S. No.	Course Code	Course	Teaching Scheme				Semester End Examination(A)						Continuous Assessment (B)					Aggregate (A+B)	Credits earned	
			Theory (hrs.)	Practical (hrs.)	Tutorial (hrs.)	Credits	Duration (hrs)	Theory	Oral	Pract	Oral & Pract	SEE Total (A)	Term Test 1 (TT1)	Term Test 2 (TT2)	Avg (TT1 & TT2)	Term Work Total	CA Total (B)			
1	DJ19ITC701	Service Oriented Architecture	3	--	--	3	3	75	--	--	--	75	25	25	25	--	25	100	3	4
	DJ19ITL701	Service Oriented Architecture Laboratory	--	2	--	1	--	--	25	--	--	25	--	--	--	25	25	50	1	
2	DJ19ITC702	Design Thinking	3	--	--	3	3	75	--	--	--	75	25	25	25	--	25	100	3	4
	DJ19ITL702	Design Thinking Laboratory	--	2	--	1	--	--	25	--	--	25	--	--	--	25	25	50	1	
3 @	DJ19ITEC7011	Wireless Sensor Network	3	--	--	3	3	75	--	--	--	75	25	25	25	--	25	100	3	4
	DJ19ITEL7011	Wireless Sensor Network Laboratory	--	2	--	1	--	--	25	--	--	25	--	--	--	25	25	50	1	
	DJ19ITEC7012	Augmented and Virtual Reality	3	--	--	3	3	75	--	--	--	75	25	25	25	--	25	100	3	
	DJ19ITEL7012	Augmented and Virtual Reality Laboratory	--	2	--	1	--	--	25	--	--	25	--	--	--	25	25	50	1	
	DJ19ITEC7013	Business Analytics	3	--	--	3	3	75	--	--	--	75	25	25	25	--	25	100	3	
	DJ19ITEL7013	Business Analytics Laboratory	--	2	--	1	--	--	25	--	--	25	--	--	--	25	25	50	1	
	DJ19ITEC7014	Machine Learning	3	--	--	3	3	75	--	--	--	75	25	25	25	--	25	100	3	
	DJ19ITEL7014	Machine Learning Laboratory	--	2	--	1	--	--	25	--	--	25	--	--	--	25	25	50	1	

	DJ19ITEC7015	Blockchain Technology	3	--	--	3	3	75	--	--	--	75	25	25	25	--	25	100	3	
	DJ19ITEL7015	Blockchain Technology Laboratory	--	2	--	1	--	--	25	--	--	25	--	--	--	25	25	50	1	
4 #	DJ19ILO7011	Product Lifecycle Management (PLM)	3	--	--	3	3	75	--	--	--	75	25	25	25	--	25	100	3	**3**
	DJ19ILO7012	Management Information System (MIS)	3	--	--	3	3	75	--	--	--	75	25	25	25	--	25	100	3	
	DJ19ILO7013	Operations Research (OR)	3	--	--	3	3	75	--	--	--	75	25	25	25	--	25	100	3	
	DJ19ILO7014	Cyber Security and Laws (CSL)	3	--	--	3	3	75	--	--	--	75	25	25	25	--	25	100	3	
	DJ19ILO7015	Personal Finance Management (PFM)	3	--	--	3	3	75	--	--	--	75	25	25	25	--	25	100	3	
	DJ19ILO7016	Energy Audit and Management (EAM)	3	--	--	3	3	75	--	--	--	75	25	25	25	--	25	100	3	
	DJ19ILO7017	Disaster Management and Mitigation Measures (DMM)	3	--	--	3	3	75	--	--	--	75	25	25	25	--	25	100	3	
	DJ19ILO7018	Science of Wellbeing (SW)	3	--	--	3	3	75	--	--	--	75	25	25	25	--	25	100	3	
	DJ19ILO7019	Research Methodology (RM)	3	--	--	3	3	75	--	--	--	75	25	25	25	--	25	100	3	
	DJ19ILO7020	Public Systems and Policies (PSP)	3	--	--	3	3	75	--	--	--	75	25	25	25	--	25	100	3	
5	DJ19ITP704	Project Stage - I	--	4	--	2	--	--	50	--		50	--	--	--	50	50	100	**2**	**2**
		Total	**12**	**10**	**0**	**17**	**12**	**300**	**125**	**0**	**50**	**425**	**100**	**100**	**100**	**125**	**225**	**650**	**17**	

@Any 1 Elective Course
#Any 1 Institute Professional Elective

Prepared By Checked By Head of the Department Vice Principal Principal

Shri Vile Parle Kelavani Mandal's
DWARKADAS J. SANGHVI COLLEGE OF ENGINEERING
(Autonomous College Affiliated to the University of Mumbai)
NAAC Accredited with "A" Grade (CGPA : 3.18)

Scheme for Final Year Undergraduate Program in Information Technology: Semester VIII (Autonomous)
(Academic Year 2022-2023)

Sr. No.	Course Code	Course	Teaching Scheme				Semester End Examination (A)						Continuous Assessment (B)					Aggregate (A+B)	Credits earned	
			Theory (hrs.)	Practical (hrs.)	Tutorial (hrs.)	Credits	Duration (hrs)	Theory	Oral	Pract	Oral & Pract	SEE Total (A)	Term Test 1 (TT1)	Term Test 2 (TT2)	Avg (TT1 & TT2)	Term Work Total	CA Total (B)			
1	DJ19ITC801	Semantic Web Technology	3	--	--	3	3	75	--	--	--	75	25	25	25	--	25	100	3	4
	DJ19ITL801	Semantic Web Technology Laboratory	--	2	--	1	--	--	25	--	--	25	--	--	--	25	25	50	1	
2	DJ19ITC802	Design Patterns	3	--	--	3	3	75	--	--	--	75	25	25	25	--	25	100	3	4
	DJ19ITL802	Design Patterns Laboratory	--	2	--	1	--	--	25	--	--	25	--	--	--	25	25	50	1	
3 @	DJ19ITEC8011	Industrial Internet of Things	3	--	--	3	3	75	--	--	--	75	25	25	25	--	25	100	3	4
	DJ19ITEL8011	Industrial Internet of Things	--	2	--	1	--	--	25	--	--	25	--	--	--	25	25	50	1	
	DJ19ITEC8012	Game Design & Gamification	3	--	--	3	3	75	--	--	--	75	25	25	25	--	25	100	3	
	DJ19ITEL8012	Game Design & Gamification Laboratory	--	2	--	1	--	--	25	--	--	25	--	--	--	25	25	50	1	
	DJ19ITEC8013	Predictive Analytics	3	--	--	3	3	75	--	--	--	75	25	25	25	--	25	100	3	
	DJ19ITEL8013	Predictive Analytics Laboratory	--	2	--	1	--	--	25	--	--	25	--	--	--	25	25	50	1	
	DJ19ITEC8014	Advanced Machine Learning	3	--	--	3	3	75	--	--	--	75	25	25	25	--	25	100	3	
	DJ19ITEL8014	Advanced Machine Learning Laboratory	--	2	--	1	--	--	25	--	--	25	--	--	--	25	25	50	1	
	DJ19ITEC8015	Advanced Security	3	--	--	3	3	75	--	--	--	75	25	25	25	--	25	100	3	
	DJ19ITEL8015	Advanced Security Laboratory	--	2	--	1	--	--	25	--	--	25	--	--	--	25	25	50	1	
	DJ19ITEC8016	Quantum Computing	3	--	--	3	3	75	--	--	--	75	25	25	25	--	25	100	3	
	DJ19ITEL8016	Quantum Computing Laboratory	--	2	--	1	--	--	25	--	--	25	--	--	--	25	25	50	1	

	DJ19ILO8021	Project Management (PM)	3	--	--	3	3	75	--	--	--	75	25	25	25	--	25	100	3		
	DJ19ILO8022	Entrepreneurship Development and Management (EDM)	3	--	--	3	3	75	--	--	--	75	25	25	25	--	25	100	3		
	DJ19ILO8023	Corporate Social Responsibility (CSR)	3	--	--	3	3	75	--	--	--	75	25	25	25	--	25	100	3		
	DJ19ILO8024	Human Resource Management (HRM)	3	--	--	3	3	75	--	--	--	75	25	25	25	--	25	100	3		
4#	DJ19ILO8025	Corporate Finance Management (CFM)	**3**	--	--	**3**	3	75	--	--	--	75	25	25	25	--	25	100	3	**3**	
	DJ19ILO8026	Logistics and Supply Chain Management (LSCM)	3	--	--	3	3	75	--	--	--	75	25	25	25	--	25	100	3		
	DJ19ILO8027	IPR and Patenting (IPR)	3	--	--	3	3	75	--	--	--	75	25	25	25	--	25	100	3		
	DJ19ILO8028	Digital Marketing Management (DMM)	3	--	--	3	3	75	--	--	--	75	25	25	25	--	25	100	3		
	DJ19ILO8029	Environmental Management (EM)	3	--	--	3	3	75	--	--	--	75	25	25	25	--	25	100	3		
	DJ19ILO8030	Labour and Corporate Law (LCL)	3	--	--	3	3	75	--	--	--	75	25	25	25	--	25	100	3		
5	DJ19ITP803	Project Stage - II	--	10	--	5	--	--	100	--	--	100	--	--	--	100	100	200	**5**	**5**	
		Total	**12**	**16**	**0**	**20**	**12**	**300**	**175**	**--**	**0**	**475**	**100**	**100**	**100**	**175**	**275**	**750**	**20**		

@Any 1 Elective Course

#Any 1 Institute Professional Elective

Prepared By Checked By Head of the Department Vice Principal Principal

Program: Final Year B.Tech	Semester: VII
Course: Service Oriented Architecture	Course Code: DJ19ITC701
Course: Service Oriented Architecture Laboratory	Course Code: DJ19ITL701

Teaching Scheme (Hours / week)				Evaluation Scheme						
				Semester End Examination Marks (A)			Continuous Assessment Marks (B)			Total marks (A+ B)
Lectures	Practical	Tutorial	Total Credits	Theory			Term Test 1	Term Test 2	Avg.	
				75			25	25	25	100
				Laboratory Examination			Term work		Total Term work	50
3	2	--	4	Oral	Practical	Oral & Practical	Laboratory Work	Tutorial / Mini project / presentation/ Journal		
				25	--	--	15	10	25	

Pre-requisite: Knowledge of Programming, Distributed Computing

Course Objectives: The objective of this course is to introduce students to Service Oriented Architecture with its characteristics and advantages. It strongly describes the distinction between client-server, two-tier, three-tier and enterprise architectures. It also teaches the basics of web services and introduces SOAP, REST, WSDL and UDDI. It highlights the SOAP and REST architecture along with its importance and standards.

Course Outcomes: On completion of the course, learner will be able to:

1. Create web services using development tools.
2. Build SOA-based solutions for intra-enterprise and inter-enterprise applications.

Detailed Syllabus: (unit wise)		
Unit	**Description**	**Duration**
1	**Introduction to SOA and Web Services:** Concepts of Distributed Computing, Fundamental of SOA, Evolution of SOA, Characteristics of SOA, Comparing SOA to client-server and distributed internet architectures, web services, SOAP, WSDL, UDDI, and Service Description.	06
2	**Principles of SOA:** Service orientation and object- orientation, SOA Standards, SOA with Web Services, Service composition guidelines – Entity-centric business service design, Application-centric business service design, Task-centric business service design.	06
3	**Message Queue and WS-* Extension:** Message Exchange Pattern, Enterprise messaging with Message Broker, Asynchronous vs. Synchronous message handling, Queues and Topics, Messaging Topologies, WS-Addressing, WS-Reliable Messaging, WS- Policy, WS-Metadata Exchange, WS-Security (including XML-Encryption, XML Signature, and SAML).	10
4	**Service-Oriented Computing:** Service Life Cycle, Service Creation, Service Design and Build, Service Deployment, Publish Web service using UDDI, Service Discovery, Service Selection, Service Composition, Service Execution and Monitoring, Modeling Business Processes with Business Process Execution Language (BPEL).	06
5	**SOA Platforms:** SOA support in J2EE, Java API for XML based web services (JAX-WS), Java architecture for XML binding (JAXB), Java API for XML Registries (JAXR), SOA support in	06

	.NET, GraphQL as query language for APIS, Wrapping GraphQL with existing RESTful, SOAP APIs.	
6	**Microservices:** Evolution, Monolithic Architecture, SOA vs Microservice, Microservice and API, Microservices Architecture, Microservices Design, Domain Driven Design, Microservice Architecture Decisions, Microservices Security, Service-to-Service Authentication and Authorization.	**08**

Suggested Lab Experiments

1. Create DTD file for student information and create a valid well-formed XML document to store student information against this DTD file
2. Create XMS schema for student information and create a valid well-formed XML document to store student information against this XMS schema file.
3. Using XSL display student information in tabular format.
4. Create web calculator service in NET Beans and consume it.
5. Create java client to consume existing web service hosted on the internet.
6. Create a RESTFUL web-service in Net beans.
7. Using JAXP SAX echo given xml file on console.
8. Using JAXP DOM echo given xml file on console.
9. Using AXIS 2 framework and TOMCAT create a simple calculator web service and create a java client to consume this web service.
10. Case Study: Microservices

Books Recommended:

Textbooks:

1. Thomas Erl, "Service Oriented Architecture: Concepts, Technology, and Design", 1st Edition, Pearson education, 2006
2. Munindar P. Singh and Michael N. Huhns, "Service-Oriented Computing: Semantics, Processes, Agents", 1st Edition, John Wiley & Sons, Ltd., 2005
3. Sam Newman, "Building Microservices", O'Reilly Media, 2015

Reference Books:

1. Mark D. Hansen, "SOA Using Java™ Web Services", Prentice Hall, 2007
2. Thomas Erl, "Web Service Contract Design & Versioning for SOA", Pearson, 2008

Evaluation Scheme:

Semester End Examination (A):

Theory:

1. Question paper based on the entire syllabus will comprise of 5 questions (All compulsory, but with internal choice as appropriate), each carrying 15 marks, total summing up to 75 marks.
2. Total duration allotted for writing the paper is 3 hrs.

Laboratory:

1. An oral examination is to be conducted on the above syllabus and list of experiments.

Continuous Assessment (B):

Theory:

1. Two term tests of 25 marks each is to be conducted during the semester.
2. Total duration allotted for writing each of the paper is 1 hr.
3. Average of the marks scored in the two tests will be considered for final grading.

Laboratory: (Term work)
Term work shall be evaluated based on laboratory work, journal and minimum two assignments.

The distribution of marks for term work shall be as follows:

i. Laboratory work (implementation of experiments as suggested by faculty): 15 marks
ii. Journal Documentation (Write-up and Assignments): 10 marks

The final certification and acceptance of term work will be subject to satisfactory performance of laboratory work and upon fulfilling minimum passing criteria in the term work.

Prepared by Checked by Head of the Department Principal

Program: Final Year B.Tech	Semester: VII
Course: Design Thinking	Course Code: DJ19ITC702
Course: Design Thinking Laboratory	Course Code: DJ19ITL702

Teaching Scheme (Hours / week)				Evaluation Scheme						
				Semester End Examination Marks (A)			Continuous Assessment Marks (B)			Total marks (A+ B)
Lectures	Practical	Tutorial	Total Credits	Theory			Term Test 1	Term Test 2	Avg.	
				75			25	25	25	100
				Laboratory Examination			Term work		Total Term work	50
3	2	--	4	Oral	Practical	Oral & Practical	Laboratory Work	Tutorial / Mini project / presentation/ Journal		
				25	--	--	15	10	25	

Pre-requisite: Knowledge of Software Engineering

Course Objectives: The course aims to familiarize students with design thinking concepts and principles. The objective of this course is to ensure students can practice the methods, processes and tools of design thinking. It also aims to inculcate attitude to solve societal problems using design thinking tools.

Course Outcomes: On successful completion of this course, students should be able to:

1. Develop a holistic application using Design Thinking Principles.
2. Work efficiently as a team member.

Detailed Syllabus: (unit wise)

Unit	Description	Duration
1	**Overview of Design Thinking Process** Design Thinking Process: Business context of innovation for applying design thinking, two models of design thinking, phases of design thinking, correlation with other philosophies Introduction to design thinking: Definition, Origin of design thinking, Importance of design thinking, Design vs Design thinking, Problem solving, Understanding design thinking and its process model, Design thinking tools. Human-Centered Design (HCD) process - Empathize, Define, Ideate, Prototype and Test and Iterate or Empathize, Analyse, Solve and Test.	09
2	**Empathize** Design thinking phases, how to empathize, Role of empathy in design thinking, purpose of empathy maps, Things to be done prior to empathy mapping, creation of user personas, customer journey mapping, how might we question.	08
3	**Analyse Or Define:** Root cause analysis, conflict of interest, perspective analysis, big picture thinking through system operator, big picture thinking through function modelling.	09

4	**Solve Or Ideate:** Silent brainstorming, metaphors for ideation, CREATE and What-If tool for ideation, introduction to TRIZ, Inventive principles and their applications	**09**
5	**Test (Prototyping and Validation): Prototyping**, Assumptions during the design thinking process, Validation in the market, best practices of presentation	**09**
6	**Design Innovation:** Benefits of iteration in the design thinking process, taking the idea to the market, introduction to innovation management in a company.	**04**

List of Laboratory Experiments:

Mini project based on following MOs:

1. Demonstrate knowledge of design thinking processusing tools like Typeform/Zoom/Creatlr.
2. Apply design thinking techniques to design relevant products/services for a customer base using SmaplyUserforge/MakeMyPersona.
3. Apply human centered design (HCD) methodology for product or service design
4. Apply ideation techniques for developing innovative products or services for a specific target market using SessionLab/ Stormboard/IdeaFlip.
5. Perform the steps to gain practical knowledge of prototyping using Boords, Mockingbird, POP.
6. Perform testing and validation using UserTesting, HotJar, PingPong.

Books Recommended:

Text books:

1. Dr. Bala Ramadurai, Karmic Design Thinking - A Buddhism-Inspired Method to Help Create Human-Centered Products & Services, Self-Published (1 January 2020).
2. Michael G. Luchs, Scott Swan, Abbie Griffin, Design Thinking: New Product Development Essentials from the PDMA, Wiley-Blackwell; 1st edition (25 September 2015).

Resources:

1. NPTEL (National Project on Technology Enhanced Learning) Course: Design Thinking - A Primer, By Prof. Ashwin Mahalingam, Prof. Bala Ramadurai,IIT Madras

Evaluation Scheme:

Semester End Examination (A):

Theory:

1. Question paper based on the entire syllabus will comprise of 5 questions (All compulsory, but with internal choice as appropriate), each carrying 15 marks, total summing up to 75 marks.
2. Total duration allotted for writing the paper is 3 hrs.

Laboratory:

1. An oral examination is to be conducted on the above syllabus and list of experiments.

Continuous Assessment (B):

Theory:

1. Two term tests of 25 marks each is to be conducted during the semester.
2. Total duration allotted for writing each of the paper is 1 hr.
3. Average marks scored in the two tests will be considered for final grading.

Laboratory: (Term work)

Term work shall be evaluated based on laboratory work, journal and minimum two assignments.

The distribution of marks for term work shall be as follows:

i. Laboratory work (implementation of experiments as suggested by faculty): 15 marks

ii. Journal Documentation (Write-up and Assignments): 10 marks

The final certification and acceptance of term work will be subject to satisfactory performance of laboratory work and upon fulfilling minimum passing criteria in the term work.

Prepared by Checked by Head of the Department Principal

Program: Final Year B.Tech	Semester: VII
Course: Wireless Sensor Network	Course Code: DJ19ITEC7011
Course: Wireless Sensor Network Laboratory	Course Code: DJ19ITEL7011

<table>
<tr><th colspan="4" rowspan="2">Teaching Scheme
(Hours / week)</th><th colspan="8">Evaluation Scheme</th></tr>
<tr><th colspan="3">Semester End Examination Marks (A)</th><th colspan="4">Continuous Assessment Marks (B)</th><th>Total marks (A+ B)</th></tr>
<tr><td rowspan="3">Lectures</td><td rowspan="3">Practical</td><td rowspan="3">Tutorial</td><td rowspan="3">Total Credits</td><td colspan="3">Theory</td><td>Term Test 1</td><td>Term Test 2</td><td>Avg.</td><td></td></tr>
<tr><td colspan="3">75</td><td>25</td><td>25</td><td>25</td><td>100</td></tr>
<tr><td colspan="3">Laboratory Examination</td><td colspan="2">Term work</td><td rowspan="2">Total Term work</td><td rowspan="3">50</td></tr>
<tr><td rowspan="2">3</td><td rowspan="2">2</td><td rowspan="2">--</td><td rowspan="2">4</td><td>Oral</td><td>Practical</td><td>Oral & Practical</td><td>Laboratory Work</td><td>Tutorial / Mini project / presentation/ Journal</td></tr>
<tr><td>25</td><td>--</td><td>--</td><td>15</td><td>10</td><td>25</td></tr>
</table>

Pre-requisite: Knowledge of Analog and digital communication, Computer Networks

Course Objectives: The objective of this course is to provide a comprehensive introduction to the wireless sensor technology. The course familiarizes students with wireless technologies and applications of WSN. Students will inculcate an understanding to design emerging wireless transmission technology and systems. They will also learn to analyze the routing protocols for any wireless network.

Course Outcomes: On completion of the course, learner will be able to:

1. Specify the requirements for the hardware and software solutions for energy-efficient sensor network.
2. Analyze various critical parameters in deploying a WSN.
3. Apply appropriate algorithms to improve existing or to develop new WSN applications.
4. Design a WSN for given sensor data using microcontroller, transceiver, middleware and operating system.
5. Work effectively as a member of a team.

Detailed Syllabus: (unit wise)		
Unit	**Description**	**Duration**
1	**Introduction to wireless communication:** Fundamentals of Wireless Communication, Advantages, limitations, and application, DSSS and FHSS, Frequency Spectrum: Radio and Infrared; Overview of wireless generations: 1G: Cellular, 2G: Mobile Radio, 3G: UMTS, 4G: LTE	**07**
2	**Evolution of Wireless Technologies:** Multiple Access Technique: TDMA, FDMA, CSMA, CDMA, Wireless Technology Overview and its architectures: GSM, GPRS, EDGE, CDMA, UMTS and LTE	**09**
3	**Basic Wireless Sensor Technology**: Sensor Node Technology, Hardware and Software, Sensor Taxonomy, Wireless sensor network operating environment, Trends in Wireless sensor networks, commercially available sensor nodes –Imote, IRIS, Mica Mote, EYES nodes, BTnodes, TelosB, Sunspot.	**08**

4	**Types and Applications of WSN**: MANET & VANET, Application, Advantage, and limitations, Introduction, Background, Range of Applications, WSN Applications - Home Control – Building Automation - Industrial Automation - Medical Applications - Reconfigurable Sensor Networks - Highway Monitoring - Military Applications	**08**
5	**Emerging Wireless Transmission technology and systems:** Wireless Technologies: Campus Applications, Bluetooth, WLAN, ZigBee, Hotspot/WiMAX, MAN/WAN Applications	**07**
6	**Routing Protocols for Wireless Networks**: Issues in designing a routing protocol for ad hoc Wireless networks, Classifications of routing protocols, On-Demand Routing Protocols: Ad Hoc On-Demand Distance-Vector Routing Protocol, Hybrid Routing Protocols: Zone Routing Protocol	**06**

Lab guidelines for mini project:

1. The mini project work is to be conducted by a group of three students.
2. Each group will be associated with a subject InCharge/ mini project mentor. The group should meet with the concerned faculty during Laboratory hours and the progress of work discussed must be documented.
3. The students may do survey for different application using different types of sensors for their mini project.
4. Each group will identify the Hardware (Motes from different Motes families) & sensor configuration and software requirement for their mini project problem statement.
5. Design your own circuit board using multiple sensors etc.
6. Installation, configure and manage your sensors in such away so that they can communicate with each other.
7. Work with operating system, emulator like contiki cooja and do coding to for input devices on sensors.
8. Create and interface using Mobile/Web to publish or remotely access the data on Internet.
9. Each group along with the concerned faculty shall identify a potential problem statement, on which the study and implementation is to be conducted.
10. Each group may present their work in various project competitions and paper presentations.
11. A detailed report is to be prepared as per guidelines given by the concerned faculty.

List of Projects not limited to :

1. Home Control
2. Building Automation
3. Industrial Automation –
4. Medical Applications
5. Reconfigurable Sensor Networks
6. Highway Monitoring
7. Military Applications
8. Civil and Environmental Engineering Applications
9. Wildfire Instrumentation
10. Habitat Monitoring
11. Nanoscopic Sensor Applications

Books Recommended:

Textbooks:

1. Holger Karl, Andreas Willig, “Protocols and Architectures for Wireless Sensor Networks”, 1st Edition, Wiley Interscience, 2007

2. T.L Singal, “Wireless Communications”, McGraw Hill Education, 2017
3. Kazem Sohraby, Daniel Minoli, Taieb Znati, “Wireless Sensor Networks Technology, Protocols, and Applications”, Wiley, 2010

Reference Books:

1. C. Siva Ram Murthy, B.S. Manoj, “Ad Hoc Wireless Networks Architectures and Protocols”, Pearson Education, 2006
2. S. Sitharama Iyengar, Nandan Parameshwaran, Vir V. Phoha, N. Balakrishnan, Chuka D. Okoye, “Fundamentals of Sensor Network Programming: Applications and Technology”, Wiley, 2010
3. Vijay Madisetti , Arshdeep Bahga, “Internet of Things (A Hands-on-Approach)”, Orient Blackswan, 2015

Evaluation Scheme:

Semester End Examination (A):

Theory:

1. Question paper based on the entire syllabus will comprise of 5 questions (All compulsory, but with internal choice as appropriate), each carrying 15 marks, total summing up to 75 marks.
2. Total duration allotted for writing the paper is 3 hrs.

Laboratory:

1. An oral examination will be conducted on the mini project implemented by group of students.

Continuous Assessment (B):

Theory:

1. Two term tests of 25 marks each will be conducted during the semester.
2. Total duration allotted for writing each paper is 1 hr.
3. Average of the marks scored in the two tests will be considered for final grading.

Laboratory: (Term work)

Term work shall be evaluated based on mini project implementation, detailed report, presentation and minimum two assignments.

The distribution of marks for term work shall be as follows:

i. Laboratory work (mini project implementation and detailed report): 15 Marks
ii. Journal Documentation (Write-up, Power Point Presentation and Assignments): 10 marks

The final certification and acceptance of term work will be subject to satisfactory performance of laboratory work and upon fulfilling minimum passing criteria in the term work.

Program: Final Year B.Tech	Semester: VII
Course: Augmented and Virtual Reality	Course Code: DJ19ITEC7012
Course: Augmented and Virtual Reality Laboratory	Course Code: DJ19ITEL7012

Teaching Scheme (Hours / week)				Evaluation Scheme						
				Semester End Examination Marks (A)			Continuous Assessment Marks (B)			Total marks (A+ B)
Lectures	Practical	Tutorial	Total Credits	Theory			Term Test 1	Term Test 2	Avg.	
				75			25	25	25	100
				Laboratory Examination			Term work		Total Term work	50
3	2	--	4	Oral	Practical	Oral & Practical	Laboratory Work	Tutorial / Mini project / presentation/ Journal		
				25	--	--	15	10	25	

Pre-requisite: Knowledge of matrices, Programming in C/JAVA.

Course Objectives: The course aims to introduce students to the basic concepts and framework of augmented and virtual reality. The course introduces students the technology for multimodal user interaction and perception in Virtual Reality (VR), in particular, the visual, audial and haptic interface and behavior and the technology for managing large scale Augmented Reality (AR) and VR environment.

Course Outcomes: On completion of the course, student should be able to:

1. Develop Virtual Reality applications.
2. Develop Augmented Reality applications.
3. Work effectively as a member of a team.

Detailed Syllabus: (unit wise)

Unit	Description	Duration
1	**Introduction to Virtual Reality (VR):** Definition and Scope, Types of VR, Characteristics of VR, Basic VR environments, Limitations of VR environments, Immersion Vs Presence, Key hardware requirements for VR	05
2	**Interface to the Virtual World:** Input: User Monitoring, Position Tracking, Body Tracking, Physical input Devices, Speech Recognition (Audio Input) and World Monitoring: Persistent Virtual Worlds, Bringing the Real World into the Virtual World. Output: Visual Displays: Properties of Visual Displays, Monitor-based or Fishtank-VR, Projection-based VR, Head-based VR, See-through Head-based Displays, Handheld VR. Aural Displays: Properties of Aural Displays, Head-based Aural Displays- Headphones, Stationary Aural Displays-Speakers. Haptic Displays: Properties of Haptic Displays, Tactile Haptic Displays, End-effector Displays, Robotically Operated Shape Displays, Vestibular and Other Senses.	08
3	**Representing and Rendering the Virtual World:** Representation of the Virtual World: Visual Representation in Virtual Reality, Aural Representation and Haptic Representation in Virtual Reality.	08

	Rendering Systems: Visual Rendering Systems: Visual Rendering Methods, Geometrically Based Rendering Systems, Non-geometric Rendering Systems, Rendering Complex Visual Scenes, Computer Graphics System Requirements. Aural Rendering Systems: Visual Rendering Methods, Rendering Complex Sounds, Sound-Generation Hardware, Internal Computer Representation. Haptic Rendering Systems: Haptic Rendering Methods, Rendering Complex Haptic Scenes with Force Displays, Haptic Rendering Techniques.	
4	**Interacting with the Virtual World and Virtual Reality Experience:** User Interface Metaphors, Manipulating a Virtual World, Properties of Manipulation, Manipulation Operations, Navigating in a Virtual World-Way finding and Travelling, Classes of Travel Methods Interacting with Others-Shared Experience, Collaborative Interaction, Interacting with the VR System, Immersion, Rules of the Virtual World: Physics, Substance of the Virtual World.	**07**
5	**Introduction to Augmented Reality (AR):** Definition and Scope, A Brief History of Augmented Reality, Displays (Multimodal Displays, Spatial Display Model, and Visual Displays), Strong vs Weak AR, Augmented Reality Hardware (Sensors, Processors, Displays), Ingredients of an AR Experience Dimensionality, Depth Cues, Registration and Latency, Working of Augmented Reality, Applications of AR, Challenges in AR	**08**
6	**Augmented Reality Software and Mobile Augmented Reality:** Augmented Reality Systems, Software Components, Software Tools for Content Creation, Interaction in Augmented Reality, Augmented Reality Techniques: Marker based and Marker less tracking, Mobile Augmented Reality.	**07**

List of Experiments:

1. Installation of Unity and Visual Studio, setting up Unity for VR development, understanding documentation of the same.
2. Demonstration of the working of HTC Vive, Google Daydream or Samsung gear VR.
3. Develop a scene in Unity that includes:
    a. A cube, plane and sphere, apply transformations on the 3 game objects.
    b. Add a video and audio source.
4. Develop a scene in Unity that includes a cube, plane and sphere. Create a new material and texture separately for three Game objects. Change the color, material and texture of each Game object separately in the scene. Write a C# program in visual studio to change the color and material/texture of the game objects dynamically on button click.
5. Develop and deploy a simple marker based AR app in which you have to write a C# program to play video on tracking a particular marker.
6. Develop and deploy an AR app, implement the following using Vuforia Engine developer portal:
    i. Plane detection
    ii. Marker based Tracking(Create a database of objects to be tracked in Vuforia)
    iii. Object Tracking
7. Mini Project

Books Recommended:

Text books:

1. William R Sherman and Alan B Craig, “Understanding Virtual Reality: Interface, Application and Design”, (The Morgan Kaufmann Series in Computer Graphics), Morgan Kaufmann Publishers, San Francisco, CA, 2002
2. Alan B Craig, “Understanding Augmented Reality, Concepts and Applications”, Morgan Kaufmann Publishers, ISBN:978-0240824086
3. Burdea, G. C. and P. Coffet. Virtual Reality Technology, Second Edition. Wiley-IEEE Press, 2003/2006.

Reference Books:

1. Alan Craig, William Sherman and Jeffrey Will, Developing Virtual Reality Applications, Foundations of Effective Design, Morgan Kaufmann, 2009.
2. Schmalstieg / Hollerer, "Augmented Reality: Principles & Practice", Pearson Education India; First edition (12 October 2016),ISBN-10: 9332578494
3. Sanni Siltanen, "Theory and applications of marker-based augmented reality", Julkaisija –Utgivare Publisher. 2012. ISBN 978-951-38-7449-0
4. Steven M. LaValle, "Virtual Reality", Cambridge University Press, 2016

Web Resources

1. http://lavalle.pl/vr/book.html
2. https://www.vttresearch.com/sites/default/files/pdf/science/2012/S3.pdf
3. MOOC Courses link:
    a. https://nptel.ac.in/courses/106/106/106106138/
    b. https://www.coursera.org/learn/introduction-virtual-reality
    c. https://www.coursera.org/learn/ar

Evaluation Scheme:

Semester End Examination (A):

Theory:

1. Question paper based on the entire syllabus will comprise of 5 questions (All compulsory, but with internal choice as appropriate), each carrying 15 marks, total summing up to 75 marks.
2. Weightage of each module in end semester examination is expected to be/will be proportional to number of respective lecture hours mentioned in the syllabus.
3. Total duration allotted for writing the paper is 3 hrs.

Laboratory:

1. Oral examination will be based on the entire syllabus including, the practicals performed during laboratory sessions.

Continuous Assessment (B):

Theory:

1. Consisting of **Two Compulsory Class Tests** Approximately 40% to 50% of syllabus content must be covered in First test and remaining 40% to 50% of syllabus contents must be covered in second test.
2. Total duration allotted for writing each of the paper is 1 hr.
3. Average of the marks scored in the two tests will be considered for final grading.

Laboratory: (Term work)

Term work shall consist of atleast 10 experiments based on the above list.

The distribution of marks for term work shall be as follows:

i. Laboratory work (Performance of Experiments, Write-up): 15 Marks
ii. Mini Project: 10 marks

The final certification and acceptance of term work will be subject to satisfactory performance of laboratory work and upon fulfilling minimum passing criteria in the term work.

Prepared by Checked by Head of the Department Principal

Program: Final Year B.Tech	Semester: VII
Course: Business Analytics	Course Code: DJ19ITEC7013
Course: Business Analytics Laboratory	Course Code: DJ19ITEL7013

Teaching Scheme (Hours / week)				Evaluation Scheme						
				Semester End Examination Marks (A)			Continuous Assessment Marks (B)			Total marks (A+ B)
Lectures	Practical	Tutorial	Total Credits	Theory			Term Test 1	Term Test 2	Avg.	
				75			25	25	25	100
				Laboratory Examination			Term work		Total Term work	50
3	2	--	4	Oral	Practical	Oral & Practical	Laboratory Work	Tutorial / Mini project / presentation/ Journal		
				25	--	--	15	10	25	

Pre-requisite: Knowledge of Statistical Analysis and Big Data Analytics

Course Objectives: The course will enable students to recognize, understand and apply the language, theory and models of the field of business analytics. It will also allow students to foster an ability to critically analyze, synthesize and solve complex unstructured business problems. The course presents major concepts in visualization design and methods for algorithmic development, in conjunction with a close examination of several important data analysis and visualization techniques.

Course Outcomes: On completion of the course, learner will be able to:

1. Apply business intelligence methods to various situations.
2. Interpret the results.
3. Identify a problem or an opportunity by taking appropriate courses of action for a given managerial situation.

Detailed Syllabus: (unit wise)

Unit	Description	Duration
1	**Business Intelligence:** What is BI? Business intelligence architectures: Cycle of a business intelligence analysis, Enabling factors in business intelligence projects, Development of a business intelligence system, Ethics and business intelligence.	05
2	**Data Visualization:** Stages in visualizing data, types of visualization, pre-processing and processing of data, find data, evaluate, extract, clean, correct and merge data, forming the right questions, forming connections and correlations, making successful data visualizations, publishing and disseminating data visualizations.	06
3	**Descriptive Analytics:** Introduction to Descriptive Analytics, Data Types and Scales, Types of Data Measurement Scales, Population and Samples, Chebyshev's Theorem, Measures of Shapes, Data Visualization: Histogram, Bar Chart, Pie Chart, Scatter Plot, Coxcomb Chart, Box Plot, Treemap, Storytelling through data, Dashboard design principles. Augmented Analytics and Augmented Enrichment	07
4	**Introduction to Base SAS:**	08

	SAS Program: Introduction to SAS program, Submitting a SAS program – SAS Studio, SAS Enterprise Guide, SAS Windowing environment, SAS program syntax **Accessing Data:** Examining SAS Data sets, Accessing SAS Libraries, **Producing Detail Reports:** Subsetting Report data, Sorting and Grouping Report data, **Enhancing Reports Formatting Data Values:** Using SAS Formats, User defined Formats	
5	**Visual Analytics:** Getting Stated with SAS Visual Analytics: Exploring SAS VA concepts, Using Home page Administrating the Environment and Managing Data: Exploring Data Builder, Exploring Administrator. Demonstrations and Exercises.	**08**
6	**Viewing SAS VA Reports and Case Study:** Creating Analyses and Reports. Viewing Reports on the Web Viewing Reports on the Mobile Device/ Office Analytics Case Study – Creating Analyses and Reports	**08**

List of Laboratory Experiments:

1. Data Visualization using Tableau
2. Importing data in SAS from Excel and CSV file.
3. Creating summary statistical data.
4. Exporting results to Excel and PDF.
5. Manipulating data with functions.
6. Using data with formats like charts and graphs.
7. Creating data by applying filters and performing data analysis on it.
8. Working with graph level display rules.
9. Analyzing a Text data source.
10. Mini Project

Any other experiment based on syllabus may be included, which would help the learner to understand topic/concept.

Books Recommended:

Text Books:

1. Efraim Turban, Ramesh Sharda, Dursun Delen, "Decision Support and Business Intelligence Systems", 9th Edition, Pearson, 2013.
2. G. Shmueli, N.R. Patel, P.C. Bruce, "Data Mining for Business Intelligence: Concepts, Techniques, and Applications in Microsoft Office Excel with XLMiner", 2nd Edition, Wiley India.
3. Alexandru C. Telea, Data Visualization: Principles and Practice, AK Peters, 2008.
4. Michael Alexander, Jared Decker & Bernard Wehbe, "Microsoft Business Intelligence Tools for Excel Analysts", WILEY, 2016.
5. Prasad, R. N., & Acharya, S., "FUNDAMENTALS OF BUSINESS ANALYTICS", John Wiley & Sons, 2011.
6. SAS programming 1 – Essentials.
7. SAS Visual Analytics – Fast Track.
8. SAS Support

Reference Books:

1. Business Intelligence: Data Mining and Optimization for Decision Making by Carlo Vercellis, Wiley India Publications.
2. Matthew Ward, Georges Grinstein, and Daniel Keim. Interactive Data Visualization: Foundations, Techniques, and Applications, AK Peters, 2010.
3. Kumar, U. D. (2017). Business Analytics: The Science of Data-driven Decision Making. Wiley India.

Evaluation Scheme:

Semester End Examination (A):

Theory:

1. Question paper based on the entire syllabus will comprise of 5 questions (All compulsory, but with internal choice as appropriate), each carrying 15 marks, total summing up to 75 marks.
2. Total duration allotted for writing the paper is 3 hrs.

Laboratory:

1. Oral examination will be based on the entire syllabus including, the practicals performed during laboratory sessions.

Continuous Assessment (B):

Theory:

1. Consisting of Two Compulsory Class Tests: Approximately 40% to 50% of syllabus content must be covered in First test and remaining 40% to 50% of syllabus contents must be covered in second test.
2. Total duration allotted for writing each of the paper is 1 hr.
3. Average of the marks scored in both the tests will be considered for final grading.

Laboratory: (Term work)

Term work shall consist of at least 10 experiments based on the above list.

The distribution of marks for term work shall be as follows:

i. Laboratory work (Performance of Experiments, Write-up): 15 Marks

ii. Journal Documentation (Write-up, Power Point Presentation and Assignments): 10 marks

The final certification and acceptance of term work will be subject to satisfactory performance of laboratory work and upon fulfilling minimum passing criteria in the term work.

Prepared by Checked by Head of the Department Principal

Program: Final Year B.Tech	Semester: VII
Course: Machine Learning	Course Code: DJ19ITEC7014
Course: Machine Learning Laboratory	Course Code: DJ19ITEL7014

Teaching Scheme (Hours / week)				Evaluation Scheme						
				Semester End Examination Marks (A)			Continuous Assessment Marks (B)			Total marks (A+ B)
Lectures	Practical	Tutorial	Total Credits	Theory			Term Test 1	Term Test 2	Avg.	
				75			25	25	25	100
				Laboratory Examination			Term work		Total Term work	50
3	2	--	4	Oral	Practical	Oral & Practical	Laboratory Work	Tutorial / Mini project / presentation/ Journal		
				25	--	--	15	10	25	

Pre-requisite: Knowledge of datamining, statistics, AI& Soft Computing.

Course Objectives: The course will introduce students to the basic concepts and techniques of Machine Learning. It will also develop skills of using recent machine learning software for solving practical problems. The course aims to give an experience of doing independent study and research.

Course Outcomes: On completion of the course, learner will be able to:

1. Solve real-world problems using suitable machine learning techniques.

Detailed Syllabus: (unit wise)

Unit	Description	Duration
1	**Introduction to Machine Learning:** Definition of learning systems. Goals and applications of machine learning. Introduction to hypothesis, Aspects of developing a learning system: training data, concept representation, function approximation., types of learning, hypothesis space and inductive bias, variance, evaluation, cross-validation. Data Pre-processing: Dataset identification, python libraries (NumPy, pandas, matplotlib, sklearn), dependant and independent variable, handling missing data, techniques for encoding categorical data and feature scaling, splitting dataset into train, test and validation sets.	06
2	**Kernels:** Kernel functions, kernel trick, Support vector machines (SVMs), Kernels for building generative models. Markov and hidden Markov models, State space models, Undirected graphical models (Markov random fields), Monte Carlo inference, Markov chain Monte Carlo (MCMC) inference, Graphical model structure learning, Deep learning, Boosting, On-Line learning, Decision Trees, Ranking. Compressive Sensing and Dictionary Learning- Pursuit algorithms and applications for imaging and vision.	08
3	**Machine Learning System Design:** Evaluating a Learning Algorithm: Deciding what to try next, Evaluating Hypothesis, Model Selection and Train/ Validation/ Test Sets, Bias Vs variance: Diagnosing Bias Vs Variance, Regularization and Bias/ Variance, Learning Curve, Building a Spam Classifier: Prioritizing what to work on, Error Analysis, handling Skewed Data: Error Matrices for	09

	Skewed Classes, Trading off Precision and recall, Data for Machine Learning; Support Vector Machines: Large Margin Classification: Optimization Objective, Large Margin Intuition, Kernels	
4	**Regression and Model Building:** Simple Linear Regression: Model Building, Estimation of Parameters Using Ordinary Least Squares, Interpretation of Simple Linear Regression Coefficients, Model Validation, Coefficient of Determination (R-squared) and Adjusted R-Squared, Spurious Regression, Hypothesis Test for Regression Coefficients (t-Test), Test for Overall Model: Analysis of Variance (F-Test), Residual Analysis. Multiple Linear Regression: Ordinary Least Squares Estimation, Model Building (Partial Correlation and Regression), Interpretation of Coefficients - Partial Regression Coefficients, Standardized Regression Coefficient, Regression Models with Categorical (i.e., Qualitative) Variables, Validation of Multiple Regression Model, Coefficient of Multiple Determination (R-Squared), Adjusted R-Squared, t-Test, F-Test, Partial F-Test, Residual Analysis.	**09**
5	**Supervised Learning-Classification:** General Approach to Classification, Logistic Regression, Decision Trees, Naive Bayesian Classifier Ensemble Methods: Bagging, Boosting and AdaBoost and XBoost, Random Forests, Advanced Classification Methods: Backpropagation in Multilayer Feed-Forward Neural Networks, Support Vector Machines, Rough Set and Fuzzy Set Approaches, Classification Model Evaluation and Selection: Sensitivity, Specificity, Positive Predictive Value, Negative Predictive Value, Lift Curves and Gain Curves, ROC Curves, Misclassification Cost Adjustment to Reflect Real-World Concerns, Decision Cost/Benefit Analysis	**06**
6	**Unsupervised Learning- Clustering:** The Clustering Task and the Requirements for Cluster Analysis , Overview of Some Basic Clustering Methods, Hierarchical Methods: Agglomerate versus Divisive Hierarchical Clustering, Distance Measures, Probabilistic Hierarchical Clustering, Multiphase Hierarchical Clustering Using Clustering Feature Trees, Partitioning Methods: k-Means Clustering, k-Mediods Clustering, Density-Based Clustering: DBSCAN - Density-Based Clustering Based on Connected Regions with High Density, Measuring Clustering Goodness, Expectation maximization (EM) for soft clustering. Semi-supervised learning with EM using labelled and unlabelled data. Principal components analysis (Eigen values, Eigen vectors, Orthogonality)	**04**

Laboratory Experiments based on:

1. Data Pre-processing
2. Model Building using Regression
3. Ensemble Methods
4. Cluster Analysis
5. Expectation maximization
6. Principal components analysis
7. Reinforcement learning methods
8. Instance based learning methods.

Books Recommended:

Text books:

1. Christopher Bishop Pattern Recognition and Machine Learning, Springer;2011 edition.
2. Kevin Murphy, Machine *Learning: A probabilistic perspective*, The MIT Press; Illustrated edition (24 August 2012).
3. Trevor Hastie, Robert Tibshirani, Jerome Friedman, The Elements of Statistical Learning: Data Mining, Inference and Prediction, Springer,2017 edition.

Reference Books:

1. Mitchell Tom M. “Machine Learning”, Tata McGraw-Hill, 1997.
2. Witten Ian H., Eibe Frank, Mark A. Hall, and Christopher J. Pal. “Data Mining: Practical machine learning tools and techniques”, Morgan Kaufmann, 2016.
3. Mehryar Mohri, Afshin Rostamizadeh, and Ameet Talwalkar. Foundations of Machine Learning, The MIT Press, 2012

Evaluation Scheme:

Semester End Examination (A):

Theory:

1. Question paper based on the entire syllabus will comprise of 5 questions (All compulsory, but with internal choice as appropriate), each carrying 15 marks, total summing up to 75 marks.
2. Weightage of each module in end semester examination is expected to be/will be proportional to number of respective lecture hours mentioned in the syllabus.
3. Total duration allotted for writing the paper is 3 hrs.

Laboratory:

1. Oral & Practical examination will be based on the entire syllabus including, the practicals performed during laboratory sessions.

Continuous Assessment (B):

Theory:

1. Consisting of **Two Compulsory Class Tests** Approximately 40% to 50% of syllabus content must be covered in First test and remaining 40% to 50% of syllabus contents must be covered in second test.
2. Total duration allotted for writing each of the paper is 1 hr.
3. Average of the marks scored in the two tests will be considered for final grading.

Laboratory: (Term work)

Term work shall consist of minimum 10 experiments and minimum 2 assignments.
The distribution of marks for term work shall be as follows:

i. Laboratory work (Performance of Experiments): 15 Marks
ii. Journal Documentation (Write-up and Assignments): 10 marks

The final certification and acceptance of term work will be subject to satisfactory performance of laboratory work and upon fulfilling minimum passing criteria in the term work.

Prepared by Checked by Head of the Department Principal

Program: Final Year B.Tech	Semester: VII
Course: Blockchain Technology	Course Code: DJ19ITEC7015
Course: Blockchain Technology Laboratory	Course Code: DJ19ITEL7015

Teaching Scheme (Hours / week)				Evaluation Scheme						
				Semester End Examination Marks (A)			Continuous Assessment Marks (B)			Total marks (A+ B)
Lectures	Practical	Tutorial	Total Credits	Theory			Term Test 1	Term Test 2	Avg.	
				75			25	25	25	100
				Laboratory Examination			Term work		Total Term work	50
3	2	--	4	Oral	Practical	Oral & Practical	Laboratory Work	Tutorial / Mini project / presentation/ Journal		
				25	--	--	15	10	25	

Pre-requisite: Computer Networking, Cryptography and Hashing, Data Structures

Course Objectives: The course will provide students with the conceptual understanding of how blockchain technology works. In this course students will also be able to design and deploy smart contracts and distributed applications using solidity language which will also help them analyze how blockchain technology can be used to innovate and improve business processes.

Course Outcomes: On completion of the course, learner will be able to:

1. Survey different blockchain platforms, their architectures and applications.
2. Develop smart contracts on Ethereum framework using solidity language.
3. Analyze the real-world problems that can be solved using blockchain technology.

Detailed Syllabus: (unit wise)

Unit	Description	Duration
1	**Introduction to Block chain:** Centralized v/s Decentralized system, Need for Decentralized system, – Design principles of the Blockchain economy, Blockchain types – Public v/s private block chain, Blockchain Architecture, Blockchain characteristics and advantages, Cryptography and Data structures for BCT (Tree, Merkel Tree), Blockchain Types.	08
2	**Decentralization of Network**: Consensus mechanism, Consensus Algorithm PoW, PoS, DPoS, issues with PoW, Distributed Consensus, Incentives and Proof of Work, Smart Contracts, Consensus without Identity.	06
3	**Introduction to cryptocurrencies:** eWallet, double spending, Introduction to bitcoin, Bitcoin block, bitcoin network, structure of a block, bitcoin blockchain, Bitcoin ecosystem, 51% attack, Mining and consensus (Mining Incentives and Strategies), Energy consumption, introduction to other cryptocurrencies, Cryptocurrency Regulation.	10
4	**Introduction to Ethereum**: The Ethereum Network – Components of Ethereum Ecosystem, Metamask, mainnet, testnet, faucets, introduction to solidity programming	06

	language, Scalability and cost issues, ethereum development standard.	
5	**Introduction to Hyperledger** – Introduction to Hyperledger fabric, Key features of Hyperledger fabric, Exploring Hyperledger framework, Functionalities offered by Hyperledger Fabric, Ethereum v/s Hyperledger framework, Hyperledger architecture, Hyperledger fabric transaction flow, Hyperledger Tools and Libraries, Hyperledger Consensus, Chaincode.	**08**
6	**Blockchain use cases and applications**: Dao, DeFi, DApps, NFT, Blockchain use case evaluation framework, World Economic Forum blockchain development toolkit.	**04**

List of Laboratory Experiments: (Any 10 from the list)

1. Install the blockchain server and establish a peer-to-peer network of nodes
2. Building a Private Blockchain with Docker and Ethereum
3. Create And Deploy Your Private Blockchain on MultiChain
4. Deploying and interacting with a token contract
5. Generate the crypto material for the various participants in the bootstrapping network.
6. Generate the genesis block for the Orderer node and start ordering service (solo node) in the bootstrapping network.
7. Installing Truffle and Ganache and deploying your first smart contract
8. Perform tests on complied programs to check for possible errors using tools such as Remix IDE, Ropsten Testnet, Ganache and Truffle.
9. Setting Up Development Environment Using Hyperledger Composer
10. Building a Blockchain PoC using Hyperledger Composer
11. Explore the user-friendly environment of Truffle for developing and testing a DApp
12. Perform basic querying of transactions, nodes, blocks using
13. Blockchains, Ethereum Query Language, Bitcoin Explorer, Ethereum Explorer
14. Perform file storage using Inter-Planetary File System (IPFS)

Any other experiment based on syllabus may be included, which would help the learner to understand topic/concept.

Books Recommended:

TextBooks:

1. Blockchain For Dummies, 2ed by by Tiana Laurence, Wiley Publications
2. Daniel Drescher, "Block Chain Basics", Apress; 1stedition, 2017
3. Blockchain Basics: A Non-Technical Introduction in 25 Steps, by Daniel Drescher, Apress publisher,
4. Building Ethereum Dapps by Roberto Infante

Reference Books:

1. Draft version of "S. Shukla, M. Dhawan, S. Sharma, S. Venkatesan, 'Blockchain Technology: Cryptocurrency and Applications', Oxford University Press, 2019.
2. Josh Thompson, 'Blockchain: The Blockchain for Beginnings, Guild to Blockchain Technology and Blockchain Programming', Create Space Independent Publishing Platform, 2017.
3. Mastering Ethereum: Building Smart Contracts and DApps, by Andreas Antonopoulos, Gavin Wood, O'Reilly Publications

Evaluation Scheme:

Semester End Examination (A):

Theory:

1. Question paper based on the entire syllabus will comprise of 5 questions (All compulsory, but with internal choice as appropriate), each carrying 15 marks, total summing up to 75 marks.

2. Total duration allotted for writing the paper is 3 hrs.

Laboratory:

1. Oral examination will be based on the entire syllabus including, the practicals performed during laboratory sessions.

Continuous Assessment (B):

Theory:

1. Consisting of Two Compulsory Class Tests: Approximately 40% to 50% of syllabus content must be covered in First test and remaining 40% to 50% of syllabus contents must be covered in second test.
2. Total duration allotted for writing each of the paper is 1 hr.
3. Average of the marks scored in both the tests will be considered for final grading.

Laboratory: (Term work)

Term work shall consist of at least 10 experiments based on the above list.

The distribution of marks for term work shall be as follows:

i. Laboratory work (Performance of Experiments, Write-up): 15 Marks
ii. Journal Documentation (Write-up, Power Point Presentation and Assignments): 10 marks

The final certification and acceptance of term work will be subject to satisfactory performance of laboratory work and upon fulfilling minimum passing criteria in the term work.

Prepared by Checked by Head of the Department Principal

<table>
<tr><td colspan="5">Program: Final Year B.Tech</td><td colspan="5">Semester: VII</td></tr>
<tr><td colspan="5">Course: Project-I</td><td colspan="5">Course Code: DJ19ITP704</td></tr>
<tr><td colspan="4" rowspan="2">Teaching Scheme (Hours / week)</td><td colspan="9">Evaluation Scheme</td></tr>
<tr><td colspan="4">Semester End Examination Marks (A)</td><td colspan="4">Continuous Assessment Marks (B)</td><td>Total marks (A+ B)</td></tr>
<tr><td rowspan="3">Lectures</td><td rowspan="3">Practical</td><td rowspan="3">Tutorial</td><td rowspan="3">Total Credits</td><td colspan="4">Theory</td><td>Term Test 1</td><td>Term Test 2</td><td>Avg.</td><td rowspan="2"></td></tr>
<tr><td colspan="4">--</td><td>--</td><td>--</td><td>--</td></tr>
<tr><td colspan="3">Laboratory Examination</td><td colspan="3">Term work</td><td rowspan="2">Total Term work</td><td rowspan="3">100</td></tr>
<tr><td rowspan="2">--</td><td rowspan="2">4</td><td rowspan="2">--</td><td rowspan="2">2</td><td>Oral</td><td>Practical</td><td>Oral & Practical</td><td>Laboratory Work</td><td colspan="2">Tutorial / Mini project / presentation/ Journal</td></tr>
<tr><td>50</td><td>--</td><td>--</td><td>--</td><td colspan="2">50</td><td>50</td></tr>
</table>

Course Objectives: To introduce the students to professional engineering practice by providing them with an opportunity to work on an open-ended engineering problem. Typically, the students would apply knowledge from different areas or courses, which they have studied in their curriculum using methods, tools, and techniques, which they learned to a real-world scenario. Students would have to apply not only their engineering knowledge and proficiencies (hard skills), but also to demonstrate their competence in generic, professional skills (soft skills). It also emphasizes the importance of life-long learning as a fundamental attribute of graduate engineers.

Course Outcomes: On completion of the course, learner will be able to:

1. Discover potential research areas in the field of IT.
2. Survey several available literatures in the related field of study.
3. Compare the several existing solutions for research challenges.
4. Design the solution for the research plan.
5. Summarize the findings of the study conducted.
6. Work effectively as a member of the team.

Guidelines

1. The department must allocate 1 day in the VII semester every week.
2. The project work is to be conducted by a group of three students
3. Each group shall identify a potential research area/problem domain, on which the study is to be conducted.
4. Each group will be associated with a project mentor/guide. The group should meet with the project mentor/guide periodically and record of the meetings and work discussed must be documented.
5. Students will do a rigorous literature survey of the problem domain by reading and understanding at least 3-5 research papers from current superior quality national/international journals/conferences. (Papers selected must be indexed by Scopus/IEEE/Springer/ACM etc.). The list of papers surveyed must be clearly documented.
6. Students will design and implement (30-40%) the system in Sem VII.
7. The project assessment for term work will be done at least two times at department level by giving presentation to panel members which consist of at least three (3) members as Internal examiners (including the project guide/mentor) appointed by the Head of the department of respective Program.
8. A report is to be prepared summarizing the findings of the literature survey. A comparative evaluation of the different

techniques surveyed is also to be done.

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

Evaluation Scheme:

Semester End Examination (A):

Presentation:

1. Each group will be jointly evaluated by a team of Internal and External Examiners approved by the University of Mumbai.
2. Oral exams will be conducted on the study done by the students.

Continuous Assessment (B):

Presentation: (Term work)

1. Each team must give a presentation/demo to the Internal Panel consisting of 3 domain experts.
2. Each team will prepare a report that will summarize the results of the literature survey and implementation and coding as project proposal in SEM VII. The list of papers surveyed must be clearly documented.

The distribution of marks for term work shall be as follows:

1. Term Work shall consist of full Project-I on above guidelines/syllabus.
2. The final certification and acceptance of term work will be subject to satisfactory performance and upon fulfilling minimum passing criteria in the term work.

Prepared by Checked by Head of the Department Principal

Program: Final Year B.Tech	Semester: VIII
Course: Semantic Web Technology	Course Code: DJ19ITC801
Course: Semantic Web Technology Laboratory	Course Code: DJ19ITL801

Teaching Scheme (Hours / week)				Evaluation Scheme						
				Semester End Examination Marks (A)			Continuous Assessment Marks (B)			Total marks (A+ B)
Lectures	Practical	Tutorial	Total Credits	Theory			Term Test 1	Term Test 2	Avg.	
				75			25	25	25	100
				Laboratory Examination			Term work		Total Term work	50
3	2	--	4	Oral	Practical	Oral & Practical	Laboratory Work	Tutorial / Mini project / presentation/ Journal		
				25	--	--	15	10	25	

Pre-requisite: Knowledge of XML and database management systems

Course Objectives: The objective of the course is to introduce students to the concept of semantic web, understand and discuss fundamental concepts along with its advantages and limits; understand and use ontologies in the context of the semantic web.

Course Outcomes: On completion of the course, learner will be able to:

1. Model ontologies using Resource Description Framework (RDF) and Web Ontology Language (OWL).
2. Query ontologies using SPARQL.
3. Apply Semantic web technologies to real world applications

Detailed Syllabus: (unit wise)		
Unit	**Description**	**Duration**
1	**Introduction-Foundation of Semantic Web Technologies:** Introduction, Todays' web, Current web vs Semantic Web, Semantic Web Technologies, A layered approach	03
2	**Structured Web Documents in XML:** The XML in nutshell, Syntax of XML, XML Schema, structuring, URIs and Namespaces, Querying and Addressing XML documents, Processing	05
3	**Simple Ontologies in RDF and RDF Schema:** Introduction to RDF, Syntax for RDF (XML-based), RDF Serialization, Advanced Features, RDF Schema (Lightweight Ontology): Basic Ideas, The Language, Simple Ontologies in RDF Schema, Encoding of Special Data structures, An Example, Ontology Querying in SPARQL	10
4	**Web Ontology Language:** Introduction, OWL and RDF/RDFS, OWL language: three sublanguages and description, OWL Species, Layering of OWL, Examples, OWL in OWL, Future extensions	08
5	**Ontology Engineering and Semantic Web Tools:** Introduction, Constructing Ontologies Manually, Reusing Existing Ontologies, Semiautomatic Ontology Acquisition, Ontology Mapping, On-To-Knowledge Semantic Web Architecture, Quality Assurance of Ontologies, Modular Ontologies: Divide and Conquer	10

	Sematic Web Tools: Software Tools for Ontology Engineering and Management, RDF Tools, FOAF, DublinCore, Ontology Design and Management using the Protege editor, Ontology Programming with the Jena API	
6	**Applications:** Horizontal Information Products at Elsevier, Openacademia: Distributed Publication Management (distributed, semantic-based publication management), Flink: the social networks of the Semantic Web Community, Bibster: Data Exchange in a Peer-to-Peer System, Data Integration at Audi, Think Tank portal at EnerSearch, e-Learning, Web Services Web Data Exchange and Syndication, Semantic Wikis, Semantic Portals, Semantic Metadata in Data Formats, Semantic Web in Life Sciences	**08**

List of Laboratory Experiments: Experiments based on content such as XML document, RDF document preparation, OWL ontology etc.

1. Working with XML
2. Working with XML Schema, DTD
3. Design of Ontology using RDF
4. Design RDF document with different Serialization format (e.g. tutle,N-triple)
5. Design of Ontology using RDFS
6. Design Of Ontology using OWL
7. Querying Ontology using SPARQL
8. Design of any domain specific Ontology in Protégé
9. Ontology Programming with Jena API
10. Case Study: WordNet
11. Case Study: Dbpedia
12. Case study: Pizza Ontology
13. Case Study: Applications of Sematic Web

Any other experiment based on syllabus may be included, which would help the learner to understand topic/concept.

List of Open-Source Software/learning website:

1. http://www.linkeddatatools.com/
2. http://opensemanticframework.org/
3. https://jena.apache.org/

Books Recommended:

Text books:

1. A Semantic Web Primer, by Grigoris Antoniou, Paul Groth, Frank van Harmelen and Rinke Hoekstra, Publisher: MIT Press; 3rd edition (September 2012).
2. Foundations of Semantic Web Technologies, by Pascal Hitzler, Markus Krötzsch, Sebastian Rudolph, Publisher: Chapman and Hall; 1st edition (August 6, 2009).
3. Peter Mika, “Social Networks and the Semantic Web”, First Edition, Springer 2007

Reference Books:

1. Semantic Web for the Working Ontologist, Second Edition: Effective Modeling in RDFS and OWL, by Dean Allemang, and James Hendler. Publisher: Morgan Kaufmann; 2nd edition (June 3, 2011).
2. Semantic Web Programming, by John Hebeler, Matthew Fisher, Ryan Blace, Andrew Perez-Lopez, and Mike

Dean (Foreword). Publisher: Wiley; 1 edition (April 13, 2009).

3. Linked Data: Structured Data on the Web, by David Wood, Marsha Zaidman, Luke Ruth, and Michael Hausenblas. Publisher: Manning Publications; 1 edition (January 24, 2014).
4. Learning SPARQL: Querying and Updating with SPARQL 1.1, by Bob DuCharme Publisher: O'Reilly Media; 2 edition (July 18, 2013).
5. Programming the Semantic Web, Build Flexible Applications with Graph Data, by Web Toby Segaran, Colin Evans, and Jamie Taylor. Publisher: O'Reilly Media; 2 edition (July, 2009).

Resources

1. W3C Semantic Web Activity, http://www.w3.org/2001/sw/
2. W3C RDF Working Group, http://www.w3.org/2011/rdf-wg/wiki/Main_Page
3. W3C OWL Working Group, http://www.w3.org/2007/OWL/wiki/OWL_Working_Group
4. W3C RIF Working Group, http://www.w3.org/2005/rules/wiki/RIF_Working_Group
5. semanticweb.org, http://semanticweb.org
6. SemWebCentral, http://www.semwebcentral.org/
7. W3Schools, http://www.w3schools.com/
8. John F. Sowa's Ontology pages: http://www.jfsowa.com/ontology/
9. The Semantic Web in Ten Passages, http://www.dfki.uni-kl.de/~boley/sw10pass/sw10pass-en.htm

Evaluation Scheme:

Semester End Examination (A):

Theory:

1. Question paper based on the entire syllabus will comprise of 5 questions (All compulsory, but with internal choice as appropriate), each carrying 15 marks, total summing up to 75 marks.
2. Total duration allotted for writing the paper is 3 hrs.

Laboratory:

1. Oral examination will be based on the entire syllabus including, the practicals performed during laboratory sessions.

Continuous Assessment (B):

Theory:

1. Consisting of Two Compulsory Class Tests: Approximately 40% to 50% of syllabus content must be covered in First test and remaining 40% to 50% of syllabus contents must be covered in second test.
2. Total duration allotted for writing each of the paper is 1 hr.
3. Average of the marks scored in both the tests will be considered for final grading.

Laboratory: (Term work)

Term work shall consist of at least 10 experiments based on the above list.

The distribution of marks for term work shall be as follows:

i. Laboratory work (Performance of Experiments, Write-up): 15 Marks

ii. Journal Documentation (Write-up, Power Point Presentation and Assignments): 10 marks

The final certification and acceptance of term work will be subject to satisfactory performance of laboratory work and upon fulfilling minimum passing criteria in the term work.

Prepared by Checked by Head of the Department Principal

Program: Final Year B.Tech	Semester: VIII
Course: Design Patterns	Course Code: DJ19ITC802
Course: Design Patterns Laboratory	Course Code: DJ19ITL802

Teaching Scheme (Hours / week)				Evaluation Scheme						
				Semester End Examination Marks (A)			Continuous Assessment Marks (B)			Total marks (A+ B)
Lectures	Practical	Tutorial	Total Credits	Theory			Term Test 1	Term Test 2	Avg.	
				75			25	25	25	100
				Laboratory Examination			Term work		Total Term work	50
3	2	--	4	Oral	Practical	Oral & Practical	Laboratory Work	Tutorial / Mini project / presentation/ Journal		
				25	--	--	15	10	25	

Pre-requisite: Software Engineering, SOA, Knowledge of Programming

Course Objectives: The objective of this course is to introduce students to a wide range of software design patterns and outlines the differences between creational, structural, and behavioral patterns. This course extends object-oriented analysis and design by incorporating design patterns to create interactive applications. Through a survey of established design patterns, students will gain a foundation for more complex software applications.

Course Outcomes: On completion of the course, learner will be able to:

1. Identify and apply the most suitable design pattern to address a given application design problem.

Detailed Syllabus: (unit wise)

Unit	Description	Duration
1	**Introduction to Design Patterns:** What is a Design Pattern, Describing Design Patterns, How Design Patterns Solve Design Problems, Selecting a Design Pattern, Using a Design Pattern.	06
2	**Creational and Structural Patterns:** Abstract Factory, Builder, Factory Method, Prototype, Singleton; Adapter, Bridge, Composite, Decorator, Facade, Flyweight, Proxy.	12
3	**Behavioral Patterns:** Chain of Responsibility, Command, Interpreter, Iterator, Mediator, Memento, Observer, State, Strategy, Template Method, Visitor.	08
4	**Understanding SOA Design Patterns:** Fundamental Terminology, Object-Oriented Patterns, Software Architecture Patterns, Enterprise Application Architecture Patterns, EAI Patterns, SOA Patterns, Pattern Notation, Symbols, and Figures.	06
5	**Service Design Patterns:** Service Identification Patterns, Service Definition Patterns, Service Implementation Patterns, Service Security Patterns, Service Contract Design Patterns, Service Governance Patterns	06
6	**Strategic Architecture Considerations:** "Compound" vs. "Composite", Compound Patterns and Pattern Relationships, Increased Federation, Increased Intrinsic Interoperability, Increased Vendor Diversification Options, Increased Business and Technology Alignment.	04

Suggested Lab Experiments (not limited to)

1. Design a UML class diagram for Abstract Factory Pattern and implement the same for any real life scenario. (For example, implement a code to list the courses offered to students based on college and department using Abstract Factory Pattern)
2. Code in any language of your choice to prevent Singleton Pattern from Reflection, Serialization and Cloning.
3. Draw class diagram for Flyweight Pattern and implement the same to demonstrate the working of Counter Strike Game (Instead of creating objects for each player, use Flyweight Pattern to create only 2 objects one for Terrorists class and other for Counter Terrorists class, and reuse them)
4. Implement the CoR Pattern using any language of your choice for the given problem statement. (A system in which several managers and executives can respond to a purchase request or hand it off to a superior. You are free to have your own set of rules to approve the orders.)
5. Implement the Observer Pattern using any language of your choice for any real life scenario. (For example, implement a system using Observer Pattern in which registered investors are notified every time a stock changes value).
6. Design a UML class diagram for Strategy Pattern and implement the same using any language of your choice. (For example, code in such a way that the system should encapsulate different sorting algorithms in the form of sorting objects. This should allow clients to dynamically change sorting strategies).
7. Case study on Enterprise Integration Patterns. (Students can refer to the Bond Trading System case study listed here: https://www.enterpriseintegrationpatterns.com/BondTradingCaseStudy.html)
8. Case study on: SOA Metadata Centralization Pattern.
9. Case study on: Compound Pattern (For example, students can be asked to form groups and discuss on how MVC architecture can be dissected into patterns).
10. Case Study on: "Why enterprise architecture maximizes organizational value" (Students can refer to the article here: https://www.cio.com/article/228396/why-enterprise-architecture-maximizes-organizational-value.html).

Books Recommended:

Textbooks:

1. Erich Gamma, Richard Helm, Ralph Johnson, John Vlissides, "Design Patterns: Elements of Reusable Object-Oriented Software", Addison-Wesley Professional, 1994
2. Thomas Erl, "SOA Design Pattern", Pearson, 2008

Reference Books:

1. Eric Freeman, Elisabeth Robson, Bert Bates, Kathy Sierra, "Head First Design Patterns", O'Reilly Media, Inc., 2004
2. Vaskaran Sarcar, "Design Patterns in C#: A Hands-on Guide with Real-World Examples", Apress, 2018

Evaluation Scheme:

Semester End Examination (A):

Theory:

1. Question paper based on the entire syllabus will comprise of 5 questions (All compulsory, but with internal choice as appropriate), each carrying 15 marks, total summing up to 75 marks.
2. Total duration allotted for writing the paper is 3 hrs.

Laboratory:

1. An oral examination is to be conducted on the above syllabus and list of experiments.

Continuous Assessment (B):

Theory:

1. Two term tests of 25 marks each is to be conducted during the semester.
2. Total duration allotted for writing each of the paper is 1 hr.
3. Average of the marks scored in both the two tests will be considered for final grading.

Laboratory: (Term work)
Term work shall be evaluated based on: laboratory work, journal and minimum two assignments.

The distribution of marks for term work shall be as follows:

i. Laboratory work (implementation of experiments as suggested by faculty): 15 marks
ii. Journal Documentation (Write-up and Assignments): 10 marks

The final certification and acceptance of term work will be subject to satisfactory performance of laboratory work and upon fulfilling minimum passing criteria in the term work.

Prepared by Checked by Head of the Department Principal

Program: Final Year B.Tech	Semester: VIII
Course: Industrial Internet of Things	Course Code: DJ19ITEC8011
Course: Industrial Internet of Things Laboratory	Course Code: DJ19ITEL8011

Teaching Scheme (Hours / week)				Evaluation Scheme						
				Semester End Examination Marks (A)			Continuous Assessment Marks (B)			Total marks (A+ B)
Lectures	Practical	Tutorial	Total Credits	Theory			Term Test 1	Term Test 2	Avg.	
				75			25	25	25	100
				Laboratory Examination			Term work		Total Term work	50
3	2	--	4	Oral	Practical	Oral & Practical	Laboratory Work	Tutorial / Mini project / presentation/ Journal		
				25	--	--	15	10	25	

Pre-requisite: Overview of IoT

Course Objectives: The objective of this course is to provide a comprehensive introduction to the concept of the Industrial Internet of Things, or IIoT, learn how it is applied in manufacturing, and what businesses should consider as they decide to implement this technology. Considerations include information technology infrastructure, the business value of implementing IIoT, and what needs to happen across the organization to ensure successful implementation.

Course Outcomes: On completion of the course, learner will be able to:

1. Explore Industry 4.0 and IIoT technologies, architectures, standards, and protocols.
2. Examine the technological developments that will shape the industrial landscape in the future.
3. Work effectively as a member of team.

Detailed Syllabus: (unit wise)		
Unit	**Description**	**Duration**
1	**Introduction to Industrial Internet of Things (IIoT):** Evolution of the Internet, What is Industrial Internet?, Why Industrial Internet and Why Now?, Key IIoT Technologies, Opportunities and Benefits	**04**
2	**IIoT Use Cases and the Innovators of Industrial Internet:** Use Cases (Health Care, Oil and Gas Industry, Smart Office, Retail); Miniaturization, Cyber Physical Systems (CPS), Wireless Technology, IP Mobility, Network Functionality Virtualization (NFV), Network Virtualization, SDN (Software Defined Networks), The Cloud and Fog, M2M Learning and Artificial Intelligence, 3D Printing, People versus Automation	**10**
3	**IIoT Reference Architecture:** Traditional M2M architecture, IIC (Industrial Internet Committee) Reference Architecture, Industrial Internet Architecture Framework (IIAF), Viewpoints (Business, Usage, Functional), Architectural Topology, The Three-Tier Topology (Edge, Platform, Enterprise), Connectivity, Key Functional Characteristics of Connectivity	**08**
4	**Designing the Industrial Internet Systems:** Proximity Network, WSN Edge Node (WSN Network Protocols, Low-Power Technologies, Designing Low-Power Device Networks),	**10**

	Legacy Industrial Protocols (RS232 Serial Communications, Field Bus Technologies), Modern Communication Protocols (Industrial Ethernet, Encapsulated Field Bus, Standard Ethernet), Wireless Communication Technologies (IEEE 802.15.4, Bluetooth Low Energy, ZigBee and ZigBee IP, Z-Wave, Wi-Fi Backscatter, RFID, NFC, 6LoWPAN, RPL)	
5	**IIoT Middleware Transport Protocols:** TCP/IP, UDP, RTP, CoAP, Middleware Software Patterns (MQTT, XMPP, AMQP, DDS), IIoT Middleware Architecture	**06**
6	**Securing the IIoT and Introduction to Industry 4.0:** Security in Manufacturing, PLCs and DCS, Securing the OT, Potential Security Issues - Network Level and System Level, Identity Access Management, Defining Industry 4.0, Four Main Characteristics of Industry 4.0, Industry 4.0 Design Principles, Building Blocks of Industry 4.0	**04**

Lab guidelines for mini project:

1. The mini project work is to be conducted by a group of three students (four in extreme case; call can be taken by subject in-charge).
2. The group should meet with the concerned faculty during laboratory hours and document the progress of work.
3. The students should be given sufficient time (6-8 hrs) to do survey for finalizing their mini project topic using Raspberry Pi / Arduino / ARM Cortex / Intel Galileo etc.
4. Each group should identify a potential problem statement on which the study and implementation is to be conducted and will also identify the hardware and software requirements for their mini project.
5. Once the topic has been finalized, students either can buy the required components by themselves or can request the college to provide the components.
6. Concerned faculty will do the term work assessment after seeing the group's presentation and overall implementation of the mini project.
7. Each group may present their work in various project competitions and paper presentations.
8. A detailed report is to be prepared as per guidelines given by the concerned faculty.

Books Recommended:

Textbooks:

1. Alasdair Gilchrist, "Industry 4.0: The Industrial Internet of Things", Apress, Jan 2017
2. Anandarup Mukherjee, Chandana Roy, and Sudip Misra, "Introduction to Industrial Internet of Things and Industry 4.0", CRC Press, Dec 2020

Reference Books:

1. Giacomo Veneri, Antonio Capasso, "Hands-On Industrial Internet of Things", Packt, Nov 2018
2. Carolina Machado, J. Paulo Davim, "Industry 4.0: Challenges, Trends, and Solutions in Management and Engineering", CRC Press, Jun 2020

Evaluation Scheme:

Semester End Examination (A):

Theory:

1. Question paper based on the entire syllabus will comprise of 5 questions (All compulsory, but with internal choice as appropriate), each carrying 15 marks, total summing up to 75 marks.
2. Total duration allotted for writing the paper is 3 hrs.

Laboratory:

1. An oral examination is to be conducted on the above syllabus and laboratory work.

Continuous Assessment (B):

Theory:

1. Two term tests of 25 marks each will be conducted during the semester.
2. Total duration allotted for writing each paper is 1 hr.
3. Average of the marks scored in the two tests will be considered for final grading.

Laboratory: (Term work)

Term work shall be evaluated based on mini project implementation, detailed report, presentation and minimum two assignments.

The distribution of marks for term work shall be as follows:

i. Laboratory work (mini project implementation and detailed report): 15 Marks

ii. Journal Documentation (Write-up, Power Point Presentation and Assignments): 10 marks

The final certification and acceptance of term work will be subject to satisfactory performance of laboratory work and upon fulfilling minimum passing criteria in the term work.

Prepared by Checked by Head of the Department Principal

Program: Final Year B.Tech	Semester: VIII
Course: Game Design & Gamification	Course Code: DJ19ITEC8012
Course: Game Design & Gamification Laboratory	Course Code: DJ19ITEL8012

Teaching Scheme (Hours / week)				Evaluation Scheme						
				Semester End Examination Marks (A)			Continuous Assessment Marks (B)			Total marks (A+ B)
Lectures	Practical	Tutorial	Total Credits	Theory			Term Test 1	Term Test 2	Avg.	
				75			25	25	25	100
				Laboratory Examination			Term work		Total Term work	50
3	2	--	4	Oral	Practical	Oral & Practical	Laboratory Work	Tutorial / Mini project / presentation/ Journal		
				25	--	--	15	10	25	

Pre-requisite: Basic knowledge of HCI, UI/UX.

Course Objectives: The course introduces the students to application of game-design elements and game principles. The objective of the course is to develop problem-solving capabilities using gamification.

Course Outcomes: On completion of the course, learner will be able to:

1. Design games using gamification principles.
2. Work effectively as a member of a team.

Detailed Syllabus: (unit wise)

Unit	Description	Duration
1	**Introduction to Game Design:** Motivation, Types of games, Different aspects of game design; Different components in a game, Game engines, Design Schemas, Game Design Fundamentals	05
2	**The Design Process:** Iterative Design, Commissions, Game creation, Game Modification, Game Analysis, Design Process, Scripted Game Deign, Play Testing, Game Mechanics and Dynamics: Feedback and Re-enforcement, Designing for engagement Game Mechanics in depth, Putting it together, Case study of 8 queen's problem.	07
3	**Rules of Digital Games:** Rule as a Whole, What are Rules, Types of Rules: constitutive, operational, and implicit, Case Study: Rules of Tetris, Why Rules.	04
4	**Foundations of Gamification:** Definition of Gamification, Why Gamify, Examples and Categories, Gamification in Context, Resetting Behavior, Replaying History, Gaming foundations: Fun Quotient, Evolution by loyalty, status at the wheel, the House always wins.	07
5	**Developing Thinking:** Re-framing Context: Communicology, Apparatus, and Post-history, Concepts Applied to Video games and Gamification, Rethinking 'playing the game' with Jacques Henriot, To Play Against: Describing Competition in Gamification, Player Motivation: Powerful Human Motivators, Why People Play, Player types, Social Games, Intrinsic verses Extrinsic Motivation, Progression to Mastery. Case studies for Thinking: Tower of Hanoi.	10

6	**Opponent Moves in Gamification:** Reclaiming Opposition: Counter gamification, Gamed Agencies: Affectively Modulating Our Screen-and App-Based Digital Futures, Remodeling design, Game Mechanics, Designing for Engagement, Case study of Maze Problem.	**09**

List of Laboratory Experiments:

1. Analyze a game and describe it in terms of its core elements, game mechanics, rules.
2. **Gamification Definition Video:** Create a video, animation, or screencast up to ten minutes long, which explains the concept of gamification. Imagine you are describing to a friend or relative what this course is about, and why it's an important topic. To the extent possible, anticipate and address possible misunderstandings. Humor and creativity are encouraged!
3. Spend some time playing a casual online/mobile game, such as Candy Crush Saga, Clash of Clans, or Words With Friends. (These are just examples; it can be any game of your choosing, so long as you didn't already use it for a prior assignment.) Analyze the techniques the game uses to motivate players to participate, and to keep playing. Are they effective? Why or why not?
4. Identify two games. Do a comparative analysis that explains which system you think is most successful, and why. Give specific examples of design aspects that you find effective or ineffective.
5. **Casual Games:** Spend some time playing a casual online/mobile game, such as Candy Crush Saga, Clash of Clans, or Words with Friends. (These are just examples; it can be any game of your choosing.) Answer the following questions, drawing on the concept discussed in the course: Is the game fun? Why or why not? What could a business learn from this game?
6. **Application Comparison:** Compare the use of gamification in two of the four application categories, viz., Marketing, Workplace, Learning, Behavior Change. How would a successful gamification system differ in the two situations, and how would it be similar? In which do you think gamification can be more effective?
7. **Mini Project**

Books Recommended:

Text books:

1. Katie Salen and Eric Zimmerman, "Rules of Play: Game Design Fundamentals", MIT Press, 2003, ISBN 0-262-24045-9
2. Ernest Adams, "Fundamentals of Game Design", 3rd Edition, New Riders; 2013 ISBN-10: 0321929675
3. Mathias Fuchs, Sonia Fizek,Paolo Ruffino, Niklas Schrape, "Rethinking Gamification", Meson Press, ISBN (Print): 978-3-95796-000-9, http://projects.digital-cultures.net/meson-press/files/2014/06/9783957960016-rethinking-gamification.pdf, ISBN (PDF): 978-3-95796-001-6.
4. Gabe Zichermann, Christopher Cunningham, "Gamification by Design", Oreilly, ISBN: 978-1-449-39767-8
5. Byron Reeves and J. Leighton Read, "Total Engagement: Using Games and Virtual Worlds To Change The Way People Work And Businesses Compete", (Harvard Business Press, 2009) (selected chapters)
6. Kevin Werbach and Daniel Hunter, "For the Win: How Game Thinking Can Revolutionize Your Business", (Wharton Digital Press, 2012)

Online References:

1. Scott Nicholson, "A User-Centered Theoretical Framework for Meaningful Gamification," Proceedings of the 8th Games Learning and Society Conference (2012)
2. B.J. Fogg, "A Behavior Model for Persuasive Design", Proceedings of the 4th international Conference on Persuasive Technology (ACM, 2009)
3. Joey Lee and Jessica Hammer, "Gamification in Education: What, How, Why Bother?" Academic Exchange Quarterly 15.2, 2011

4. Steffen P. Walz and Sebastian Deterding, eds., "The Gameful World: Approaches, Issues, Applications", MIT Press, 2015, (selected chapters), chapter. 18 (Gamification and the Enterprise)
5. Juho Hamari and Vili Lehdonvirta, "Game Design as Marketing: How Game Mechanics Create Demand for Virtual Goods," International Journal of Business Science and Applied Management 5:14 (2010)
6. Roger E. Pedersen, "Game Design Foundations", Jones & Bartlett Learning; 2009, Second Edition, ISBN-10: 1598220349

Evaluation Scheme:

Semester End Examination (A):

Theory:

1. Question paper based on the entire syllabus will comprise of 5 questions (All compulsory, but with internal choice as appropriate), each carrying 15 marks, total summing up to 75 marks.
2. Total duration allotted for writing the paper is 3 hrs.

Laboratory:

1. Oral examination will be based on the entire syllabus including, the practicals performed during laboratory sessions.

Continuous Assessment (B):

Theory:

1. Two term tests of 25 marks each will be conducted during the semester. Approximately 40% to 50% of syllabus content must be covered in First test and remaining 40% to 50% of syllabus contents must be covered in second test. Total duration allotted for writing each of the paper is 1 hr.
2. Average of the marks scored in the two tests will be considered for final grading.

Laboratory: (Term work)

Term Work shall consist of at least 10 practical's based on the above list.

The distribution of marks for term work shall be as follows:

i. Laboratory work (Performance of Experiments, Write-up): 15 Marks
ii. Mini Project: 10 marks

The final certification and acceptance of term work will be subject to satisfactory performance of laboratory work and upon fulfilling minimum passing criteria in the term work.

Prepared by Checked by Head of the Department Principal

Program: Final Year B.Tech	Semester: VIII
Course: Predictive Analytics	Course Code: DJ19ITEC8013
Course: Predictive Analytics Laboratory	Course Code: DJ19ITEL8013

Teaching Scheme (Hours / week)				Evaluation Scheme						
				Semester End Examination Marks (A)			Continuous Assessment Marks (B)			Total marks (A+ B)
Lectures	Practical	Tutorial	Total Credits	Theory			Term Test 1	Term Test 2	Avg.	
				75			25	25	25	100
				Laboratory Examination			Term work		Total Term work	50
3	2	--	4	Oral	Practical	Oral & Practical	Laboratory Work	Tutorial / Mini project / presentation/ Journal		
				25	--	--	15	10	25	

Pre-requisite: Knowledge of Statistical Analysis and Business Analytics

Course Objectives: The objective of this course is to gain understanding of the computational foundations in Data Science and develop critical inferential thinking.

Course Outcomes: On completion of the course, learner will be able to:

1. Apply prediction modeling techniques to turn data into actionable insights.
2. Select a suitable model to carry out the prediction.

Detailed Syllabus: (unit wise)

Unit	Description	Duration
1	**Introduction to Predictive Analytics**: Supervised vs. Unsupervised Learning, Parametric vs. Non-Parametric Models, Predictive Analytics vs. Business Intelligence, Similarities between Business Intelligence and Predictive Analytics, Predictive Analytics vs. Statistics, Statistics and Analytics, Predictive Analytics and Statistics Contrasted, Predictive Analytics vs. Data Mining, Users of Predictive Analytics, Challenges in Using Predictive Analytics	05
2	**Setting Up the Problem:** Defining Data for Predictive Modeling, Defining the Target Variable, Defining Measures of Success for Predictive Models, Doing Predictive Modeling Out of Order: Building Models First, Early Model Deployment	05
3	**Regression:** Multiple Linear Regression (MLR) - Problems and Resolutions, Stepwise Regression, Dummy Regression, Logistic Regression: Why Logistic Regression, Odds and Probabilities, Log Likelihood ratio test, ROC Plot, Classification table.	08
4	**Neural Network:** Building Blocks: The Neuron, Neural Network Training, The Flexibility of Neural Networks, Neural Network Settings, Neural Network Pruning, Interpreting Neural Networks, Neural Network Decision Boundaries, Other Practical Considerations for Neural Networks	08
5	**Linear Discriminant Analysis:** Product moment correlation, Partial correlation, non-metric correlation, Regression analysis, Bivariate regression, Multiple regression, Multicollinearity,	08

	Relative importance of predictors, Cross-validation, Regression with dummy variables, Analysis of variance and covariance with regression.	
6	**Time Series Forecasting:** Introduction to Time Series, Time series objects in R, Trends and seasonality variation, Decomposition of time series, Autocorrelation, Partial Autocorrelation, Interpretation of ACF and PACF, Correlation, Exponential Smoothing, Holt Winters Method, Forecasting, Stationarity, Regression Methods, Moving Average Models, Autoregressive Moving Average (ARMA) models, Autoregressive Integrated Moving Average (ARIMA) models	**08**

List of Laboratory Experiments (Tools: SAS and SPSS):

1. Constructing a Decision Tree Predictive Model
2. Assessing a Decision Tree
3. Understanding Additional Plots and Tables (Self Managing Missing Values and Running the Regression Node)
4. Optimizing Regression Complexity
5. Neural Networks: training a neural network, selecting neural network input, increasing the network feasibility
6. Chi- Square Test (Parametric and Non-Parametric Test)
7. Exploratory Factor Analysis
8. Discriminant Analysis
9. Confirmatory Factor Analysis
10. Conjoint Analysis
11. Time Series Forecasting
12. MANOVA

Any other experiment based on syllabus may be included, which would help the learner to understand topic/concept.

Books Recommended:

Text Books:

1. Dean Abott, "Applied Predictive Analytics: Principles and Techniques for the Professional Data Analyst", Wiley Publication, 2014.
2. Prasad, R. N., & Acharya, S., "FUNDAMENTALS OF BUSINESS ANALYTICS", John Wiley & Sons, 2011.
3. "Machine Learning, A probabilistic perspective", Kevin P Murphy, IGHT Press Aug 2012.
4. Peter Christie, Jim Georges, Jeff Thompson, and Chip Wells, "Applied Analytics Using SAS Enterprise Miner, SAS Institute Inc., 2016
5. Predictive & Advanced Analytics (IBM ICE Publication).

Reference Books:

1. Eric Siegal, "Predictive Analytics", Wiley Publications, 2016.
2. Kumar, U. D., "Business Analytics: The Science of Data-driven Decision Making", Wiley India, 2017.
3. Predictive Modeling with SAS Enterprise Miner: Practical Solutions for Business Applications, Second Edition, 2016.
4. Edward W. Frees, Glenn Meyers, Richard A. Derrig, "Predictive Modeling Applications in Actuarial Science: Volume 2, Case Studies in Insurance (International Series on Actuarial Science)", Cambridge press, 2016.

Evaluation Scheme:

Semester End Examination (A):

Theory:

1. Question paper based on the entire syllabus will comprise of 5 questions (All compulsory, but with internal choice as appropriate), each carrying 15 marks, total summing up to 75 marks.
2. Total duration allotted for writing the paper is 3 hrs.

Laboratory:

1. Oral examination will be based on the entire syllabus including, the practicals performed during laboratory sessions.

Continuous Assessment (B):

Theory:

1. Consisting of Two Compulsory Class Tests: Approximately 40% to 50% of syllabus content must be covered in First test and remaining 40% to 50% of syllabus contents must be covered in second test.
2. Total duration allotted for writing each of the paper is 1 hr.
3. Average of the marks scored in both the tests will be considered for final grading.

Laboratory: (Term work)

Term work shall consist of at least 10 experiments based on the above list.

The distribution of marks for term work shall be as follows:

i. Laboratory work (Performance of Experiments, Write-up): 15 Marks

ii. Journal Documentation (Write-up, Power Point Presentation and Assignments): 10 marks

The final certification and acceptance of term work will be subject to satisfactory performance of laboratory work and upon fulfilling minimum passing criteria in the term work.

Prepared by Checked by Head of the Department Principal

Program: Final Year B.Tech	Semester: VIII
Course: Advanced Machine Learning	Course Code: DJ19ITEC8014
Course: Advanced Machine Learning Laboratory	Course Code: DJ19ITEL8014

Teaching Scheme (Hours / week)				Evaluation Scheme						
				Semester End Examination Marks (A)			Continuous Assessment Marks (B)			Total marks (A+ B)
Lectures	Practical	Tutorial	Total Credits	Theory			Term Test 1	Term Test 2	Avg.	
				75			25	25	25	100
				Laboratory Examination			Term work		Total Term work	50
3	2	--	4	Oral	Practical	Oral & Practical	Laboratory Work	Tutorial / Mini project / presentation/ Journal		
				25	--	--	15	10	25	

Pre-requisite: Knowledge of data mining, machine learning, statistics

Course Objectives: This course will provide students with a solid foundation for both applying and optimizing machine learning to complex real world problems and for addressing core research topics in machine learning.

Course Outcomes: On successful completion of this course, students should be able to:

1. Develop an appropriate machine learning model.
2. Apply optimization techniques to real world problems.
3. Work efficiently as a part of a team.

Detailed Syllabus: (unit wise)

Unit	Description	Duration
1	Reinforcement Learning: The reinforcement learning problem; Tabular & approximate solution methods: dynamic programming, Monto-Carlo Methods, Markov Decision Processes (MDPs), Q-learning and SARSA Model, Deep Q-Networks (DQNs), Deep Deterministic Policy Gradient (DDPG). Temporal difference learning, eligibility traces; planning and learning; dimensions of reinforcement learning, practical applications of Reinforcement Learning (AlphaGo Zero, Robotics and Industrial Automation).	06
2	Learning Techniques: Instance-Based Learning: K-Nearest Neighbor, Learning Vector Quantization (LVQ), Self-Organizing Map (SOM), Locally Weighted Learning (LWL), and case-based reasoning (CBR).	08
3	**Deep Learning:** Graphical Models: Basic graph concepts; Bayesian Networks; conditional independence; Markov Networks; Inference: variable elimination, belief propagation, max-	07

	product, junction trees, loopy belief propagation, expectation propagation, sampling; structure learning; learning with missing data.	
4	**Deep Networks**: Definition, Motivation, Applications; Restricted Boltzmann Machine; Sparse Auto-encoder; Deep Belief Net; Hidden Markov Model. Deep Learning Architectures: Concepts of Convolutional Neural Network, RNN, LSTM RNN, GRU RNN, Feature Maps, Relu Activation, Max Pooling structured deep learning, applications.	**09**
5	**Recurrent Neural Networks (RNN):** Architecture, BPTT Backprop through time, Mathematics of RNN, LTSM RNN and GRU RNN, probabilistic neural nets; Boltzmann machines; RBMs; sigmoid belief nets; autoencoders; deep reinforcement learning. Vanishing Gradient and exploding Gradient problem, LTSM architecture, GRU Architecture. LSTM RNN implementation in TensorFlow. Generative models for discrete data, Gaussian Models, Bayesian Statistics, Linear Regression, Logistic Regression, Directed graphical models (Bayes nets), Mixture models and the EM algorithm, Sparse linear models. Variational Autoencoders, Generative Adversarial Networks, Multi-task Deep Learning, Multi-view Deep Learning	**06**
6	**Optimization Methods in Machine Learning** Introduction to Optimization, Convex Sets, Convex Functions, Lagrange Duality, Convex Optimization Algorithms, Second-order cone models, Semi-definite programming, Semi-infinite programming, Minimax, Sublinear algorithms, Interior Point Methods, Active set, Stochastic gradient, Coordinate descent, Cutting planes method, Applications to Image/Video/Multimedia Processing	**04**

List of Laboratory Experiments:

1. Demonstrate Bayesian network for image processing/document classification/semantic search.
2. Perform classification using autoencoder in Python with Keras using any dataset.
3. Build RNN model for any dataset using TensorFlow.
4. Demonstrate working of GAN on any suitable dataset using any libraries.
5. Demonstrate optimization on any machine learning problem using appropriate techniques.
6. Mini Project based on the concepts relevant to the syllabus.

Books Recommended:

Text books:

1. Kevin P. Murphy. Machine Learning: A Probabilistic Perspective. MIT Press 2012
2. Ian Goodfellow, Yoshua Bengio and Aaron Courville. Deep Learning. MIT Press 2016

Reference Books:

1. Aurélien Géron, Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow, 2nd Edition,2019.
2. Andrew W. Trask, Grokking Deep Learning, Manning publication,2019.
3. François Chollet, Deep Learning with Python, Manning publication, 2017.
4. Charu C. Aggarwal,Neural Networks and Deep Learning: A Textbook, Springer; 1st ed. 2018 edition.
5. Umberto Michelucci "Applied Deep Learning. A Case-based Approach to Understanding Deep Neural Networks" Apress, 2018.

Evaluation Scheme:

Semester End Examination (A):

Theory:

1. Question paper based on the entire syllabus will comprise of 5 questions (All compulsory, but with internal choice as appropriate), each carrying 15 marks, total summing up to 75 marks.
2. Weightage of each module in end semester examination is expected to be/will be proportional to number of respective lecture hours mentioned in the syllabus.
3. Total duration allotted for writing the paper is 3 hrs.

Laboratory:

1. Oral & Practical examination will be based on the entire syllabus including, the practicals performed during laboratory sessions.

Continuous Assessment (B):

Theory:

1. Consisting of **Two Compulsory Class Tests** Approximately 40% to 50% of syllabus content must be covered in First test and remaining 40% to 50% of syllabus contents must be covered in second test.
2. Total duration allotted for writing each of the paper is 1 hr.
3. Average of the marks scored in the two tests will be considered for final grading.

Laboratory: (Term work)

Term work shall consist of minimum 10 - 12 experiments, minimum 2 assignments and Mini Project.

The distribution of marks for term work shall be as follows:

i. Laboratory work (Performance of Experiments): 15 Marks
ii. Journal Documentation (Write-up and Assignments): 10 marks

The final certification and acceptance of term work will be subject to satisfactory performance of laboratory work and upon fulfilling minimum passing criteria in the term work.

Prepared by Checked by Head of the Department Principal

Program: Final Year B.Tech	Semester: VIII
Course: Advanced Security	Course Code: DJ19ITEC8015
Course: Advanced Security Laboratory	Course Code: DJ19ITEL8015

Teaching Scheme (Hours / week)				Evaluation Scheme						
				Semester End Examination Marks (A)			Continuous Assessment Marks (B)			Total marks (A+ B)
Lectures	Practical	Tutorial	Total Credits	Theory			Term Test 1	Term Test 2	Avg.	
				75			25	25	25	100
				Laboratory Examination			Term work		Total Term work	50
3	2	--	4	Oral	Practical	Oral & Practical	Laboratory Work	Tutorial / Mini project / presentation/ Journal		
				25	--	--	15	10	25	

Prerequisites: Computer Networks, Information Security

Course Objectives: In this course, students will gain an in-depth knowledge of various computer security threats and vulnerabilities along with the regulatory pressure reinforcement that is required for organizations to improve the control of the security of any information systems with the help of the Security Operations Center (SOC). Students will learn to leverage information from a variety of external sources that provides insight into threats, vulnerabilities to reduce strain on analysts and execute the Security Operation Center's (SOC) objective to identify, investigate, and mitigate threats and adversary tactics, techniques, and procedures as part of an Incident Response (IR) process.

Course Outcomes: On successful completion of this course, students should be able to:

1. Perform appropriate surveillance of IT infrastructure for vulnerabilities.
2. Describe how Security Operations Centers (SOC) work as a valuable resource for security incident detection.
3. Analyze cybersecurity incidents.
4. Reconstruct the series of events using suitable Incident Response (IR) process.

Detailed Syllabus: (unit wise)

Unit	Description	Duration
1	Threat Detection. Nature of malign threats. Organisational risk context. Attack vectors. Models for understanding attacks. Vulnerabilities. Threat detection systems. Security architectures. Intrusion detection. Insider threat detection. Signatures and rules and anomaly detection, The Computer Misuse Act and ethical considerations. Situational Awareness. Cybersecurity Visualization. Dependency Modelling. Threat Modelling, Enhance Security with Geolocation	08
2	**Blue Team Principles:** Defensive network – architecture and monitoring, Endpoint Architecture and Monitoring, Security Data Locations, Authentication, Authorization, and Accounting, Defending Network Infrastructure, Intrusion Prevention Systems and Firewalls, Name Resolution Attacks and Defence, Securing Private and Public Cloud Infrastructure.	06

3	**Security Operations Center (SOC)**: What is a SOC, SOC types, Security Operations (SecOps), The People, Processes, and Technology, Vulnerability Management, Automation, Improvement, and Tuning, Security Operations Framework – SOC elements and processes, Security Operations Infrastructure and Automation, Threat Prevention and Intelligence, Introduction to Network Operation Centre (NOC), NOC v/s SOC	**08**
4	**Malware Analysis:** Identification of Malicious Software, Infection Methods, Persistence Mechanisms, Beacons, Understanding Antivirus technologies Creating the Safe Environment, Static Analysis, Dynamic Analysis. Behaviour Based Analysis, Ransomware, Manual Code Reversing **Traffic Analysis:** Manual Analysis Principles, Automated Analysis Principles - Signatures compared to Behaviours, Application Protocols Analysis Principles, Networking Forensics	**08**
5	**Digital Forensics and Incident Management:** Active Defence, DFIR Core Concepts, Digital Forensics and Incident Response, Modern DFIR, Cyber Security Incident Response - CSIR Plan, CSIR Models, SIEM, SIEM Architecture, SIEM – Logging, Evaluation, Analytics, Detection, Threat Intelligence, SIEM for Advanced Analytics - Architectural Benefits, Profiling and Baselining, Advanced Analytics.	**08**
6	**Open-Source Intelligence:** Search Engines, WHOIS, Online Tools, Social Networking & Communities, Internet Archive, Dark Web, Threat Reporting, Threat Intelligence, IOC Concepts	**04**

List of Laboratory Experiments:

1. Establishing IPS and Logging into the VMs Lab
2. Blue Team Principles Lab - Analyze Initial Compromise Vector, Network Forensics, System Forensics
3. Digital Forensics Lab - Analysis of Captured Network Activity, Analysis of captured files
4. Malware Analysis Lab - Analysis of an MSF Venom Executable, Analysis of Locky Ransomware, Creating YARA Rules based on Analysis Results and Final Assessment
5. Traffic Analysis - Traffic Analysis of a Website Defacement Attack, Traffic Analysis Based on IDS Alerts
6. Assessing Current State of Defense within an Organization Lab - Configuring Firewall, Configuring SIEM , Configuring IPDS, Upgrading Detection/Protection Capabilities
7. Leveraging SIEM for Advanced Analytics - Deploying Agent, Implementing User Behavior Analytics through Machine Learning, Simulate an Attack and Analyze Alerts
8. Exploring mobile forensics tools and technique
9. Case study based on Scenario for SOC design
10. Study experiment on Dark Web.

Any other experiment based on syllabus may be included, which would help the learner to understand topic/concept.

Books Recommended:

Text Books:

1. Security Operations Center: Building, Operating, and Maintaining your SOC by Joseph Muniz, Gary McIntyre , Nadhem AlFardan, Cisco Press,
2. The Modern Security Operations Center by Joseph Muniz, Addison-Wesley
3. Enterprise Cybersecurity - How to Build a Successful Cyberdefense Program Against Advanced Threats, by Scott E. Donaldson, Stanley G. Siegel, Chris K. Williams and Abdul Aslam, 2015.

Reference Books:

1. Network Security Metrics, by Lingyu Wang, Sushi Jajodia and Anoop Singhal, 2017.
2. Blue Team Field Manual, by Alan J White and Ben Clark, 2017.
3. Blue Team Handbook: Incident Response Edition, by Don Murdoch 2014.

Evaluation Scheme:

Semester End Examination (A):

Theory:

1. Question paper based on the entire syllabus will comprise of 5 questions (All compulsory, but with internal choice as appropriate), each carrying 15 marks, total summing up to 75 marks.
2. Total duration allotted for writing the paper is 3 hrs.

Laboratory:

1. Oral examination will be based on the entire syllabus including, the practicals performed during laboratory sessions.

Continuous Assessment (B):

Theory:

1. Consisting of Two Compulsory Class Tests: Approximately 40% to 50% of syllabus content must be covered in First test and remaining 40% to 50% of syllabus contents must be covered in second test.
2. Total duration allotted for writing each of the paper is 1 hr.
3. Average of the marks scored in both the tests will be considered for final grading.

Laboratory: (Term work)

Term work shall consist of at least 10 experiments based on the above list.

The distribution of marks for term work shall be as follows:

i. Laboratory work (Performance of Experiments, Write-up): 15 Marks
ii. Journal Documentation (Write-up, Power Point Presentation and Assignments): 10 marks

The final certification and acceptance of term work will be subject to satisfactory performance of laboratory work and upon fulfilling minimum passing criteria in the term work.

Prepared by Checked by Head of the Department Principal

Program: Final Year B.Tech	Semester: VIII
Course: Quantum Computing	Course Code: DJ19ITEC8016
Course: Quantum Computing Laboratory	Course Code: DJ19ITEL8016

Teaching Scheme (Hours / week)				Evaluation Scheme						
				Semester End Examination Marks (A)			Continuous Assessment Marks (B)			Total marks (A+ B)
Lectures	Practical	Tutorial	Total Credits	Theory			Term Test 1	Term Test 2	Avg.	
				75			25	25	25	100
				Laboratory Examination			Term work		Total Term work	50
3	2	--	4	Oral	Practical	Oral & Practical	Laboratory Work	Tutorial / Mini project / presentation/ Journal		
				25	--	--	15	10	25	

Pre-requisite: Knowledge of Linear Algebra and Discrete Structures

Course Objectives: The objective of this course is to introduce students to quantum computing using qubits, entanglement, quantum circuits and protocols. The change from conventional computing to quantum computing will be highlighted, with the help of quantum algorithms.

Course Outcomes: On completion of the course, learner will be able to:

1. Design quantum circuits.
2. Implement quantum algorithms.

Detailed Syllabus: (unit wise)

Unit	Description	Duration
1	**Quantum States and Qubits:** Introduction, The Atoms of Computation, Bloch sphere representation of a qubit, multiple qubits, representing Qubit states, The Case for Quantum	04
2	**Linear Algebra**: Complex Numbers versus Real Numbers, Vectors, Diagrams of Vectors, Lengths of Vectors, Scalar Multiplication, Vector Addition, Orthogonal Vectors, Multiplying a Bra by a Ket, Bra-Kets and Lengths, Bra-Kets and Orthogonality, Orthonormal Bases, Vectors as Linear Combinations of Basis Vectors, Ordered Bases, Length of Vectors, Matrices	08
3	**Multiple Qubits and Entanglement:** Introduction, Multiple Qubits and Entangled States, Phase Kickback, More Circuit Identities, Proving Universality, Classical Computation on a Quantum Computer	06
4	**Quantum Circuits:** single qubit gates, multiple qubit gates, design of quantum circuits.	06
5	**Quantum Protocols and Quantum Algorithms:** Defining Quantum Circuits, Deutsch-Jozsa Algorithm, Shor's Algorithm, Grover's Algorithm, Quantum Counting	10

6	**Quantum Algorithms for Applications:** Applied Quantum Algorithms, Solving Linear Systems of Equations using HHL, Simulating Molecules using VQE, solving combinatorial optimization problems using QAOA, Solving Satisfiability Problems using Grover's Algorithm, Hybrid quantum-classical Neural Networks with PyTorch and Qiskit. Implementations of Recent Quantum Algorithms: Quantum Image Processing - FRQI and NEQR Image Representations, Quantum Edge Detection - QHED Algorithm on Small and Large Images	**08**

List of Laboratory Experiments:

1. Quantum Circuits
2. Quantum Measurement
3. Accuracy of Quantum Phase Estimation
4. Iterative Quantum Phase Estimation
5. Shor's Algorithm
6. Grover's search Algorithm
7. Quantum Simulation as a Search Algorithm
8. Programs using Ket Quantum Programming Language

Any other experiment based on syllabus may be included, which would help the learner to understand topic/concept.

Books Recommended:

Text books:

1. Chris Bernhardt, Quantum Computing for Everyone, The MIT Press Cambridge, Massachusetts London, England, 2019.
2. Nielsen M. A., Quantum Computation and Quantum Information, Cambridge University Press, 2002.
3. Benenti G., Casati G. and Strini G., Principles of Quantum Computation and Information, Vol. I: Basic Concepts, Vol II: Basic Tools and Special Topics, World Scientific, 2004.
4. Pittenger A. O., An Introduction to Quantum Computing Algorithms 2000.

Reference Books:

1. Ronald de Wolf, Quantum Computing: Lecture Notes, QuSoft, CWI and University of Amsterdam, 2021.
2. Michael Nielsen and Isaac Chuang, "Quantum Computation and Quantum Information," 10th Anniversary Edition, Cambridge University Press, 2010.

Web References:

1. https://qiskit.org/textbook/preface.html
2. https://quantum-ket.gitlab.io/
3. https://www.coursera.org/learn/quantum-computing-algorithms
4. YouTube Quantum learning series: https://www.youtube.com/playlist?list=PLOFEBzvs-Vvp2xg9-POLJhQwtVktlYGbY
5. NPTEL Course on Introduction to Quantum Computing: Quantum Algorithms and Qiskit, https://onlinecourses.nptel.ac.in/noc21_cs103/preview

Evaluation Scheme:

Semester End Examination (A):

Theory:

1. Question paper based on the entire syllabus will comprise of 5 questions (All compulsory, but with internal choice as appropriate), each carrying 15 marks, total summing up to 75 marks.
2. Total duration allotted for writing the paper is 3 hrs.

Laboratory:

2. Oral examination will be based on the entire syllabus including, the practicals performed during laboratory sessions.

Continuous Assessment (B):

Theory:

1. Consisting of Two Compulsory Class Tests: Approximately 40% to 50% of syllabus content must be covered in First test and remaining 40% to 50% of syllabus contents must be covered in second test.
2. Total duration allotted for writing each of the paper is 1 hr.
3. Average of the marks scored in both the tests will be considered for final grading.

Laboratory: (Term work)

Term work shall consist of at least 10 experiments based on the above list.

The distribution of marks for term work shall be as follows:

i. Laboratory work (Performance of Experiments, Write-up): 15 Marks

ii. Journal Documentation (Write-up, Power Point Presentation and Assignments): 10 marks

The final certification and acceptance of term work will be subject to satisfactory performance of laboratory work and upon fulfilling minimum passing criteria in the term work.

Prepared by Checked by Head of the Department Principal

<table>
<tr><td colspan="5">Program: Final Year B.Tech</td><td colspan="5">Semester: VIII</td></tr>
<tr><td colspan="5">Course: Project-II</td><td colspan="5">Course Code: DJ19ITP803</td></tr>
<tr><td colspan="4" rowspan="2">Teaching Scheme (Hours / week)</td><td colspan="9">Evaluation Scheme</td></tr>
<tr><td colspan="4">Semester End Examination Marks (A)</td><td colspan="4">Continuous Assessment Marks (B)</td><td>Total marks (A+ B)</td></tr>
<tr><td rowspan="3">Lectures</td><td rowspan="3">Practical</td><td rowspan="3">Tutorial</td><td rowspan="3">Total Credits</td><td colspan="4">Theory</td><td>Term Test 1</td><td>Term Test 2</td><td>Avg.</td><td rowspan="2"></td></tr>
<tr><td colspan="4">--</td><td>--</td><td>--</td><td>--</td></tr>
<tr><td colspan="4">Laboratory Examination</td><td colspan="3">Term work</td><td rowspan="3">Total Term work</td><td rowspan="3">200</td></tr>
<tr><td rowspan="2">--</td><td rowspan="2">10</td><td rowspan="2">--</td><td rowspan="2">5</td><td>Oral</td><td>Practical</td><td>Oral & Practical</td><td>Laboratory Work</td><td colspan="2">Tutorial / Mini project / presentation/ Journal</td></tr>
<tr><td>100</td><td>--</td><td>--</td><td>--</td><td colspan="2">100</td><td>100</td></tr>
</table>

Course Objectives: To introduce the students to professional engineering practice by providing them with an opportunity to work on an open-ended engineering problem. Typically, the students would apply knowledge from different areas or courses, which they have studied in their curriculum using methods, tools, and techniques, which they learned to a real-world scenario. Students would have to apply not only their engineering knowledge and proficiencies (hard skills), but also to demonstrate their competence in generic, professional skills (soft skills). It also emphasizes the importance of life-long learning as a fundamental attribute of graduate engineers.

Course Outcomes: On completion of the course, learner will be able to:

1. Develop the proposed solution using appropriate techniques.
2. Test the developed system for its correctness using appropriate techniques.
3. Work effectively as a member of the team.

Guidelines

1. The department must allocate 2 days in the Semester VIII every week.
2. Students will do coding and testing in Semester VIII.
3. Each group along with its guide/mentor shall identify an appropriate technique/s for testing the developed system.
4. The project assessment for term work will be done at least two times at department level by giving presentation to panel members which consist of at least three (3) members as Internal examiners (including the project guide/mentor) appointed by the Head of the department of respective Program.
5. A report is to be prepared summarizing the findings of the literature survey, coding and testing.
6. Every team must publish their work in national / international conference/journals (if possible, publish in Scopus indexed journals).

Evaluation Scheme:

Semester End Examination (A):

Laboratory:

1. Each group will be jointly evaluated by a team of Internal and External Examiners approved by the University of Mumbai.
2. An oral exam will be conducted on the project done by the students.

Continuous Assessment (B):

Laboratory: (Term work)

1. Each team must give a presentation/demo to the Internal Panel consisting of 3 domain experts.
2. Each team will prepare a report that will summarize the results of the literature survey, coding and testing as a product in SEM VIII. The list of papers surveyed must be clearly documented.

The distribution of marks for term work shall be as follows:

i. Term Work shall consist of full Project-II on above guidelines/syllabus.

ii. The final certification and acceptance of term work will be subject to satisfactory performance and upon fulfilling minimum passing criteria in the term work.

Prepared by Checked by Head of the Department Principal