

# **K.L.N.COLLEGE OF ENGINEERING**

**Pottapalayam, Sivagangai District**

**(An Autonomous Institution, Affiliated to AnnaUniversity, Chennai)**



**Estd:1994**

**THIRD YEAR**

**CURRICULUM AND SYLLABUS**

**REGULATIONS 2020**

**For Under Graduate Program**

**B.E. COMPUTER SCIENCE AND ENGINEERING (IOT)**

**CHOICE BASED CREDIT SYSTEM**

**(For the students admitted in the academic year 2023-2024)**



**K.L.N. COLLEGE OF ENGINEERING, POTTAPALAYAM**  
(An Autonomous Institution, Affiliated to Anna University, Chennai)



**VISION OF THE INSTITUTION**

To become a Centre of Excellence in Technical Education and Research in producing Competent and Ethical professionals to the society.

**MISSION OF THE INSTITUTION**

To impart Value and Need based curriculum to the students with enriched skill development in the field of Engineering, Technology, Management and Entrepreneurship and to nurture their character with social concern and to pursue their career in the areas of Research and Industry.

**VISION OF THE DEPARTMENT**

To evolve in the field of Computer Science & Engineering through sustainable technical education with innovative research and to foster competent professionals to serve and lead the society.

**MISSION OF THE DEPARTMENT**

- Imparting demand based proficient education through quality teaching – learning process in tune with the interdisciplinary needs of global work environment.
- Inculcating the attitude of continuous learning through industry institution interaction, consultancy and research activities.
- Cultivating professionalism, ethics and integrity of character for positive contributions to society.

**PROGRAM EDUCATIONAL OBJECTIVES (PEOs)**

- PEO I** Contribute effectively to the society by applying principles of Computer Science and Engineering for analyzing the real world problems to produce optimal and sustainable technical solutions.
- PEO II** Sustain as good professionals by pursuing career / advanced studies and practice innovation in emerging technologies and current trends through lifelong learning.
- PEO III** Build professionalism, team work, effective communication, ethical values and leadership qualities.

**PROGRAM SPECIFIC OUTCOMES (PSOs)**

- PSO1** Ability to apply good analytical, design and implementation skills to formulate and solve scientific and business applications pertaining to Algorithms, Computer Systems, Networks, Security, Data Analytics and Artificial Intelligence.
- PSO2** Ability to update knowledge continuously in various domains like Virtualization, Mobile Application Development, Data Visualization, Machine Learning and Technologies like Storage, Computing, Communication to meet the industry requirements.



## **PROGRAM OUTCOMES (POs)**

### **PO1: Engineering Knowledge**

Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

### **PO2: Problem Analysis**

Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

### **PO3: Design/Development of Solutions**

Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

### **PO4: Conduct Investigations of Complex Problems**

Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

### **PO5: Modern Tool Usage**

Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.

### **PO6: The Engineer and Society**

Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

### **PO7: Environment and Sustainability**

Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

### **PO8: Ethics**

Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

### **PO9: Individual and Team Work**

Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

### **PO10: Communication**

Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

### **PO11: Project Management and Finance**

Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

### **PO12: Life-Long Learning**

Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.



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## **REGULATIONS 2020**

**For Under Graduate Program**

**B.E. COMPUTER SCIENCE AND ENGINEERING (IOT)**

**CHOICE BASED CREDIT SYSTEM**

### **CATEGORY OF COURSES**

- i. **Humanities and Social Sciences (HS) Courses** include Technical English, Environmental Science and Engineering, Engineering Ethics and human values, Communication Skills and Management courses.
- ii. **Basic Sciences (BS) Courses** include Mathematics, Physics, and Chemistry.
- iii. **Engineering Sciences (ES) Courses** include Engineering Practices, Engineering Graphics, Basics of Electrical / Electronics / Mechanical / Computer Engineering / Instrumentation etc.
- iv. **Professional Core (PC) Courses** include the core courses relevant to the chosen programme of study.
- v. **Professional Elective (PE) Courses** include the elective courses relevant to the chosen programme of study.
- vi. **Open Elective (OE) Courses** include courses from other departments which a student can choose from the list specified in the curriculum of the students B.E. / B.Tech. Programmes.
- vii. **Employability Enhancement Courses (EEC)** include Project Work and/or Internship, Seminar, Professional Practices, Case Study and Industrial/Practical Training.
- viii. **Mandatory Courses (MC)** include Personality and Character development and the courses recommended by the regulatory bodies such as AICTE, UGC, etc



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**B.E. COMPUTER SCIENCE AND ENGINEERING (IoT)**

**SEMESTER V**

S. No.	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
<b>THEORY</b>								
1	20CI501	Adhoc and Wireless Sensor Networks	PC	3	3	0	0	3
2	20CI502	IOT Communication Protocols	PC	3	3	0	0	3
3	20CI503	Embedded Systems Design	PC	3	3	0	0	3
4		Professional Elective I	PE	3	3	0	0	3
5		Professional Elective II	PE	3	3	0	0	3
6	20MC501	Constitution of India	MC	1	1	0	0	-
<b>THEORY CUM PRACTICAL</b>								
7	20CS504	Software Engineering (Common to B.E.CSE, B.E.CSE(IoT) & B.Tech IT programmes)	PC	5	3	0	2	4
<b>PRACTICAL</b>								
8	20CI5L1	IOT Communication Protocols Lab	PC	4	0	0	4	2
9	20CI5L2	Embedded Systems Design Laboratory	PC	4	0	0	4	2
<b>TOTAL</b>				<b>29</b>	<b>19</b>	<b>0</b>	<b>10</b>	<b>23</b>

**SEMESTER VI**

S.No.	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
<b>THEORY</b>								
1	20CS602	<a href="#">Cryptography and Network Security</a> (Common to B.E.CSE & B.E.CSE(IoT) programmes)	PC	3	3	0	0	3
2		Professional Elective III	PE	3	3	0	0	3
3		Professional Elective IV	PE	3	3	0	0	3
4		Open Elective I	OE	3	3	0	0	3
5	20MC801	Disaster Management	MC	2	2	0	0	-
<b>THEORY CUM PRACTICAL</b>								
6	20CS604	<a href="#">Machine Learning</a> (Common to B.E.CSE, B.E.CSE(IoT) & B.Tech IT programmes)	PC	5	3	0	2	4
7	20CS605	<a href="#">Web Technology</a> (Common to B.E.CSE & B.E.CSE(IoT) programmes)	PC	5	3	0	2	4
<b>PRACTICAL</b>								
8	20CS6L1	<a href="#">Mobile Application Development Laboratory</a> (Common to B.E.CSE, B.E.CSE(IoT), B.Tech IT & B.Tech AIDS programmes)	PC	4	0	0	4	2
<b>TOTAL</b>				<b>28</b>	<b>20</b>	<b>0</b>	<b>8</b>	<b>22</b>



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**B.E. COMPUTER SCIENCE AND ENGINEERING (IoT)**

**PROFESSIONAL ELECTIVE (PE) : VERTICALS**

Vertical I	Vertical II	Vertical III	Vertical IV	Vertical V
<b>Cloud Computing and Data Center Technologies</b>	<b>Cyber Security and Data Privacy</b>	<b>Full Stack Development for IT</b>	<b>Innovative Computing Technologies</b>	<b>Artificial Intelligence and Machine Learning</b>
Cloud Computing Techniques	Social Network Analysis	Principles of Programming Languages	Data and Information Security	Business Intelligence System
Data Warehousing and Data Mining	Cyber Physical Systems	UI and UX Design	Quantum Computing	Data Communication and Computer Networks
Cloud Services Management	Digital and Mobile Forensics	Cloud Services Management	Neural Networks and Deep Learning	Neural Networks and Deep Learning
Software Defined Networks	Cryptocurrency and Blockchain Technologies	Software Testing and Automation	Cryptocurrency and Blockchain Technologies	Robotic Process Automation
Storage Technologies	Web Application Security	Web Application Security	Cyber Security	Text and Speech Analysis
Computer Vision	Engineering Secure Software Systems	Information Retrieval Techniques	3D Printing and Design	Fuzzy Logic and Applications
Security and Privacy in Cloud	Security and Privacy in Cloud	DevOps	Agile Methodologies	Ethics and AI
Reinforcement Learning Techniques	Malware Analysis	Reinforcement Learning Techniques	Virtual Reality and Augmented Reality	Health Care Analytics

**Vertical I : Cloud Computing and Data Center Technologies**

S.No.	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
1.	20CSV11	Cloud Computing Techniques	PE	4	2	0	2	3
2.	20CSV21	Data Warehousing and Data Mining	PE	3	3	0	0	3
3.	20CSV31	Cloud Services Management	PE	3	3	0	0	3
4.	20CSV41	Software Defined Networks	PE	3	3	0	0	3
5.	20ADV51	Storage Technologies	PE	3	3	0	0	3
6.	20CSV61	Computer Vision	PE	3	3	0	0	3
7.	20SCV71	Security and Privacy in Cloud	PE	3	3	0	0	3
8.	20ITV81	Reinforcement Learning Techniques	PE	3	3	0	0	3

**Vertical II : Cyber Security and Data Privacy**

S.No.	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
1.	20CSV12	Social Network Analysis	PE	3	3	0	0	3
2.	20ITV22	Cyber Physical Systems	PE	3	3	0	0	3
3.	20SCV32	Digital and Mobile Forensics	PE	4	2	0	2	3
4.	20ITV42	Cryptocurrency and Blockchain Technologies	PE	3	3	0	0	3
5.	20SCV52	Web Application Security	PE	3	3	0	0	3
6.	20CSV62	Engineering Secure Software Systems	PE	3	3	0	0	3
7.	20SCV71	Security and Privacy in Cloud	PE	3	3	0	0	3
8.	20SCV82	Malware Analysis	PE	4	2	0	2	3

**Vertical III : Full Stack Development for IT**

S.No.	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
1.	20ITV13	Principles of Programming Languages	PE	3	3	0	0	3
2.	20CSV23	UI and UX Design	PE	4	2	0	2	3
3.	20CSV31	Cloud Services Management	PE	3	3	0	0	3
4.	20ITV43	Software Testing and Automation	PE	3	3	0	0	3
5.	20SCV52	Web Application Security	PE	3	3	0	0	3
6.	20ITV63	Information Retrieval Techniques	PE	3	3	0	0	3
7.	20ITV73	DevOps	PE	4	2	0	2	3
8.	20ITV81	Reinforcement Learning Techniques	PE	3	3	0	0	3

**Vertical IV : Innovative Computing Technologies**

S.No.	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
1.	20ADV14	Data and Information Security	PE	3	3	0	0	3
2.	20ITV24	Quantum Computing	PE	3	3	0	0	3
3.	20ADV34	Neural Networks and Deep Learning	PE	4	2	0	2	3
4.	20ITV42	Cryptocurrency and Blockchain Technologies	PE	3	3	0	0	3
5.	20SCV54	Cyber Security	PE	3	3	0	0	3
6.	20ITV64	3D Printing and Design	PE	3	3	0	0	3
7.	20CSV74	Agile Methodologies	PE	3	3	0	0	3
8.	20CSV84	Virtual Reality and Augmented Reality	PE	3	3	0	0	3

**Vertical V: Artificial Intelligence and Machine Learning**

S.No.	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
1.	20ADV15	Business Intelligence System	PE	3	3	0	0	3
2.	20ADV25	Data Communication and Computer Networks	PE	3	3	0	0	3
3.	20ADV34	Neural Network and Deep Learning	PE	4	2	0	2	3
4.	20ADV45	Robotic Process Automation	PE	3	3	0	0	3
5.	20ADV55	Text and Speech Analysis	PE	3	3	0	0	3
6.	20ITV65	Fuzzy Logic and Applications	PE	3	3	0	0	3
7.	20ADV75	Ethics and AI	PE	3	3	0	0	3
8.	20ADV85	Health Care Analytics	PE	3	3	0	0	3

**OPEN ELECTIVE I (OE I)**

S. No.	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
1	20OE101	Mechatronics and Applications	OE	3	3	0	0	3
2.	20OE201	Fundamentals of Renewable Energy Systems	OE	3	3	0	0	3
3.	20OE202	Principles of Measurements and Instrumentation	OE	3	3	0	0	3
4.	20OE203	Introduction to Nanoscience	OE	3	3	0	0	3
5.	20OE303	Fundamentals of Wireless Communication	OE	3	3	0	0	3
6.	20OE601	Fundamentals of Electric Vehicles	OE	3	3	0	0	3
7.	20OE602	Supply Chain Management	OE	3	3	0	0	3
8.	20OE603	Automotive Safety Systems	OE	3	3	0	0	3
9.	20OE701	Biomedical Instrumentation and Measurements	OE	3	3	0	0	3
10.	20OE801	Linear Algebra and Number Theory	OE	3	3	0	0	3

**KLNCE UG CSE(IoT) R2020 (AY 2023-2024 admitted)**

**OPEN ELECTIVE - I offered to other Departments**

<b>S.No.</b>	<b>COURSE CODE</b>	<b>COURSE TITLE</b>	<b>CATEGORY</b>	<b>CONTACT PERIODS</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
1.	20OEB01	IOT Device Programming	OE	3	3	0	0	3
2.	20OEB02	Artificial IOT	OE	3	3	0	0	3
3.	20OEB03	Data Science for IOT	OE	3	3	0	0	3
4.	20OEB04	IOT Security	OE	3	3	0	0	3

<b>20CI501</b>	<b>ADHOC AND WIRELESS SENSOR NETWORKS</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

**OBJECTIVES:**

- To learn the Ad hoc network and Sensor Network fundamentals
- To understand the different routing protocols
- To have an in-depth knowledge on sensor network architecture and design issues
- To understand the transport layer and security issues possible in Ad hoc and Sensor networks
- To have an exposure to mote programming platforms and tools

**PRE-REQUISITE:**

Course code:20CS501

Course Name: Computer Networks

**UNIT-I AD HOC NETWORKS INTRODUCTION AND ROUTING PROTOCOLS 9**

Elements of Ad hoc Wireless Networks, Issues in Ad hoc wireless networks, Example commercial applications of Ad hoc networking, Ad hoc wireless Internet, Issues in Designing a Routing Protocol for Ad Hoc Wireless Networks, Classifications of Routing Protocols, Table Driven Routing Protocols - Destination Sequenced Distance Vector (DSDV), On-Demand Routing protocols –Ad hoc On-Demand Distance Vector Routing (AODV).

**UNIT-II SENSOR NETWORKS – INTRODUCTION & ARCHITECTURES 9**

Challenges for Wireless Sensor Networks, Enabling Technologies for Wireless Sensor Networks, WSN application examples, Single-Node Architecture - Hardware Components, Energy Consumption of Sensor Nodes, Network Architecture - Sensor Network Scenarios, Transceiver Design Considerations, Optimization Goals and Figures of Merit.

**UNIT - III WSN NETWORKING CONCEPTS AND PROTOCOLS 9**

MAC Protocols for Wireless Sensor Networks, Low Duty Cycle Protocols and Wakeup Concepts - S-MAC, The Mediation Device Protocol, Contention based protocols - PAMAS, Schedule based protocols – LEACH, IEEE 802.15.4 MAC protocol, Routing Protocols Energy Efficient Routing, Challenges and Issues in Transport layer protocol.

**UNIT - IV SENSOR NETWORK SECURITY 9**

Network Security Requirements, Issues and Challenges in Security Provisioning, Network Security Attacks, Layer wise attacks in wireless sensor networks, possible solutions for jamming, tampering, black hole attack, flooding attack. Key Distribution and Management, Secure Routing – SPINS, reliability requirements in sensor networks.

**UNIT - V SENSOR NETWORK PLATFORMS AND TOOLS 9**

Sensor Node Hardware – Berkeley Motes, Programming Challenges, Node-level software platforms – Tiny OS, nes C, CONTIKIOS, Node-level Simulators – NS2 and its extension to sensor networks, COOJA, TOSSIM, Programming beyond individual nodes – State centric programming.

**TOTAL: 45 PERIODS**

**TEXT BOOKS:**

1. C. Siva Ram Murthy and B. S. Manoj, "Ad Hoc Wireless Networks Architectures and Protocols", Prentice Hall, PTR, 2004.
2. Holger Karl, Andreas willig, "Protocol and Architecture for Wireless Sensor Networks", John Wiley publication, Jan 2006.

**REFERENCES:**

1. Feng Zhao, Leonidas Guibas, "Wireless Sensor Networks: an information processing approach", Elsevier publication, 2004.
2. Charles E. Perkins, "Ad Hoc Networking", Addison Wesley, 2000.
3. I.F. Akyildiz, W. Su, Sankarasubramaniam, E. Cayirci, "Wireless sensor networks: a survey , computer networks", Elsevier, 2002, 394 - 422.

**OUTCOMES:**

**AT THE END OF THE COURSE, LEARNERS WILL BE ABLE TO:**

<b>Course Name :Adhoc and Wireless Sensor Networks</b>		<b>Course Code: 20CI501</b>			
<b>CO</b>	<b>Course Outcomes</b>	<b>Unit</b>	<b>K-CO</b>	<b>POs</b>	<b>PSOs</b>
C301.1	Construct an Ad hoc networks and Wireless Sensor Networks	I	K2		
C301.2	Implement a suitable routing algorithm based on the network and user requirement	II	K3		
C301.3	Identify appropriate physical and MAC layer protocols and its issues	III	K2		
C301.4	Demonstrate the security issues possible in Adhoc and sensor networks	IV	K3		
C301.5	Illustrate with the OS used in Wireless Sensor Networks	V	K2		
C301.6	Illustrate with the basic build modules	V	K2		

<b>20CI502</b>	<b>IOT COMMUNICATION PROTOCOLS</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

**OBJECTIVES:**

- To understand the fundamentals of IoT architecture outline and standards.
- To understand the concept of IoT reference architecture.
- To understand the importance of IoT Data Link Layer & Network Layer Protocols.
- To understand the importance of IoT Transport & Session Layer Protocols.

**PRE-REQUISITE:NIL**

**UNIT-I INTRODUCTION 9**

IoT architecture outline, standards - IoT Technology Fundamentals- Devices and gateways, Local and wide area networking, Data management, Business processes in IoT, Everything as a Service (XaaS), M2M and IoT Analytics.

**UNIT-II IoT REFERENCE ARCHITECTURE 9**

Introduction, Functional View, Information View, Deployment and Operational View, Other Relevant Architectural views. Real-World Design Constraints- Introduction, Technical Design constraints.

**UNIT - III IoT Data Link Layer 9**

PHY/MAC Layer (3GPP MTC, IEEE 802.11, IEEE 802.15), Wireless HART, ZWave, Bluetooth Low Energy, Zigbee Smart Energy, DASH7

**UNIT - IV IoT Network Layer Protocols 9**

Network Layer-IPv4, IPv6, 6LoWPAN, 6TiSCH, ND, DHCP, ICMP, RPL, CORPL, CARP.

**UNIT - V IoT Transport & Session Layer Protocols 9**

Transport Layer - TCP, MPTCP, UDP, DCCP, SCTP-TLS, DTLS – Session Layer-HTTP, CoAP, XMPP, AMQP, MQTT.

**TOTAL: 45 PERIODS**

**TEXT BOOKS:**

1. Daniel Minoli, "Building the Internet of Things with IPv6 and MIPv6: The Evolving World of M2M Communications", ISBN: 978-1-118-47347-4, Willy Publications, 2016
2. Jan Holler, Vlasios Tsiatsis, Catherine Mulligan, Stefan Avesand, Stamatis Karnouskos, David Boyle, "From Machine-to-Machine to the Internet of Things: Introduction to a New Age of Intelligence", 1st Edition, Academic Press, 2015.

**REFERENCES:**

1. Bernd Scholz-Reiter, Florian Michahelles, "Architecting the Internet of Things", ISBN 978-3-642-19156-5 e-ISBN 978-3-642-19157-2, Springer, 2016.
2. N. Ida, Sensors, Actuators and Their Interfaces, Scitech Publishers, 2014

**OUTCOMES:  
AT THE END OF THE COURSE, LEARNERS WILL BE ABLE TO**

<b>Course Name :IoT Communication Protocols</b>		<b>Course Code: 20CI502</b>			
<b>CO</b>	<b>Course Outcomes</b>	<b>Unit</b>	<b>K-CO</b>	<b>POs</b>	<b>PSOs</b>
C302.1	Explain the fundamentals of IoT architecture outline and standards.	I	K2		
C302.2	Explain the concept of IoT reference architecture.	II	K2		
C302.3	Explain the concept of IoT Data Link Layer.	III	K2		
C302.4	Explain the concept of IoT Network Layer Protocols.	IV	K2		
C302.5	Explain the concept of IoT Transport Layer Protocols	V	K2		
C302.6	Explain the concept of IoT Session Layer Protocols	V	K2		

<b>20CI503</b>	<b>EMBEDDED SYSTEMS DESIGN</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

**OBJECTIVES:**

- To introduce the basic concept of Embedded Systems
- To impart the knowledge of hardware test and debug in embedded systems design
- To introduce the basic concept of Embedded C Program

**UNIT - I AN INTRODUCTION TO EMBEDDED SYSTEMS 9**

Introduction - The Core Level - Embedded Systems – An Instruction Set View - Execution Flow - Embedded Systems – A Register View - Register Transfer –Over View of a Microprocessor – ARM-7 Architecture, I/O Ports, Memory Organization- Pipelining stages -The Interrupt.

**UNIT - II EMBEDDED SYSTEMS DESIGN AND DEVELOPMENT 9**

Design methodologies and flows - examples such as model train controller - Embedded firmware design approaches-super loop based approach, operating system based approach - embedded firmware development languages - Software design - Co-Design - Co-Design Process Overview - Formulating the Requirements Specification.

**UNIT - III HARDWARE TEST AND DEBUG 9**

Module Debug and Test - Debugging and Testing - Testing and Debugging Combinational Logic - Path Sensitizing - Masking and Untestable Faults - Single Variable–Multiple Paths - Bridge Faults - Debugging – Sequential Logic - Scan Design Testing - Boundary-Scan Testing

**UNIT - IV OPERATING SYSTEMS AND TASK MANAGEMENT 9**

The Real-Time Operating System (RTOS) - Operating System Architecture - Tasks and Task Control Blocks - Time, Time-Based Systems, and Reactive Systems – Task Scheduling - Scheduling Algorithms - Time-Shared Systems - Priority Schedule

**UNIT - V EMBEDDED C PROGRAMMING 9**

An Embedded C Program - Developing Embedded Software - C Building Blocks -C Program Structure - Bitwise Operators - Pointer Variables and Memory Addresses -The Function – Structures .

**TOTAL: 45 PERIODS**

**TEXT BOOKS**

1. Michael J Pont —Embedded C, Addison-Wesley Professional, 2002
2. Peckol, James K. Embedded systems: a contemporary design tool, John Wiley & Sons, 2019.

**REFERENCES:**

1. Embedded Systems: Architecture and programming, Raj Kamal, TMH, 2008.
2. Embedded Systems Architecture - A comprehensive guide for Engineers and programmers, Tammy Noergaard, Elsevier Publication, 2005.
3. Programming for Embedded Systems, Dream tech Software Team, John Wiely India pvt. Ltd, 2008.

**OUTCOMES:  
AT THE END OF THE COURSE, LEARNERS WILL BE ABLE TO**

<b>Course Name :EMBEDDED SYSTEMS DESIGN</b>		<b>Course Code: 20CI503</b>			
<b>CO</b>	<b>Course Outcomes</b>	<b>Unit</b>	<b>K-CO</b>	<b>POs</b>	<b>PSOs</b>
C303.1	Explain the fundamental concepts of Embedded Systems and ARM7 architecture.	I	K2		
C303.2	Apply embedded system design methodologies and firmware development approaches to simple applications.	II	K3		
C303.3	Integrate hardware and software co-design principles to formulate requirement specifications for embedded system development.	II	K3		
C303.4	Demonstrate testing and debugging techniques for combinational and sequential circuits.	III	K3		
C303.5	Explain RTOS concepts, operating system architecture in embedded systems.	IV	K2		
C303.6	Develop simple embedded C programs using C building blocks for embedded applications.	V	K3		

<b>20MC501</b>	<b>CONSTITUTION OF INDIA</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>1</b>	<b>0</b>	<b>0</b>	<b>0</b>

**OBJECTIVES:**

- To enable the student to understand the importance of the constitution
- To understand the structure of executive, legislature, and judiciary
- To understand the philosophy of fundamental rights, duties and Emergency Provisions.
- To understand the autonomous nature of constitutional bodies like Supreme Court and high court.
- To understand the central and state relation financial and administrative.

**PRE-REQUISITE:** NIL

**UNIT – I INTRODUCTION 3**

History of Making of the Indian Constitution-Drafting Committee- (Composition & Working) - Philosophy of the Indian Constitution-Preamble-Salient Features.

**UNIT – II CONTOURS OF CONSTITUTIONAL RIGHTS & DUTIES 3**

Fundamental Rights-Right to Equality-Right to Freedom-Right against Exploitation Right to Freedom of Religion-Cultural and Educational Rights-Right to Constitutional Remedies Directive Principles of State Policy-Fundamental Duties.

**UNIT – III ORGANS OF GOVERNANCE 3**

Parliament-Composition-Qualifications and Disqualifications-Powers and Functions- Executive President-Governor-Council of Ministers-Judiciary, Appointment and Transfer of Judges, Qualifications Powers and Functions.

**UNIT – IV EMERGENCY PROVISIONS 3**

Emergency Provisions - National Emergency, President Rule, Financial Emergency

**UNIT – V LOCAL ADMINISTRATION 3**

District's Administration head- Role and Importance-Municipalities- Introduction- Mayor and role of Elected Representative-CEO of Municipal Corporation-Pachayati raj- Introduction- PRI- Zila PachayatElected officials and their roles- CEO ZilaPachayat- Position and role- Block level-Organizational Hierarchy (Different departments)-Village level- Role of Elected and Appointed officials-Importance of grass root democracy

**TOTAL: 15 periods**

**TEXT BOOKS:**

1. Rajesh Kumar, Universal's Guide to the Constitution of India. Universal Law Publications, 2016.
2. D.C. Gupta, Indian Government and Politics, Vikas Pub, 2018.

**REFERENCES:**

1. H.M.Sreevai, Constitutional Law of India, 4<sup>th</sup> edition in 3 volumes, Universal Law Publication
2. J.C. Johari, Indian Government and Politics, Shoban Lal & Co, 2012.
3. Noorani, A.G., (South Asia Human Rights Documentation Centre), Challenges to Civil Rights Guarantees in India, Oxford University Press, 2012.

**OUTCOMES:**

**AT THE END OF THE COURSE, LEARNERS WILL BE ABLE TO:**

<b>Course Name :CONSTITUTION OF INDIA</b>		<b>Course Code : 20MC501</b>			
<b>CO</b>	<b>CourseOutcomes</b>	<b>Unit</b>	<b>K –CO</b>	<b>POs</b>	<b>PSOs</b>
C304.1	Explain history and philosophy of Indian Constitution.	I	K2		
C304.2	Explain the premises informing the twin themes of liberty and freedom from a civil rights perspective.	II	K2		
C304.3	Explain the powers and functions of Indian government	III	K2		
C304.4	Explain the emergency rules of Indian Constitution.	IV	K2		
C304.5	Explain the structure and functions of local administration.	V	K2		

<b>20CS504</b>	<b>SOFTWARE ENGINEERING</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>3</b>	<b>0</b>	<b>2</b>	<b>4</b>

**OBJECTIVES:**

- To understand the phases in a software project
- To understand fundamental concepts of requirements engineering and Analysis Modeling.
- To understand the various software design methodologies
- To design with static and dynamic UML diagrams.
- To learn various testing and project management.

**PRE-REQUISITE: NIL**

**UNIT – I SOFTWARE PROCESS AND AGILE DEVELOPMENT 9**

Introduction to Software Engineering, Software Process, Process Models – Introduction to Agility-Agile Process-Extreme programming-XP Process.

**LAB COMPONENT 6**

1. Write down the problem statement for a suggested system of sample projects.

**UNIT-II REQUIREMENTS ANALYSIS AND SPECIFICATION 9**

Software Requirements: Functional and Non-Functional, User requirements, System requirements, Software Requirements Document – Requirement Engineering Process: Feasibility Studies, Requirements elicitation and analysis, requirements validation, requirements management-Classical analysis: Structured system Analysis, Petri Nets- Data Dictionary.

**LAB COMPONENT 6**

1. Do requirement analysis and develop Software Requirement Specification Sheet (SRS) for suggested system
2. Develop Data Flow Diagram (DFD) model (level-0,level-1) of the project

**UNIT - III SOFTWARE DESIGN AND UML MODEL 9**

Design Engineering: Design process and design quality, design concepts, the design model. Creating a Architectural Design: Architectural styles, Architectural Design, Architectural Mapping using Data Flow. Conceptual model of UML: basic structural modeling, use case diagram, class diagrams, sequence diagrams, collaboration diagrams, state chart diagram, activity diagram, component diagrams, deployment diagram

**LAB COMPONENT 12**

1. Identify use cases to develop the Use Case model and model the class diagram.
2. Using the identified scenarios, find the interaction between objects and represent them using UML Sequence and Collaboration Diagrams
3. Draw relevant State Chart and Activity Diagrams for the same system.
4. Implement the system as per the detailed design

**UNIT - IV SOFTWARE TESTING 9**

Software testing fundamentals-Internal and external views of Testing-white box testing - basis path testing-control structure testing-black box testing- Regression Testing – Unit Testing – Integration Testing – Validation Testing – System Testing And Debugging.

1. Test the software system for all the scenarios identified as per the usecase diagram

**UNIT - V SOFTWARE PROJECT MANAGEMENT 9**

Software Project Management: Estimation – LOC, FP Based Estimation, Make/Buy Decision  
COCOMO I & II Model –Risk Management – Identification, Projection -RMMM Plan.

**TOTAL: 75 PERIODS**

**TEXT BOOKS:**

1. Roger S. Pressman, — Software Engineering – A Practitioner’s Approach, Eighth Edition, Mc Graw-Hill International Edition, 2015
2. Ian Sommerville, — Software Engineering, 10th Edition, Pearson Education Asia, 2016.
3. Craig Larman, — Applying UML and Patterns: An Introduction to Object-Oriented Analysis and Design and Iterative Development, Third Edition, Pearson Education, 2005.

**REFERENCES:**

1. Rajib Mall, — Fundamentals of Software Engineering, Third Edition, PHI Learning Private Limited, 2009.
2. Ali Bahrami - Object Oriented Systems Development - McGraw Hill International Edition - 1999.
3. Pankaj Jalote, “Software Engineering, A Precise Approach”, Wiley India, 2010.

**OUTCOMES:**

**AT THE END OF THE COURSE, LEARNERS WILL BE ABLE TO:**

Course Name : SOFTWARE ENGINEERING		Course Code : 20CS504			
CO	Course Outcomes	Unit	K-CO	POs	PSOs
C305.1	Apply the software process models and Identify the problem statement for a suggested system of project.	I	K3		
C305.2	Build the SRS and DFD using software requirements for classical analysis.	II	K3		
C305.3	Examine the identified objects and functionality of the system using USE CASE and CLASS model.	III	K4		
C305.4	Demonstrate the code from objects interaction and implementation models for the system.	III	K3		
C305.5	Illustrate the developed code using testing strategies.	IV	K3		
C305.6	Calculate the software project effort and cost.	V	K3		



**OUTCOMES:  
AT THE END OF THE COURSE, LEARNERS WILL BE ABLE TO:**

<b>Course Name :IOT COMMUNICATION PROTOCOLS LABORATORY</b>		<b>Course Code :20C15L1</b>			
<b>CO</b>	<b>Course Outcomes</b>	<b>Expt.</b>	<b>K-CO</b>	<b>POs</b>	<b>PSOs</b>
C306.1	Explore the concepts of IoT programming.	1,2	K3		
C306.2	Develop the applications using Arduino/ Equivalent boards..	3,4,5	K3		
C306.3	Develop the Communicate between Arduino and Raspberry PI using any wireless medium.	6,7	K3		
C306.4	Develop the Raspberry PI to Interface with the sensors.	7	K3		
C306.5	Develop applications that would read the sensor data and post it in Cloud.	8,9	K3		
C306.6	Develop an IoT based system.	10	K4		

<b>20C15L2</b>	<b>EMBEDDED SYSTEMS DESIGN LABORATORY</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>0</b>	<b>0</b>	<b>4</b>	<b>2</b>

**OBJECTIVES:**

- To learn the working of ARM processor
- To understand the Building Blocks of Embedded Systems
- To learn the concept of memory map and memory interface
- To write programs to interface memory, I/Os with processor
- To know the characteristics of Real Time
- To write programs to interface memory, I/Os with processor

**PRE-REQUISITE:NIL**

**LIST OF EXPERIMENTS**

1. Study of ARM evaluation system
2. Interfacing ADC and DAC.
3. Interfacing LED and PWM.
4. Interfacing real time clock and serial port.
5. Interfacing keyboard and LCD.
6. Interfacing EPROM and interrupt.
7. Interrupt performance characteristics of ARM and FPGA.
8. Flashing of LEDS.
9. Interfacing stepper motor and temperature sensor.
10. Implementing zigbee protocol with ARM.

**TOTAL: 60 PERIODS**

**LABORATORY REQUIREMENT FOR BATCH OF 30 STUDENTS:**

**HARDWARE/ SOFTWARE:**

1. Embedded trainer kits with ARM board
2. Embedded trainer kits suitable for wireless communication
3. Adequate quantities of Hardware, software and consumables

**OUTCOMES:  
AT THE END OF THE COURSE, LEARNERS WILL BE ABLE TO**

<b>Course Name :EMBEDDED SYSTEMS DESIGN LABORATORY</b>		<b>Course Code: 20C15L2</b>			
<b>CO</b>	<b>Course Outcomes</b>	<b>Expt.</b>	<b>K-CO</b>	<b>POs</b>	<b>PSOs</b>
C307.1	Explore the ARM processor architecture and Instruction set for program	1	K3		
C307.2	Apply the concept of ARM processor for interfacing the peripherals to control system	2,3,5,8	K3		
C307.3	Develop the communication protocol using the embedded kit	4	K3		
C307.4	Developing of memories such as EPROM, EEPROM, using ARM processor	6	K3		
C307.5	Implementation of FPGA in ARM processor	7	K3		
C307.6	Develop realtime embedded System using ARM processor.	9,10	K4		

<b>20CS602</b>	<b>CRYPTOGRAPHY AND NETWORK SECURITY</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

**OBJECTIVES:**

- To understand OSI security architecture and classical encryption techniques.
- To understand the Symmetric cryptography techniques.
- To understand the public key cryptography Systems.
- To understand the various message authentication functions.
- To understand the different level of security and services.

**PRE-REQUISITE:**

Course Code : 20CS501

Course Name :Computer Networks

**UNIT – I INTRODUCTION 10**

Security trends - Legal, Need for Security at Multiple levels, Security Policies - Model of network security – Security attacks, services and mechanisms – OSI security architecture – Classical encryption techniques: substitution techniques, transposition techniques, steganography).- Foundations of modern cryptography: perfect security – information theory – product cryptosystem – cryptanalysis.

**UNIT – II SYMMETRIC CRYPTOGRAPHY 8**

Mathematics Of Symmetric Key Cryptography: Algebraic structures - Modular arithmetic- Euclid’s algorithm- Congruence and matrices - Groups, Rings, Fields- Finite fields- SYMMETRIC KEY CIPHERS: SDES – Block cipher Principles of DES – Strength of DES – Differential and linear cryptanalysis - Block cipher design principles – Block cipher mode of operation – Evaluation criteria for AES – Advanced Encryption Standard - RC4 – Key distribution.

**UNIT – III PUBLIC KEY CRYPTOGRAPHY 9**

Mathematics Of Asymmetric Key Cryptography: Primes – Primality Testing – Factorization – Euler’s totient function, Fermat’s and Euler’s Theorem - Chinese Remainder Theorem – Exponentiation and logarithm - ASYMMETRIC KEY CIPHERS: RSA cryptosystem – Key distribution – Key management – Diffie Hellman key exchange - ElGamal cryptosystem – Elliptic curve arithmetic-Elliptic curve cryptography.

**UNIT – IV MESSAGE AUTHENTICATION AND INTEGRITY 9**

Authentication requirement – Authentication function – MAC – Hash function – Security of hash function and MAC – SHA –Digital signature and authentication protocols – DSS- Entity Authentication: Biometrics, Passwords, Challenge Response protocols- Authentication applications - Kerberos, X.509

**UNIT – V SECURITY PRACTICE AND SYSTEM SECURITY 9**

Electronic Mail security – PGP, S/MIME – IP security – Web Security - SYSTEM SECURITY: Intruders – Malicious software – Malware, Ransomware– Viruses – Firewalls.

**TOTAL: 45 PERIODS**

**TEXT BOOKS:**

1. William Stallings, Cryptography and Network Security: Principles and Practice, PHI 7th Edition, 2017.
2. Charlie Kaufman, Radia Perlman and Mike Speciner, "Network Security", Prentice Hall of India, 2<sup>nd</sup> Edition 2017.

**REFERENCES:**

1. C K Shyamala, N Harini and Dr. T R Padmanabhan: Cryptography and Network Security, Wiley India Pvt.Ltd
2. Behrouz A. Forouzan, Cryptography and Network Security, Tata McGraw Hill 2007.
3. Man Young Rhee, "Internet Security: Cryptographic Principles", "Algorithms and Protocols", Wiley Publications, 2003.
4. Ulysess Black, "Internet Security Protocols", Pearson Education Asia, 2000
5. Bruce Schneier and Neils Ferguson, "Practical Cryptography", First Edition, Wiley Dreamtech India Pvt Ltd, 2003.
6. Douglas R Simson "Cryptography – Theory and practice", First Edition, CRC Press, 1995.

**OUTCOMES:**

**AT THE END OF THE COURSE, LEARNERS WILL BE ABLE TO:**

<b>Course Name : CRYPTOGRAPHY AND NETWORK SECURITY</b>		<b>Course Code : 20CS602</b>			
<b>CO</b>	<b>Course Outcomes</b>	<b>Unit</b>	<b>K-CO</b>	<b>POs</b>	<b>PSOs</b>
C312.1	Describe the fundamental theory of cryptography and OSI security architecture in networks.	I	K2		
C312.2	Apply the classical encryption techniques for network security.	I	K3		
C312.3	Illustrate the different cryptographic operations of symmetric cryptographic algorithms	II	K3		
C312.4	Illustrate the different cryptographic operations of public key cryptography	III	K3		
C312.5	Apply the various security mechanisms to build different Authentication services.	IV	K3		
C312.6	Explain the various Security practices and System security standards.	V	K2		

<b>20CS604</b>	<b>MACHINE LEARNING</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		3	0	2	4

**OBJECTIVES:**

- To understand the need for machine learning for various problem solving.
- To study the various supervised, semi-supervised and unsupervised learning algorithms in machine learning.
- To understand the latest trends in machine learning
- To design appropriate machine learning algorithms for problem solving.

**PRE-REQUISITE: NIL**

**UNIT - I SUPERVISED LEARNING: REGRESSION 9**

Paradigms of Machine Learning - Examples- Types of Learning - Types of supervised learning - Introduction to Regression - Linear regression - Geometrical Interpretation - Iterative solution: Gradient descent - Performance metrics of machine learning - Python libraries suitable for Machine Learning.

**LAB COMPONENT**

1. Installing Anaconda-Jupyter Notebook-Learn Python ML Packages.
2. Implement data loading methods - understanding data with statistics, visualization - Data Preprocessing - Data Labeling. 6

**UNIT - II SUPERVISED LEARNING: CLASSIFICATION 9**

K-Nearest Neighbour Classification - Distance metric and Cross-Validation - Computational efficiency of KNN - Introduction to Decision Trees - Entropy and Information Gain - Naive Bayes classifier - Perceptron and its learning algorithm - Support Vector Machine.

**LAB COMPONENT**

3. Logistic Regression Implementation: Implement the standard Logistic Regression model generally used for classifying data into binary classes such as pass/fail, win/lose, alive/dead or healthy/sick. 6
4. Decision Tree Implementation: Implement the standard Decision Tree Class used for classifying data into various classes using a tree-like model of decisions and their possible consequences.

**UNIT - III UNSUPERVISED LEARNING 9**

K-means Clustering - Lloyd's Algorithms - Convergence and Initialization - Covariance Matrix and Eigen direction - PCA

**LAB COMPONENT**

5. Tumor Prediction: Detect Brain tumor images from the given data set. 6
6. Dimensionality Reduction: Analyze PCA for the appropriate data set.

**UNIT - IV RECOMMENDER SYSTEMS 9**

Recommender Systems - Introduction - Non-Personalized Recommender Systems - Content-Based Recommender Systems - Recommender System Evaluation.

**LAB COMPONENT**

7. Movie/Book/Any Product recommendation by using content based filtering. 6

**UNIT - V CASE STUDIES 9**

**Text Classification:** Build a classifier model using Naive Bayes algorithm to predict the topic of an article present in a newspaper. **Twitter Sentiment Analysis:** Analyse the tweets posted on twitter to predict the sentiment of the tweet i.e. positive, negative or neutral.

**LAB COMPONENT**

8. Mini Project

6

**TOTAL: 75 PERIODS**

**TEXT BOOKS:**

1. Marc Peter Deisenroth, A. Aldo Faisal and Cheng Soon Ong, "Mathematics for Machine Learning", Cambridge University Press, 2020.
2. Gopal sakarkar, gaurav patil and prateek dutta, "Machine Learning Algorithms using Python Programming", Nova Science Publishers, Newyork, 2021.

**REFERENCES:**

1. Tom M. Mitchell, "Machine Learning", McGraw-Hill Education (India) Private Limited, 2013.
2. Stephen Marsland, "Machine Learning: An Algorithmic Perspective", CRC Press, 2009.
3. Mehryar Mohri, Afshin Rostamizadeh and Ameet Talwalkar, "Foundations of Machine Learning", MIT Press, 2012.
4. Ethem Alpaydin, "Introduction to Machine Learning (Adaptive Computation and Machine Learning)", The MIT Press, 2004.

**OUTCOMES:**

**AT THE END OF THE COURSE, LEARNERS WILL BE ABLE TO:**

Course Name : MACHINE LEARNING		Course Code : 20CS604			
CO	Course Outcomes	Unit	K-CO	POs	PSOs
C316.1	Identify the category of the learning problem, and measure its performance like recall, precision etc.	I	K3		
C316.2	Apply the classification algorithms like K-NN, Decision Tree, Naive Bayes, Logistic Regression to label the data set.	II	K3		
C316.3	Apply unsupervised algorithms namely K-means and PCA to cluster the given data set.	III	K3		
C316.4	Apply Content-based recommender systems and Collaborative Filtering to implement recommender systems.	IV	K3		
C316.5	Identify any societal problem and examine by applying acquired knowledge of machine learning in order to develop a mini project	V	K4		
C316.6	Combine all the modules of mini project through effective team work after efficient testing, and compile a detailed report.	V	K4		

<b>20CS605</b>	<b>WEB TECHNOLOGY</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>3</b>	<b>0</b>	<b>2</b>	<b>4</b>

**OBJECTIVES:**

- To be familiar with web pages design using HTML, XML, Style Sheets.
- To be exposed to creation of user interfaces using Java Frames & Applets.
- To be able to create dynamic web pages using server side scripting.
- To learn to write server side applications.
- To be familiar with PHP & AJAX programming

**PRE-REQUISITE: NIL**

**UNIT – I WEBSITE BASICS, HTML 5, CSS 9**

Web Essentials: Clients, Servers and Communication – The Internet – HTML5 – Tables – Lists – Image – HTML5 control elements – Drag and Drop – Audio – Video controls - CSS – Inline, embedded and external style sheets

**LAB COMPONENT 6**

1. Create Simple website with 5 pages (Home, About, Gallery, Course, Contact). Gallery and contact page with contact us form is must.
2. Create a web page with the following using HTML
  - i) To embed an image map in a web page ii) To fix the hot spots iii) Show all the related information when the hot spots are clicked.
3. Create a web page with all types of Cascading style sheets.

**UNIT - II CLIENT SIDE PROGRAMMING 9**

Java Script: An introduction to JavaScript, Regular Expressions- Exception Handling- Validation-Built-in objects-Event Handling-DHTML with JavaScript.

**LAB COMPONENT 6**

1. Write a JavaScript to design a simple calculator to perform the following operations: sum, product, difference and quotient.
2. Client Side Scripts for Validating Web Form Controls using DHTML

**UNIT - III JAVA, JAVA SERVLET, JSP 9**

Applet : Graphics programming- Frame — Components- layout management, Servlets: Java Servlet Architecture- Servlet Life Cycle- Form GET and POST actions – Database Connectivity: JDBC program example –JSP: -Creating HTML forms by embedding JSP code.

**LAB COMPONENT 6**

1. Write programs in Java to create applets incorporating the following features
  - Create a color palette with matrix of buttons Set background and foreground of the control text area by selecting a color from color palette. In order to select Foreground or background use check box control as radio buttons To set background images
2. Write programs in Java using Servlets: To invoke servlets from HTML forms To invoke servlets from Applets.
3. Write programs in Java to create three-tier applications using JSP and Databases for conducting on-line examination for displaying student mark list. Assume that student information is available in database which has been stored in a database server.



**OUTCOMES:**

**AT THE END OF THE COURSE, LEARNERS WILL BE ABLE TO:**

Course Name : WEB TECHNOLOGY		Course Code : 20CS605			
CO	Course Outcomes	Unit	K-CO	POs	PSOs
CO1	Use HTML / CSS tag to create static and dynamic web pages	I	K3		
CO2	Apply the Java script to design a simple application and form validation	II	K3		
CO3	Explain the Java Servlet architecture and database connectivity	III	K2		
CO4	Build an applications using server side script languages	III	K3		
CO5	Develop web related applications using PHP and XML	IV	K3		
CO6	Develop an interactive web service using AJAX	V	K3		

20MC801

DISASTER MANAGEMENT

L	T	P	C
2	0	0	-

**OBJECTIVES:**

- Learn to demonstrate a critical understanding of key concepts in disaster risk reduction and humanitarian response.
- Critically evaluate disaster risk reduction and humanitarian response policy and practice from multiple perspectives.
- Develop an understanding of standards of humanitarian response and practical relevance in specific types of disasters and conflict situations.
- Critically understand the strengths and weaknesses of disaster management approaches, planning and programming in different countries, particularly their home country or the countries they work in

**UNIT – I INTRODUCTION 6**

**Disaster:** Definition, Factors and Significance, Difference between Hazard and Disaster.

**Natural and Manmade Disasters:** Difference, Nature, Types and Magnitude.

**UNIT – II REPERCUSSIONS OF DISASTERS AND HAZARDS 6**

**Repercussions of Disasters and Hazards:** Economic Damage, Loss of Human and Animal Life, Destruction of Ecosystem.

**Natural Disasters:** Earthquakes, Volcanisms, Cyclones, Tsunamis, Floods, Droughts and Famines, Landslides and Avalanches.

**Man-made Disaster:** Nuclear Reactor Meltdown, Industrial Accidents, Oil Slicks and Spills, Out breaks of Disease and Epidemics, War and Conflicts.

**UNIT – III DISASTER PRONE AREAS IN INDIA 6**

**Disaster Prone are as in India:** Study of Seismic Zones, Areas Prone to Floods and Droughts,

Landslides and Avalanches; Areas Prone to Cyclonic and Coastal Hazards with Special Reference to Tsunami; Post – Disaster Diseases and Epidemics.

**UNIT – IV DISASTER PREPAREDNESS AND MANAGEMENT 6**

**Disaster Preparedness and Management Preparedness:** Monitoring of Phenomena Triggering a Disaster or Hazard.

**Evaluation of Risk:** Application of Remote Sensing, Data from Meteorological and other Agencies.

**Media Reports:** Governmental and Community Preparedness.

**UNIT - V RISK ASSESSMENT 6**

**Risk Assessment Disaster Risk:** Concept and Elements, Disaster Risk Reduction, Global and National Disaster Risk Situation. Techniques of Risk Assessment, Global Co - Operation In Risk Assessment and Warning, People’s Participation in Risk Assessment. Strategies for Survival.

**TOTAL: 30 PERIODS**

**REFERENCES:**

1. Nishith Rai and A.K. Singh, “Disaster Management in India: Perspectives, Issues and Strategies”, New Royal Book Company, 2007.
2. Pardeep Sahni, Alka Dhameja and Uma Medury, “Disaster Mitigation: Experiences and Reflections”, Prentice Hall India Learning Private Limited, 2001.
3. S.L.Goel, “Disaster Administration and Management: Text and Case Studies”, Deep & Deep Publication Pvt.Ltd., 2007

**20CS6L1 MOBILE APPLICATION DEVELOPMENT LABORATORY**    **L    T    P    C**  
**0    0    4    2**

**OBJECTIVES:**

- To understand the components and structure of mobile application development frameworks for Android OS based mobiles.
- To understand how to work with various mobile application development frameworks.
- To learn the basic and important design concepts and issues of development of mobile applications.
- To understand the capabilities and limitations of mobile devices

**LIST OF EXPERIMENTS**

1. Develop an application that uses GUI components, Font and Colours
2. Develop an application that uses Layout Managers and event listeners.
3. Develop an application that draws basic graphical primitives on the screen.
4. Develop an application that makes use of databases.
5. Develop an application that makes use of Notification Manager
6. Implement an application that uses Multi-threading
7. Develop a native application that uses GPS location information
8. Implement an application that writes data to the SD card.
9. Write a mobile application that creates alarm clock
10. Write a mobile application that makes use of RSS feed
11. Develop a mobile application to send an email.
12. Develop a Mobile application for simple needs (Mini Project)

**TOTAL: 60 PERIODS**

**LABORATORY REQUIREMENT FOR BATCH OF 30 STUDENTS:**

C / C++ / Java or equivalent compiler GnuPG, Snort, N-Stalker or Equivalent  
**HARDWARE:** Standalone desktops - 30 Nos. (or) Server supporting 30 terminals or more.

**OUTCOMES:**

**AT THE END OF THE COURSE, LEARNERS WILL BE ABLE TO:**

<b>Course Name : Mobile Application Development Laboratory</b>		<b>Course Code : 20CS6L1</b>			
<b>CO</b>	<b>Course Outcomes</b>	<b>Expt.</b>	<b>K-CO</b>	<b>POs</b>	<b>PSOs</b>
C317.1	Develop mobile applications using GUI and Layouts.	1,2	K3		
C317.2	Develop mobile applications using EventListener.	2,3	K3		
C317.3	Develop mobile applications using Databases.	4	K3		
C317.4	Develop mobile applications using Notification Manager	5	K3		
C317.5	Develop mobile applications using RSS Feed, Internal/External Storage, SMS, Multi-threading and GPS.	6,7,8	K3		
C317.6	Create own mobile app for simple needs	9-12	K6		

<b>20CSV11</b>	<b>CLOUD COMPUTING TECHNIQUES</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>2</b>	<b>0</b>	<b>2</b>	<b>3</b>

**OBJECTIVES:**

- To understand the principles of cloud architecture, models and infrastructure.
- To understand the concepts of virtualization and virtual machines.
- To gain knowledge about virtualization Infrastructure.
- To explore and experiment with various Cloud deployment environments.
- To learn about the security issues in the cloud environment.

**PRE-REQUISITE: NIL**

**UNIT - I CLOUD ARCHITECTURE MODELS AND INFRASTRUCTURE 6**

Cloud Architecture: System Models for Distributed and Cloud Computing – NIST Cloud Computing

Reference Architecture – Cloud deployment models – Cloud service models; Cloud Infrastructure: Architectural Design of Compute and Storage Clouds – Design Challenges.

**LAB COMPONENT: 6**

1. Install Virtualbox /VMware / Equivalent open source cloud Workstation with different flavours of Linux or Windows OS on top of windows 8 and above.

**UNIT - II VIRTUALIZATION BASICS 6**

Virtual Machine Basics – Taxonomy of Virtual Machines – Hypervisor – Key Concepts – Virtualization structure – Implementation levels of virtualization – Virtualization Types: Full Virtualization – Para Virtualization – Hardware Virtualization – Virtualization of CPU, Memory and I/O devices.

**LAB COMPONENT: 6**

1. Install a C compiler in the virtual machine created using a virtual box and execute Simple Programs

**UNIT - III VIRTUALIZATION INFRASTRUCTURE AND DOCKER 6**

Desktop Virtualization – Network Virtualization – Storage Virtualization – System-level of Operating

Virtualization – Application Virtualization – Virtual clusters and Resource Management – Containers

vs. Virtual Machines – Introduction to Docker – Docker Components – Docker Container – Docker

Images and Repositories.

**LAB COMPONENT: 6**

1. Find a procedure to transfer the files from one virtual machine to another virtual machine.
2. Creating and Executing Your First Container Using Docker.

**UNIT - IV CLOUD DEPLOYMENT ENVIRONMENT 6**

Google App Engine – Amazon AWS – Microsoft Azure; Cloud Software Environments – Eucalyptus

– OpenStack.

**LAB COMPONENT: 6**

1. Install Google App Engine. Create a hello world app and other simple web applications using python/java.
2. Use the GAE launcher to launch the web applications.

**UNIT - V CLOUD SECURITY 6**

Virtualization System-Specific Attacks: Guest hopping – VM migration attack – hyperjacking. DataSecurity and Storage; Identity and Access Management (IAM) - IAM Challenges - IAM Architecture and Practice.

**LAB COMPONENT:**

6

1. Install Hadoop single node cluster and run simple applications like word count.
2. Simulate a cloud scenario using CloudSim and run a scheduling algorithm that is not present in CloudSim.

**TOTAL: 60 PERIODS**

**TEXT BOOKS:**

1. Kai Hwang, Geoffrey C Fox, Jack G Dongarra, "Distributed and Cloud Computing, From Parallel Processing to the Internet of Things", Morgan Kaufmann Publishers, 2012.
2. James Turnbull, "The Docker Book", O'Reilly Publishers, 2014.
3. Krutz, R. L., Vines, R. D, "Cloud security. A Comprehensive Guide to Secure Cloud Computing", Wiley Publishing, 2010.

**REFERENCES:**

1. James E. Smith, Ravi Nair, "Virtual Machines: Versatile Platforms for Systems and Processes", Elsevier/Morgan Kaufmann, 2005.
2. Tim Mather, Subra Kumaraswamy, and Shahed Latif, "Cloud Security and Privacy: an enterprise perspective on risks and compliance", O'Reilly Media, Inc., 2009..

**OUTCOMES:**

**AT THE END OF THE COURSE, LEARNERS WILL BE ABLE TO:**

Course Name : Cloud Computing Techniques										Course Code :20CSV11				
CO	Course Outcomes									Unit	K-CO	POs	PSOs	
CO1	Describe the cloud architecture, cloud deployment & service models and challenges of cloud design									I	K2	1,2,8,9	1,2	
CO2	Apply the concept of virtualization and its types									II	K3	1,2,8,9	1,2	
CO3	Experiment with virtualization of hardware resources									III	K2	1,2,8,9	1,2	
CO4	Use Docker in cloud environment									III	K3	1,2,8,9	1,2	
CO5	Develop and deploy services on the cloud and set up a cloud environment									III	K3	1,2,8,9	1,2	
CO6	Explain security challenges in the cloud environment									IV	K2	1,2,8,9	1,2	
CO-PO Mapping														
COs	PO 1	PO2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12	PSO 1	PSO2
CO1	2	1	-	-	-	-	-	1	1	-	-	-	2	2
CO2	3	2	1	-	-	-	-	1	1	1	-	-	2	2
CO3	2	1	-	-	1	-	-	1	1	1	-	-	2	2
CO4	3	2	1	-	1	-	-	1	1	1	-	-	2	2
CO5	3	2	1	-	1	-	-	1	1	1	-	-	2	2
CO6	2	1	-	-	-	-	-	1	1	-	-	-	2	2

<b>20CSV21</b>	<b>DATA WAREHOUSING AND DATA MINING</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

**OBJECTIVES:**

- To understand data warehouse concepts, architecture, business analysis and tools
- To understand data pre-processing and data visualization techniques
- To study algorithms for finding hidden and interesting patterns in data
- To understand and apply various classification and clustering techniques using tools.

**PRE-REQUISITE:**

Course Code : 20CS402

Course Name : Database Management Systems

**UNIT - I DATA WAREHOUSING, BUSINESS ANALYSIS AND ON-LINE ANALYTICAL PROCESSING (OLAP) 9**

Basic Concepts - Data Warehousing Components – Building a Data Warehouse – Database Architectures for Parallel Processing – Parallel DBMS Vendors - Multidimensional Data Model – Data Warehouse Schemas for Decision Support, Concept Hierarchies - Characteristics of OLAP Systems – Typical OLAP Operations, OLAP and OLTP

**UNIT - II DATA MINING - INTRODUCTION 9**

Introduction– Data – Types of Data – Data Mining Functionalities – Interestingness of Patterns. Introduction to Data Mining Systems – Knowledge Discovery Process – Data Mining Techniques – Issues – applications- Data Objects and attribute types, Statistical description of data, Data Preprocessing – Cleaning, Integration, Reduction, Transformation and discretization, Data Visualization, Data similarity and dissimilarity measures.

**UNIT - III FREQUENT PATTERN ANALYSIS 9**

Mining Frequent Patterns, Associations and Correlations – Mining Methods- Pattern Evaluation Method – Pattern Mining in Multilevel, Multi Dimensional Space – Constraint Based Frequent Pattern Mining, Classification using Frequent Patterns

**UNIT - IV CLASSIFICATION AND CLUSTERING 9**

Decision Tree Induction - Bayesian Classification – Rule Based Classification – Classification by Back Propagation – Support Vector Machines —Clustering Techniques – Cluster Analysis- Partitioning Methods - Hierarchical Methods – Density Based Methods - Grid Based Methods – Evaluation of clustering – Clustering high dimensional data- Clustering with constraints, Outlier analysis

**UNIT - V DATA MINING TOOLS 9**

Datasets – Introduction, Iris plants database, Breast cancer database, Auto imports database – Data mining tools: WEKA, Hadoop, Spark, R tool – Learning algorithms, Clustering algorithms, Association–rule learners.

**TOTAL: 45 PERIODS**

**TEXT BOOKS:**

1. Jiawei Han and Micheline Kamber, Data Mining Concepts and Techniques, Third Edition, Elsevier, 2012.
2. Alex Berson and Stephen J.Smith, Data Warehousing, Data Mining & OLAP, Tata McGraw – Hill Edition, 5th Reprint 2016.

**REFERENCES:**

1. K.P. Soman, Shyam Diwakar and V. Ajay, Insight into Data Mining Theory and Practice, Eastern Economy Edition, Prentice Hall of India, 2006.
2. Ian H.Witten and Eibe Frank, Data Mining: Practical Machine Learning Tools and Techniques, Elsevier, Second Edition.
3. Daniel T.Larose, "Data Mining Methods and Models", Wiley-Interscience, 2006.

**OUTCOMES:**

**AT THE END OF THE COURSE, LEARNERS WILL BE ABLE TO:**

<b>Course Name : DATA WAREHOUSING AND DATA MINING</b>		<b>Course Code : 20CSV21</b>			
<b>CO</b>	<b>Course Outcomes</b>	<b>Unit</b>	<b>K-CO</b>	<b>POs</b>	<b>PSOs</b>
<b>CO1</b>	Discuss data warehouse system and business analysis with OLAP tools	I	K2	1,2	1,2
<b>CO2</b>	Describe various pre-processing and visualization techniques for data analysis	II	K2	1,2,8,9,10	1,2
<b>CO3</b>	Apply frequent pattern and association rule mining techniques	III	K3	1,2,3,8,9,10	1,2
<b>CO4</b>	Select and apply an appropriate classification algorithm for labeled data	IV	K3	1,2,3,8,9,10,12	1,2
<b>CO5</b>	Apply various clustering techniques for unlabeled data	IV	K3	1,2,3,8,9,10,12	1,2
<b>CO6</b>	Apply learning and clustering algorithms using data mining tools	V	K3	1,2,3,8,9,10,12	1,2

**CO-PO Mapping**

<b>COs</b>	<b>PO1</b>	<b>PO2</b>	<b>PO3</b>	<b>PO4</b>	<b>PO5</b>	<b>PO6</b>	<b>PO7</b>	<b>PO8</b>	<b>PO9</b>	<b>PO10</b>	<b>PO11</b>	<b>PO12</b>	<b>PSO1</b>	<b>PSO2</b>
<b>CO1</b>	2	1	-	-	-	-	-	-	-	-	-	-	2	1
<b>CO2</b>	2	1	-	-	-	-	-	1	1	-	-	-	2	1
<b>CO3</b>	3	2	1	-	-	-	-	1	1	1	-	-	2	1
<b>CO4</b>	3	2	1	-	-	-	-	1	1	1	-	1	2	1
<b>CO5</b>	3	2	1	-	-	-	-	1	1	1	-	1	2	1
<b>CO6</b>	3	2	1	-	-	-	-	1	1	1	-	1	2	1

<b>20CSV31</b>	<b>CLOUD SERVICE MANAGEMENT</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

**OBJECTIVES:**

- Introduce Cloud Service Management terminology, definition & concepts
- Compare and contrast cloud service management with traditional IT service management
- Identify strategies to reduce risk and eliminate issues associated with adoption of cloud services
- Illustrate the benefits and drive the adoption of cloud-based services to solve real world problems

**PRE-REQUISITE : NIL**

**UNIT - I CLOUD SERVICE MANAGEMENT FUNDAMENTALS 9**

Cloud Ecosystem, The Essential Characteristics, Basics of Information Technology Service Management and Cloud Service Management, Service Perspectives, Cloud Service Models, Cloud Service Deployment Models.

**UNIT - II CLOUD SERVICES STRATEGY 9**

Cloud Strategy Fundamentals, Cloud Strategy Management Framework, Cloud Policy, Key Driver for Adoption, Risk Management, IT Capacity and Utilization, Demand and Capacity matching, Demand Queueing, Change Management, Cloud Service Architecture.

**UNIT - III CLOUD SERVICE MANAGEMENT 9**

Cloud Service Reference Model, Cloud Service Life Cycle, Basics of Cloud Service Design, Dealing with Legacy Systems and Services, Benchmarking of Cloud Services, Cloud Service Capacity Planning, Cloud Service Deployment and Migration, Cloud Marketplace, Cloud Service Operations Management.

**UNIT - IV CLOUD SERVICE ECONOMICS 9**

Pricing models for Cloud Services, Freemium, Pay Per Reservation, Pay per User, Subscription based Charging, Procurement of Cloud-based Services, Capex vs Opex Shift, Cloud service Charging, Cloud Cost Models.

**UNIT - V CLOUD SERVICE GOVERNANCE & VALUE 9**

IT Governance Definition, Cloud Governance Definition, Cloud Governance Framework, Cloud Governance Structure, Cloud Governance Considerations, Cloud Service Model Risk Matrix, Understanding Value of Cloud Services, Measuring the value of Cloud Services, Balanced Scorecard, Total Cost of Ownership.

**TOTAL: 45 PERIODS**

**TEXT BOOKS:**

1. Cloud Service Management and Governance: Smart Service Management in Cloud Era by Enamul Haque, Enel Publications
2. Cloud Computing: Concepts, Technology & Architecture by Thomas Erl, Ricardo Puttini, Zaigham Mohammad 2013
3. Cloud Computing Design Patterns by Thomas Erl, Robert Cope, Amin Naserpour

**REFERENCES:**

1. Economics of Cloud Computing by Praveen Ayyappa, LAP Lambert Academic Publishing
2. Mastering Cloud Computing Foundations and Applications Programming Rajkumar Buyya, Christian Vechhiola, S. Thamarai Selvi.

**OUTCOMES:**

**AT THE END OF THE COURSE, LEARNERS WILL BE ABLE TO:**

Course Name :CLOUD SERVICE MANAGEMENT		Course Code :20CSV31			
CO	Course Outcomes	Unit	K-CO	POs	PSOs
CO1	Discuss the fundamentals of cloud service management	I	K2	1,2	2
CO2	Describe the cloud service strategies like cloud policy, risk management and change management etc.,	II	K2	1,2,8,9	2
CO3	Explain the life cycle and benchmarks of cloud services	III	K2	1,2,8,9	2
CO4	Illustrate deployment and migration of cloud services	IV	K2	1,2,8,9	2
CO5	Discuss the economic based cloud services	IV	K2	1,2,8,9,10	2
CO6	Explain the strong theoretical foundation leading to cloud service governance & measuring the value of cloud-based services	V	K2	1,2,8,9,10	2

**CO-PO Mapping**

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1	-	-	-	-	-	-	-	-	-	-	-	2
CO2	2	1	-	-	-	-	-	1	1	-	-	-	-	2
CO3	2	1	-	-	-	-	-	1	1	-	-	-	-	2
CO4	2	1	-	-	-	-	-	1	1	-	-	-	-	2
CO5	2	1	-	-	-	-	-	1	1	1	-	-	-	2
CO6	2	1	-	-	-	-	-	1	1	1	-	-	-	2

<b>20CSV41</b>	<b>SOFTWARE DEFINED NETWORKS</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

**OBJECTIVES:**

1. To learn the fundamentals of software defined networks.
2. To understand the separation of the data plane and the control plane.
3. To study about the SDN Programming.
4. To study about the various applications of SDN

**PRE-REQUISITE: NIL**

<b>UNIT - I</b>	<b>INTRODUCTION TO SOFTWARE DEFINED NETWORK</b>	<b>9</b>
SDN Origins and Evolution – Introduction – Why SDN? - Centralized and Distributed Control and Data Planes - The Genesis of SDN		
<b>UNIT - II</b>	<b>OPEN FLOW AND SDN CONTROLLERS</b>	<b>9</b>
Open Flow Specification – Drawbacks of Open SDN, SDN via APIs, SDN via HypervisorBased Overlays – SDN via Opening up the Device – SDN Controllers – General Concepts.		
<b>UNIT - III</b>	<b>DATA CENTERS</b>	<b>9</b>
Multitenant and Virtualized Multitenant Data Center – SDN Solutions for the Data Center Network – VLANs – EVPN – VxLAN – NVGRE		
<b>UNIT - IV</b>	<b>SDN PROGRAMMING</b>	<b>9</b>
Programming SDNs: Northbound Application Programming Interface, Current Languages and Tools, Composition of SDNs – Network Functions Virtualization (NFV) and Software Defined Networks: Concepts, Implementation and Applications		
<b>UNIT - V</b>	<b>SDN FRAMEWORK</b>	<b>9</b>
Juniper SDN Framework – IETF SDN Framework – Open Daylight Controller – Floodlight Controller – Bandwidth Calendaring – Data Center Orchestration		
		<b>TOTAL: 45 PERIODS</b>

**TEXT BOOKS:**

1. Paul Goransson and Chuck Black, Software Defined Networks: A Comprehensive Approach, First Edition, Morgan Kaufmann, 2014.
2. Thomas D. Nadeau, Ken Gray, SDN: Software Defined Networks, O'Reilly Media, 2013

**REFERENCES:**

1. SiamakAzodolmolky, Software Defined Networking with Open Flow, Packet Publishing, 2013.
2. Vivek Tiwari, SDN and Open Flow for BeginnersII, Amazon Digital Services, Inc., 2013.
3. Fei Hu, Editor, Network Innovation through Open Flow and SDN: Principles and Design, CRC Press, 2014.

**OUTCOMES:**

**AT THE END OF THE COURSE, LEARNERS WILL BE ABLE TO:**

Course Name : Software Defined Networks											Course Code : 20CSV41			
CO	Course Outcomes										Unit	K-CO	POs	PSOs
CO1	Explain the key benefits of SDN by separation of Data and Control Planes.										I	K2	1, 2, 8, 9	1
CO2	Discuss the openflow specification and different controllers of SDN.										II	K2	1, 2, 8, 9	1
CO3	Describe various Data centers and SDN solutions for the Data Center networks.										III	K2	1, 2,8, 9	1
CO4	Develop various applications of SDN using current languages and tools.										IV	K3	1, 2, 3, 8, 9	1
CO5	Explain the various concepts of Network function virtualization in SDN programming.										IV	K2	1, 2, 8, 9	1
CO6	Explain different framework and controller used in SDN										V	K2	1, 2,8,9	1
CO-PO Mapping														
CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1	-	-	-	-	-	1	1	1	-	-	2	-
CO2	2	1	-	-	-	-	-	1	1	1	-	-	2	-
CO3	2	1	-	-	-	-	-	1	1	1	-	-	2	-
CO4	3	2	1	-	-	-	-	1	1	1	-	-	2	-
CO5	3	2	-	-	-	-	-	1	1	1	-	-	2	-
CO6	3	2	-	-	-	-	-	1	1	1	-	-	2	-

20ADV51	STORAGE TECHNOLOGIES	L	T	P	C
		3	0	0	3
<b>OBJECTIVES:</b>					
<ul style="list-style-type: none"> <li>● Characterize the functionalities of logical and physical components of storage</li> <li>● Describe various storage networking technologies</li> <li>● Identify different storage virtualization technologies</li> <li>● Discuss the different backup and recovery strategies</li> <li>● Understand common storage management activities and solutions</li> </ul>					
<b>PRE-REQUISITE: NIL</b>					
<b>UNIT - I STORAGE SYSTEMS</b>		<b>9</b>			
Introduction to Information Storage: Digital data and its types, Information storage, Key characteristics of data center and Evolution of computing platforms. Information Lifecycle Management. Third Platform Technologies: Cloud computing and its essential characteristics, Cloud services and cloud deployment models, Big data analytics, Social networking and mobile computing, Characteristics of third platform infrastructure and Imperatives for third platform transformation. Data Center Environment: Building blocks of a data center, Compute systems and compute virtualization and Software-defined data center.					
<b>UNIT - II INTELLIGENT STORAGE SYSTEMS AND RAID</b>		<b>5</b>			
Components of an intelligent storage system, Components, addressing, and performance of hard disk drives and solid-state drives, RAID, Types of intelligent storage systems, Scale-up and scale out storage Architecture.					
<b>UNIT- III STORAGE NETWORKING TECHNOLOGIES AND VIRTUALIZATION</b>		<b>13</b>			
Block-Based Storage System, File-Based Storage System, Object-Based and Unified Storage. Fibre Channel SAN: Software-defined networking, FC SAN components and architecture, FC SAN topologies, link aggregation, and zoning, Virtualization in FC SAN environment. Internet Protocol SAN: iSCSI protocol, network components, and connectivity, Link aggregation, switch aggregation, and VLAN, FCIP protocol, connectivity, and configuration. Fibre Channel over Ethernet SAN: Components of FCoE SAN, FCoE SAN connectivity, Converged Enhanced Ethernet, FCoE architecture.					
<b>UNI - IV BACKUP, ARCHIVE AND REPLICATION</b>		<b>12</b>			
Introduction to Business Continuity, Backup architecture, Backup targets and methods, Data deduplication, Cloud-based and mobile device backup, Data archive, Uses of replication and its characteristics, Compute based, storage-based, and network-based replication, Data migration, Disaster Recovery as a Service (DRaaS).					
<b>UNIT - V SECURING STORAGE INFRASTRUCTURE</b>		<b>6</b>			
Information security goals, Storage security domains, Threats to a storage infrastructure, Security controls to protect a storage infrastructure, Governance, risk, and compliance, Storage infrastructure management functions, Storage infrastructure management processes.					
<b>TOTAL: 45 PERIODS</b>					

**OUTCOMES:**

**On Completion of the course, the students should be able to:**

CO1: Demonstrate the fundamentals of information storage management and various models of

Cloud infrastructure services and deployment

CO2: Illustrate the usage of advanced intelligent storage systems and RAID

CO3: Identify various storage networking architectures - SAN

CO4: Apply storage subsystems and Virtualization

CO5: Examine the different role in providing disaster recovery and remote replication technologies

CO6: Infer the security needs and security measures to be employed in information

**TEXT BOOKS**

1. EMC Corporation, Information Storage and Management, Wiley, India

2. Jon Tate, Pall Beck, Hector Hugo Ibarra, Shanmuganathan Kumaravel and Libor Miklas,

**REFERENCES:**

1. Ulf Troppens, Rainer Erkens, Wolfgang Mueller-Friedt, Rainer Wolafka, Nils Haustein ,Storage Networks Explained, Second Edition, Wiley, 2009

<b>20CSV61</b>	<b>INFORMATION RETRIEVAL TECHNIQUES</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		3	0	0	3

**OBJECTIVES:**

- To understand the basics of Information Retrieval.
- To understand machine learning techniques for text classification and clustering.
- To understand various search engine system operations.
- To learn different techniques of recommender system.

**PRE-REQUISITE:NIL**

**UNIT - I INTRODUCTION 9**

Information Retrieval – Early Developments – The IR Problem – The User's Task – Information versus Data Retrieval - The IR System – The Software Architecture of the IR System – The Retrieval and Ranking Processes - The Web – The e-Publishing Era – How the web changed Search – Practical Issues on the Web – How People Search – Search Interfaces Today – Visualization in Search Interfaces.

**UNIT - II MODELING AND RETRIEVAL EVALUATION 9**

Basic IR Models - Boolean Model - TF-IDF (Term Frequency/Inverse Document Frequency) Weighting - Vector Model – Probabilistic Model – Latent Semantic Indexing Model – Neural Network Model – Retrieval Evaluation – Retrieval Metrics – Precision and Recall – Reference Collection – User-based Evaluation – Relevance Feedback and Query Expansion – Explicit Relevance Feedback.

**UNIT - III TEXT CLASSIFICATION AND CLUSTERING 9**

A Characterization of Text Classification – Unsupervised Algorithms: Clustering – Naïve Text Classification – Supervised Algorithms – Decision Tree – k-NN Classifier – SVM Classifier – Feature Selection or Dimensionality Reduction – Evaluation metrics – Accuracy and Error – Organizing the classes – Indexing and Searching – Inverted Indexes – Sequential Searching – Multi-dimensional Indexing.

**UNIT - IV WEB RETRIEVAL AND WEB CRAWLING 9**

The Web – Search Engine Architectures – Cluster based Architecture – Distributed Architectures – Search Engine Ranking – Link based Ranking – Simple Ranking Functions – Learning to Rank – Evaluations -- Search Engine Ranking – Search Engine User Interaction – Browsing – Applications of a Web Crawler – Taxonomy – Architecture and Implementation – Scheduling Algorithms – Evaluation.

**UNIT - V RECOMMENDER SYSTEM 9**

Recommender Systems Functions – Data and Knowledge Sources – Recommendation Techniques – Basics of Content-based Recommender Systems – High Level Architecture – Advantages and Drawbacks of Content-based Filtering – Collaborative Filtering – Matrix factorization models – Neighborhood models.

**TOTAL: 45 PERIODS**

**TEXT BOOKS:**

1. Ricardo BaezaYates and Berthier RibeiroNeto, Modern Information Retrieval: The Concepts and Technology behind Search, Second Edition, ACM Press Books, 2011.
2. Ricci, F, Rokach, L. Shapira, B.Kantor, Recommender Systems Handbook, First Edition, 2011.

**REFERENCES:**

1. C. Manning, P. Raghavan, and H. Schütze, Introduction to Information Retrieval, Cambridge University Press, 2008.
2. Stefan Buettcher, Charles L. A. Clarke and Gordon V. Cormack, Information Retrieval: Implementing and Evaluating Search Engines, The MIT Press, 2010.

**OUTCOMES:**

**AT THE END OF THE COURSE, LEARNERS WILL BE ABLE TO:**

<b>Course Name : INFORMATION RETRIEVAL TECHNIQUES</b>		<b>Course Code :20CSV61</b>												
<b>CO</b>	<b>Course Outcomes</b>	<b>Unit</b>	<b>K-CO</b>	<b>POs</b>	<b>PSOs</b>									
<b>CO1</b>	Explain the IR components and Web Search Engine Framework	I	K2	1, 2, 8, 9	1,2									
<b>CO2</b>	Discuss various information retrieval models	II	K2	1, 2,8,9	1,2									
<b>CO3</b>	Apply appropriate method of classification or clustering	III	K3	1, 2, 3, 8,9	1,2									
<b>CO4</b>	Explain the Web Search Engine architecture and ranking functions	IV	K2	1, 2,8,9	1,2									
<b>CO5</b>	Discuss Web Link Analysis algorithms and advanced search	IV	K2	1, 2,8,9	1,2									
<b>CO6</b>	Illustrate recommendation techniques and develop content-based Recommender Systems	V	K3	1, 2, 3,5, 8,9	1,2									
<b>CO-PO Mapping</b>														
<b>CO</b>	<b>PO1</b>	<b>PO2</b>	<b>PO3</b>	<b>PO4</b>	<b>PO5</b>	<b>PO6</b>	<b>PO7</b>	<b>PO8</b>	<b>PO9</b>	<b>PO10</b>	<b>PO11</b>	<b>PO12</b>	<b>PSO1</b>	<b>PSO2</b>
<b>CO1</b>	2	1	-	-	-	-	-	1	1	-	-	2	2	2
<b>CO2</b>	2	1	-	-	-	-	-	1	1	-	-	2	2	2
<b>CO3</b>	3	2	1	-	-	-	-	1	1	-	-	2	2	2
<b>CO4</b>	2	1	-	-	-	-	-	1	1	-	-	2	2	2
<b>CO5</b>	2	1	-	-	-	-	-	1	1	-	-	2	2	2
<b>CO6</b>	3	2	1	-	1	-	-	1	1	-	-	2	2	2
<b>C</b>	2	2	1	-	1	-	-	1	1	-	-	2	2	2



**OUTCOMES:**

**AT THE END OF THE COURSE, LEARNERS WILL BE ABLE TO:**

Course Name : SECURITY AND PRIVACY IN CLOUD		Course Code :20SCV71			
CO	Course Outcomes	Unit	K-CO	POs	PSOs
CO1	Discuss the fundamental concepts of cloud security	I	K2	1,2,8,9	1,2
CO2	Illustrate the various cloud security design for cloud	II	K2	1,2,8,9	1,2
CO3	Apply data protection strategies for cloud	III	K3	1,2,5,8,9,10	1,2
CO4	Identify the cloud requirements, storage and network access control options	IV	K2	1,2,8,9	1,2
CO5	Explain the different types of architectural and design considerations for security in the cloud.	IV	K2	1,2,8,9	1,2
CO6	Explain the various risks, audit and monitoring mechanisms in the cloud.	V	K2	1,2,8,9	1,2

**CO-PO Mapping**

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1	-	-	-	-	-	1	1	-	-	-	1	1
CO2	2	1	-	-	-	-	-	1	1	-	-	-	1	1
CO3	3	2	1	-	1	-	-	1	1	-	-	-	1	1
CO4	2	1	-	-	-	-	-	1	1	-	-	-	1	1
CO5	2	1	-	-	-	-	-	1	1	-	-	-	1	1
CO6	2	1	1	-	-	-	-	1	1	-	-	-	1	1
C	2	1	1	-	1	-	-	1	1	-	-	-	1	1

<b>20ITV81</b>	<b>REINFORCEMENT LEARNING TECHNIQUES</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		3	0	0	3

**Objectives:**

- To introduce the fundamentals of Reinforcement Learning
- To illustrate model-based prediction and control using dynamic programming
- To illustrate model-free prediction and control
- To introduce planning and learning with tabular methods
- To explain approximation of a value function

**PRE-REQUISITE:NIL**

**UNITI INTRODUCTION 9**

Introduction to Reinforcement learning, examples - Elements of reinforcement learning - Limitations and Scope- An extended example - multi-armed bandits - k-armed bandit problem - action-value methods - the 10-armed testbed - incremental implementation - tracking a nonstationary problem - optimistic initial values - upper-confidence-bound action selection - associative search

**UNITII MARKOV DECISION PROCESS AND MODEL-BASED PREDICTION AND CONTROL 9**

Finite Markov Decision Process - The Agent–Environment Interface - Goals and Rewards - Returns and Episodes - Unified Notation for Episodic and Continuing Tasks - Policies and Value Functions - Optimal Policies and Optimal Value Functions - Optimality and Approximation - Dynamic Programming - Policy Evaluation (Prediction) - Policy Improvement - Policy Iteration - Value Iteration - Generalized Policy Iteration - Efficiency of Dynamic Programming - Asynchronous Dynamic Programming

**UNITIII MODEL-FREE PREDICTION AND CONTROL 9**

Model-free learning - Model-free prediction - Monte Carlo methods - Monte Carlo Prediction - Monte Carlo Estimation of Action Values - Temporal-Difference Learning - TD Prediction - Advantages of TD Prediction Methods - Optimality of TD(0) - n-step Bootstrapping - n-step TD Prediction - n-step Sarsa - Model-free control - Monte Carlo Control - Monte Carlo Control without Exploring Starts - Off policy learning - Importance sampling - Off-policy Monte Carlo Control - Sarsa: On-policy TD Control - Q-learning: Off-policy TD control

**UNITIV PLANNING AND LEARNING WITH TABULAR METHODS 9**

Models and planning - Dyna: Integrated Planning, Acting and Learning - When the model is wrong - Prioritized Sweeping - Real-time Dynamic Programming - Monte Carlo Tree Search

**UNITV VALUE FUNCTION APPROXIMATION 9**

On-policy Prediction with Approximation - Value Function Approximation - The Prediction Objective (VE) - Stochastic-gradient and Semi-gradient Methods - Linear Methods - Least-Squares TD.

**TOTAL:45PERIODS**

**TEXTBOOKS:**

1. Richard S. Sutton and Andrew G. Barto, Reinforcement Learning: An introduction, 2<sup>nd</sup> edition, The MIT Press, 2015.
2. Martijn van Otterlo, Marco Wiering, Reinforcement Learning: State-of-the-Art, Springer Verlag Berlin Heidelberg, 2012.
3. Artificial Intelligence: A Modern Approach, Stuart J. Russell and Peter Norvig, 3rd edition, Pearson, 2015.

**REFERENCES:**

1. Good fellow, Y. Bengio, A. Courville, Deep Learning, MIT Press Ltd., 2016.
2. Reinforcement Learning with MATLAB, Math Works Inc., 2020.

<b>20CSV12</b>	<b>SOCIAL NETWORK ANALYSIS</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

**OBJECTIVES:**

- To understand the concept of semantic web and related applications.
- To learn knowledge representation using ontology.
- To understand human behaviour in social web and related communities.
- To learn visualization of social networks.

**PRE-REQUISITE:**

Course Code :20CS501

Course Name :Computer Networks

**UNIT - I INTRODUCTION 9**

Introduction to Semantic Web: Limitations of current Web - Development of Semantic Web - Emergence of the Social Web - Social Network analysis: Development of Social Network Analysis - Key concepts and measures in network analysis - Electronic sources for network analysis: Electronic discussion networks, Blogs and online communities - Web-based networks - Applications of Social Network Analysis.

**UNIT - II MODELLING, AGGREGATING AND KNOWLEDGE REPRESENTATION 9**

Ontology and their role in the Semantic Web: Ontology-based knowledge Representation - Ontology languages for the Semantic Web: Resource Description Framework - Web Ontology Language - Modelling and aggregating social network data: State-of-the-art in network data representation - Ontological representation of social individuals - Ontological representation of social relationships - Aggregating and reasoning with social network data - Advanced representations.

**UNIT - III EXTRACTION AND MINING COMMUNITIES IN WEB SOCIAL NETWORKS 9**

Extracting evolution of Web Community from a Series of Web Archive - Detecting communities in social networks - Definition of community - Evaluating communities - Methods for community detection and mining - Applications of community mining algorithms - Tools for detecting communities social network infrastructures and communities - Decentralized online social networks - Multi-Relational characterization of dynamic social network communities.

**UNIT - IV PREDICTING HUMAN BEHAVIOUR AND PRIVACY ISSUES 9**

Understanding and predicting human behaviour for social communities - User data management - Inference and Distribution - Enabling new human experiences - Reality mining - Context - Awareness - Privacy in online social networks - Trust in online environment - Trust models based on subjective logic - Trust network analysis - Trust transitivity analysis - Combining trust and reputation - Trust derivation based on trust comparisons - Attack spectrum and countermeasures.

**UNIT - V VISUALIZATION AND APPLICATIONS OF SOCIAL NETWORKS 9**

Graph theory - Centrality - Clustering - Node-Edge Diagrams - Matrix representation - Visualizing online social networks, Visualizing social networks with matrix-based representations - Matrix and Node-Link Diagrams - Hybrid representations - Applications - Cover networks - Community welfare - Collaboration networks - Co-Citation networks.

**TOTAL: 45 PERIODS**

**TEXT BOOKS:**

1. Peter Mika, Social Networks and the Semantic Web, First Edition, Springer 2007.
2. Borko Furht, Handbook of Social Network Technologies and Applications, 1st Edition, Springer, 2010.

**REFERENCES:**

1. Guandong Xu, Yanchun Zhang and Lin Li, Web Mining and Social Networking – Techniques and applications, First Edition, Springer, 2011.
2. Dion Goh and Schubert Foo, Social information Retrieval Systems: Emerging Technologies and Applications for Searching the Web Effectively, IGI Global Snippet, 2008.
3. Max Chevalier, Christine Julien and Chantal Soulé-Dupuy, Collaborative and Social Information Retrieval and Access: Techniques for Improved user Modelling, IGI Global Snippet, 2009.
4. John G. Breslin, Alexander Passant and Stefan Decker, The Social Semantic Web, Springer, 2009.

**OUTCOMES:**

**AT THE END OF THE COURSE, LEARNERS WILL BE ABLE TO:**

Course Name : SOCIAL NETWORK ANALYSIS										Course Code :20CSV12				
CO	Course Outcomes									Unit	K-CO	POs	PSOs	
CO1	Explain the semantic web concepts and applications of social network analysis.									I	K2	1, 2, 8,9	2	
CO2	Discuss about modeling and knowledge representation using ontology of social network.									II	K2	1, 2, 8,9	2	
CO3	Illustrate the extraction and mining communities in web social networks.									III	K2	1, 2, 8,9	2	
CO4	Illustrate the various methods for predicting human behaviour in social communities.									IV	K2	1, 2, 8,9	2	
CO5	Describe the privacy issues in trust network analysis.									IV	K2	1, 2, 8,9	2	
CO6	Make use of visualization techniques for social network applications									V	K3	1, 2, 3, 8,9	2	
CO-PO Mapping														
CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1	-	-	-	-	-	1	1	-	-	-	2	2
CO2	2	1	-	-	-	-	-	1	1	-	-	-	2	2
CO3	2	1	-	-	-	-	-	1	1	1	-	-	2	2
CO4	2	1	-	-	-	-	-	1	1	-	-	-	2	2
CO5	2	1	-	-	-	-	-	1	1	-	-	-	2	2
CO6	3	2	1	-	-	-	-	1	1	1	-	-	2	2
C	2	1	1	-	-	-	-	1	1	1	-	-	2	2

<b>20ITV22</b>	<b>CYBER PHYSICAL SYSTEMS</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

**OBJECTIVES:**

- To understand the nature of continuous and discrete systems
- To develop synchronous and asynchronous model of processes
- To specify both safety and liveness requirements in temporal logic
- To debug the correctness of the protocol using model checking
- To develop and analyze model of timed and hybrid systems
- To understand zero behaviors and its hybrid automata

**PRE-REQUISITE:** NIL

**UNIT I INTRODUCTION** 9

Introduction-key features of cyber physical systems- Continuous dynamics: Newtonian mechanics- actor models-properties of systems-feedback control-Discrete dynamics: Discrete systems- Finite state machines

**UNIT II SYNCHRONOUS AND ASYNCHRONOUS MODEL** 9

Synchronous model: Reactive components-properties of components-composing components- synchronous design, Asynchronous model- asynchronous processes-asynchronous design primitives- coordination protocols.

**UNIT III SAFETY AND LIVENESS REQUIREMENT** 9

Safety specifications- verifying invariants- Enumerative search- Temporal logic- Model checking- reachability analysis- proving liveness

**UNIT IV TIMED MODEL AND REAL-TIME SCHEDULING** 9

Timed processes- Timing based protocols: Timing-Based Distributed Coordination-Audio Control Protocol- Timed automata: Model of Timed Automata-Region Equivalence-Matrix-Based Representation for Symbolic Analysis, Real-time scheduling.

**UNIT V HYBRID SYSTEMS** 9

Classes of Hybrid Systems-Hybrid dynamic models: Hybrid Processes-Process Composition-Zeno Behaviors-Stability- designing hybrid systems- linear hybrid automata

**TOTAL: 45 PERIODS**

**TEXT BOOKS**

1. Rajeev Alur, Principles of cyber-physical systems, The MIT press, 2015
2. E. A. Lee and S. A. Seshia, Introduction to Embedded Systems - A Cyber-Physical Systems Approach, Lulu.com, Second Edition, 2015.

**REFERENCE:**

- 1.Sang C.Suh , U.JohnTanik and John N.Carbone , Applied Cyber-Physical systems, Springer,2014

**OUTCOMES:**

**AT THE END OF THE COURSE, LEARNERS WILL BE ABLE TO:**

Course Name : CYBER PHYSICAL SYSTEMS										Course Code : 20ITV22				
CO	Course Outcomes									Unit	K-CO	POs	PSOs	
CO1	Ability to understand knowledge, opportunities, challenges and Logical Foundations of Cyber Physical Systems.									I	K2	1, 2, 8, 9	1,2	
CO2	Ability to develop model for synchronous, asynchronous, continuous and discrete systems.									II	K2	1, 2, 8,9,10	1,2	
CO3	Ability to identify safety specifications and critical properties of Cyber Physical Systems.									III	K2	1, 2, 5, 8, 9	1,2	
CO4	Ability to design and analyze the stability of hybrid systems.									IV	K2	1, 2, 5, 8, 9,10	1,2	
CO5	Ability to apply automata for timed systems.									V	K2	1, 2, 5, 8, 9	1.2	
CO6	Ability to understand Zeno Behaviors									V	K2	1, 2, 5, 8, 9	1,2	
CO-PO Mapping														
CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO1 2	PSO1	PSO 2
CO1	2	1			-	-	-	1	1		-	-	1	1
CO2	2	1			-	-	-	1	1	1	-	-	1	1
CO3	2	1			1	-	-	1	1	-	-	1	1	1
CO4	2	1			1	-	-	1	1	1	-	1	1	1
CO5	2	1			1	-	-	1	1	-	-	1	1	1
CO6	2	1			1			1	1				1	1
C	2	1			1			1	1		1		1	1

<b>20SCV32</b>	<b>DIGITAL AND MOBILE FORENSICS</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>2</b>	<b>0</b>	<b>2</b>	<b>3</b>

**OBJECTIVES:**

- To understand basic digital forensics and techniques.
- To understand digital crime and investigation.
- To understand how to be prepared for digital forensic readiness.
- To understand and use forensics tools for iOS devices.
- To understand and use forensics tools for Android devices.

**PRE-REQUISITE:** NIL

**UNIT - I INTRODUCTION TO DIGITAL FORENSICS 6**

Forensic Science – Digital Forensics – Digital Evidence – The Digital Forensics Process – Introduction – The Identification Phase – The Collection Phase – The Examination Phase – The Analysis Phase – The Presentation Phase.

**Lab Component: 6**

1. Installation of Sleuth Kit on Linux. List all data blocks. Analyze allocated as well as unallocated blocks of a disk image.

**UNIT - II DIGITAL CRIME AND INVESTIGATION 6**

Digital Crime – Substantive Criminal Law – General Conditions – Offenses – Investigation Methods for Collecting Digital Evidence – International Cooperation to Collect Digital Evidence.

**Lab Component: 6**

1. Data extraction from call logs using Sleuth Kit.

**UNIT - III DIGITAL FORENSIC READINESS 6**

Introduction – Law Enforcement versus Enterprise Digital Forensic Readiness – Rationale for Digital Forensic Readiness – Frameworks, Standards and Methodologies – Enterprise Digital Forensic Readiness – Challenges in Digital Forensics.

**Lab Component: 6**

1. Data extraction from SMS and contacts using Sleuth Kit.

**UNIT - IV iOS FORENSICS 6**

Mobile Hardware and Operating Systems - iOS Fundamentals – Jailbreaking – File System – Hardware – iPhone Security – iOS Forensics – Procedures and Processes – Tools – Oxygen Forensics – MobilEdit – iCloud.

**Lab Component: 6**

1. Install Mobile Verification Toolkit or MVT and decrypt encrypted iOS backups.
2. Process and parse records from the iOS system.

**UNIT-V ANDROID FORENSICS 6**

Android basics – Key Codes – ADB – Rooting Android – Boot Process – File Systems – Security – Tools – Android Forensics – Forensic Procedures – ADB – Android Only Tools – Dual Use Tools – Oxygen Forensics – MobilEdit – Android App Decompiling.

**Lab Component: 6**

1. Extract installed applications from Android devices.
2. Extract diagnostic information from Android devices through the adb protocol.
3. Generate a unified chronological timeline of extracted records.

**TOTAL: 60 PERIODS**

**TEXT BOOKS:**

1. Andre Arnes, "Digital Forensics", Wiley, 2018.
2. Chuck Easttom, "An In-depth Guide to Mobile Device Forensics", First Edition, CRC Press, 2022.

**REFERENCE:**

1. Vacca, J, Computer Forensics, Computer Crime Scene Investigation, 2nd Ed, Charles River Media, 2005, ISBN: 1-58450-389.

**OUTCOMES:**

**AT THE END OF THE COURSE, LEARNERS WILL BE ABLE TO:**

Course Name : <b>DIGITAL AND MOBILE FORENSICS</b>		Course Code : <b>20SCV32</b>												
CO	Course Outcomes	Unit	K-CO	POs	PSOs									
CO1	Explain various digital forensics process	I	K2	1,2	1,2									
CO2	Discuss various digital crime and investigation methods.	II	K2	1,2,8,9	1,2									
CO3	Illustrate the digital forensic readiness and challenges in digital forensic	III	K2	1,2,8,9	1,2									
CO4	Identify and extract digital evidence from iOS devices.	IV	K2	1,2,8,9	1,2									
CO5	Discuss the basics of Android forensics	V	K2	1,2,8,9	1,2									
CO6	Apply needed tools in Android devices	V	K3	1,2,3,5,8,9,10	1,2									
<b>CO-PO Mapping</b>														
CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1	-	-	-	-	-	-	-	-	-	-	1	2
CO2	2	1	-	-	-	-	-	1	1	-	-	-	1	2
CO3	2	1	-	-	-	-	-	1	1	-	-	-	1	2
CO4	2	1	-	-	-	-	-	1	1	-	-	-	1	2
CO5	2	1	-	-	-	-	-	1	1	-	-	-	1	2
CO6	3	2	1	-	1	-	-	1	1	1	-	-	1	2
	2	1	1	-	1	-	-	1	1	1	-	-	1	2

<b>20ITV42</b>	<b>CRYPTOCURRENCY AND BLOCKCHAIN TECHNOLOGIES</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

**Objectives:**

- To understand the basics of Blockchain
- To learn Different protocols and consensus algorithms in Blockchain
- To learn the Blockchain implementation frameworks
- To understand the Blockchain Applications
- To experiment the Hyperledger Fabric, Ethereum networks

**PRE-REQUISITE:NIL**

**UNITI INTRODUCTION TO BLOCKCHAIN 9**

Blockchain- Public Ledgers, Blockchain as Public Ledgers - Block in a Blockchain, Transactions- The Chain and the Longest Chain - Permissioned Model of Blockchain, Cryptographic -Hash Function, Properties of a hash function-Hash pointer and Merkle

**UNITII BITCOIN AND CRYPTOCURRENCY 9**

A basic crypto currency, Creation of coins, Payments and double spending, FORTH – the precursor for Bitcoin scripting, Bitcoin Scripts , Bitcoin P2P Network, Transaction in Bitcoin Network, Block Mining, Block propagation and block relay

**UNITIII BITCOIN CONSENSUS 9**

Bitcoin Consensus, Proof of Work (PoW)- Hashcash PoW , Bitcoin PoW, Attacks on PoW,monopoly problem- Proof of Stake- Proof of Burn - Proof of Elapsed Time - Bitcoin Miner, Mining Difficulty, Mining Pool-Permissioned model and use cases

**UNITIV HYPERLEDGER FABRIC & ETHEREUM 9**

Architecture of Hyperledger fabric v1.1- chain code- Ethereum: Ethereum network, EVM, Transaction fee, Mist Browser, Ether, Gas, Solidity

**UNITV BLOCKCHAIN APPLICATIONS 9**

Smart contracts, Truffle Design and issue- DApps- NFT. Blockchain Applications in Supply Chain Management, Logistics, Smart Cities, Finance and Banking, Insurance,etc- Case Study.

**TOTAL:45PERIODS**

**TEXTBOOKS:**

1. Bashir and Imran, Mastering Blockchain: Deeper insights into decentralization, cryptography, Bitcoin, and popular Blockchain frameworks, 2017.
2. Andreas Antonopoulos, “Mastering Bitcoin: Unlocking Digital Cryptocurrencies”, O’Reilly, 2014.

**REFERENCES:**

1. Daniel Drescher, “Blockchain Basics”, First Edition, Apress, 2017
2. Arvind Narayanan, Joseph Bonneau, Edward Felten, Andrew Miller, and Steven Goldfeder. Bitcoin and cryptocurrency technologies: a comprehensive introduction.
3. Melanie Swan, “Blockchain: Blueprint for a New Economy”, O’Reilly,
4. Ritesh Modi, “Solidity Programming Essentials: A Beginner’s Guide to Build Smart Contracts for Ethereum and Blockchain”. Packt Publishing
5. Handbook of Research on Blockchain Technology, published by Elsevier Inc. ISBN: 9780128198162, 2020.

<b>20SCV52</b>	<b>WEBAPPLICATIONSECURITY</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

**OBJECTIVES:**

- To understand the fundamentals of web application security
- To focus on wide aspects of secure development and deployment of web applications
- To learn how to build secure APIs
- To learn the basics of vulnerability assessment and penetration testing
- To get an insight about Hacking techniques and Tools

**PRE-REQUISITE: NIL**

**UNIT - I      FUNDAMENTALS OF WEB APPLICATION SECURITY      9**

The history of Software Security-Recognizing Web Application Security Threats, Web Application Security, Authentication and Authorization, Secure Socket layer, Transport layer Security, Session Management-Input Validation

**UNIT - II      SECURE DEVELOPMENT AND DEPLOYMENT      9**

Web Applications Security - Security Testing, Security Incident Response Planning, The Microsoft Security Development Lifecycle (SDL), OWASP Comprehensive Lightweight Application Security Process (CLASP), The Software Assurance Maturity Model (SAMM)

**UNIT - III      SECURE API DEVELOPMENT      9**

API Security- Session Cookies, Token Based Authentication, Securing Natter APIs: Addressing threats with Security Controls, Rate Limiting for Availability, Encryption, Audit logging, Securing service-to-service APIs: API Keys , OAuth2, Securing Microservice APIs: Service Mesh, Locking Down Network Connections, Securing Incoming Requests.

**UNIT - IV      VULNERABILITY ASSESSMENT AND PENETRATION TESTING      9**

Vulnerability Assessment Lifecycle, Vulnerability Assessment Tools: Cloud-based vulnerability scanners, Host-based vulnerability scanners, Network-based vulnerability scanners, Database-based vulnerability scanners, Types of Penetration Tests: External Testing, Web Application Testing, Internal Penetration Testing, SSID or Wireless Testing, Mobile Application Testing.

**UNIT - V      HACKING TECHNIQUES AND TOOLS      9**

Social Engineering, Injection, Cross-Site Scripting (XSS), Broken Authentication and Session Management, Cross-Site Request Forgery, Security Misconfiguration, Insecure Cryptographic Storage, Failure to Restrict URL Access, Tools: Comodo, OpenVAS, Nexpose, Nikto, Burp Suite, etc.

**TOTAL: 45 PERIODS**

**TEXT BOOKS:**

1. Andrew Hoffman, Web Application Security: Exploitation and Countermeasures for Modern Web Applications, First Edition, 2020, O'Reilly Media, Inc.
2. Bryan Sullivan, Vincent Liu, Web Application Security: A Beginner's Guide, 2012, The McGraw-Hill Companies.
3. Neil Madden, API Security in Action, 2020, Manning Publications Co., NY, USA.

**REFERENCES:**

1. Michael Cross, Developer's Guide to Web Application Security, 2007, Syngress Publishing, Inc.
2. RaviDasandGregJohnson, TestingandSecuringWebApplications, 2021, Taylor&FrancisGroup, LLC.
3. PrabathSiriwardena, AdvancedAPISecurity, 2020, ApressMediaLLC, USA.
4. Malcom McDonald, WebSecurityfor Developers, 2020, NoStarchPress, Inc.
5. AllenHarper, ShonHarris, JonathanNess, ChrisEagle, GideonLenkey, andTerronWilliams Grey Hat Hacking: The Ethical Hacker's Handbook, Third Edition, 2011, TheMcGraw-HillCompanies.



**REFERENCES:**

1. Robert C. Seacord, "Secure Coding in C and C++ (SEI Series in Software Engineering)", Addison-Wesley Professional, 2005.
2. Jon Erickson, "Hacking: The Art of Exploitation", 2nd Edition, No Starch Press, 2008.
3. Mike Shema, "Hacking Web Apps: Detecting and Preventing Web Application Security Problems", First edition, Syngress Publishing, 2012
4. Bryan Sullivan and Vincent Liu, "Web Application Security, A Beginner's Guide", Kindle Edition, McGraw Hill, 2012
5. Lee Allen, "Advanced Penetration Testing for Highly-Secured Environments: The Ultimate Security Guide (Open Source: Community Experience Distilled)", Kindle Edition, Packt Publishing, 2012
6. Jason Grembi, "Developing Secure Software"

**OUTCOMES:**

**AT THE END OF THE COURSE, LEARNERS WILL BE ABLE TO:**

Course Name : ENGINEERING SECURE SOFTWARE SYSTEMS		Course Code :20CSV62												
CO	Course Outcomes	Unit	K-CO	POs	PS Os									
C304.1	Identify various vulnerabilities related to memory attacks and low level attacks.	I	2	1,2,8,9,10	1									
C304.2	Apply security principles in software development and secure design.	II	3	1,2,3,8,9,10,11	1									
C304.3	Discuss the risk factors in software systems and risk assessment techniques.	III	2	1,2,8,9,10,11	1									
C304.4	Apply various testing techniques related to software security in the testing phase of software development	IV	3	1,2,3,8,9,10,11	1									
C304.5	Discuss the web application security , bypassing Firewalls and tools for penetration testing.	IV	2	1,2,8,9,10	1									
C304.6	Illustrate secure project management and its framework.	V	3	1,2,3,8,9,10,11	1									
CO-PO Mapping														
CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
C304.1	2	1		-	-	-	-	3	1	1	-	-	2	-
C304.2	3	2	1	-	-	-	-	3	1	1	2	-	2	-
C304.3	2	1		-	-	-	-	3	1	1	2	-	2	-
C304.4	3	2	1	-	-	-	-	3	1	1	2	-	2	-
C304.5	2	1		-	-	-	-	3	1	1	-	-	2	-
C304.6	3	2	1	-	-	-	-	3	1	1	2	-	2	-

<b>20SCV82</b>	<b>MALWARE ANALYSIS</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>2</b>	<b>0</b>	<b>2</b>	<b>3</b>

**OBJECTIVES:**

- To introduce the fundamentals of malware, types and its effects
- To enable to identify and analyse various malware types by static analysis
- To enable to identify and analyse various malware types by dynamic analysis
- To deal with detection, analysis, understanding, controlling, and eradication of malware

**PRE-REQUISITE:NIL**

**UNIT - I INTRODUCTION AND BASIC ANALYSIS 6**

Goals of Malware Analysis, AV Scanning, Hashing, Finding Strings, Packing and Obfuscation, PE file format, Static, Linked Libraries and Functions, Static Analysis tools, Virtual Machines and their usage in malware analysis, Sandboxing, Basic dynamic analysis, Malware execution, Process Monitoring, Viewing processes, Registry snapshots.

**Lab Component: 6**

1. Experimentation on Initial Infection Vectors and Malware Discovery
2. Implementation on Sandboxing Malware and Gathering Information From Runtime Analysis

**UNIT - II ADVANCED STATIC ANALYSIS 6**

The Stack, Conditionals, Branching, Rep Instructions, Disassembly, Global and local variables, Arithmetic operations, Loops, Function Call Conventions, C Main Method and Offsets. Portable Executable File Format, The PE File Headers and Sections, IDA Pro, Function analysis, Graphing, The Structure of a Virtual Machine, Analyzing Windows programs, Anti-static analysis techniques, obfuscation, packing, metamorphism, polymorphism.

**Lab Component: 6**

1. Implementation on Portable Executable (PE32) File Format
2. Implementation on Executable Metadata and Executable Packers

**UNIT - III ADVANCED DYNAMIC ANALYSIS 6**

Live malware analysis, dead malware analysis, analyzing traces of malware, system calls, api calls, registries, network activities. Anti-dynamic analysis techniques, VM detection techniques, Evasion techniques, , Malware Sandbox, Monitoring with Process Monitor, Packet Sniffing with Wireshark, Kernel vs. User-Mode Debugging, OllyDbg, Breakpoints, Tracing, Exception Handling, Patching

**Lab Component: 6**

1. Experimentation on Malware Self - Defense, Compression, and Obfuscation Techniques
2. Experimentation on Malware behaviour analysis

**UNIT - IV MALWARE FUNCTIONALITY 6**

Down loaders and Launchers, Backdoors, Credential Stealers, Persistence Mechanisms, Handles, Mutexes, Privilege Escalation, Covert malware launching- Launchers, Process Injection, Process Replacement, Hook Injection, Detours, APC injection.

**Lab Component: 6**

1. Experimentation on analyzing Malicious Microsoft Office and Adobe PDF Documents
2. Experimentation on Mobile malware analysis
3. Experimentation on Packing and Unpacking of malware

**UNIT - V ANDROID MALWARE ANALYSIS**

6

Android Malware Analysis: Android architecture, App development cycle, APKTool, APKInspector, Dex2Jar, JD-GUI, Static and Dynamic Analysis, Case studies.

**Lab Component:**

6

1. Experimentation on Rootkit AntiForensics and Covert Channels
2. Experimentation on Modern Rootkit Analysis
3. Experimentation on Malware traffic analysis

**TOTAL: 60 PERIODS**

**TEXT BOOKS:**

1. Michael Sikorski and Andrew Honig, "Practical Malware Analysis" by No Starch Press, 2012, ISBN: 9781593272906
2. Bill Blunden, "The Rootkit Arsenal: Escape and Evasion in the Dark Corners of the System", Second Edition, Jones & Bartlett Publishers, 2009.

**REFERENCES:**

1. Jamie Butler and Greg Hoglund, "Rootkits: Subverting the Windows Kernel" by 2005, Addison-Wesley Professional.
2. Bruce Dang, Alexandre Gazet, Elias Bachaalany, Sébastien Josse, "Practical Reverse Engineering: x86, x64, ARM, Windows Kernel, Reversing Tools, and Obfuscation", 2014.
3. Victor Marak, "Windows Malware Analysis Essentials" Packt Publishing, O'Reilly, 2015.
4. Ken Dunham, Shane Hartman, Manu Quintans, Jose Andre Morales, Tim Strazzere, "Android Malware and Analysis", CRC Press, Taylor & Francis Group, 2015.
5. Windows Malware Analysis Essentials by Victor Marak, Packt Publishing, 2015.

**OUTCOMES:**

**AT THE END OF THE COURSE, LEARNERS WILL BE ABLE TO:**

Course Name : MALWARE ANALYSIS		Course Code :20SCV82			
CO	Course Outcomes	Unit	K-CO	POs	PSOs
CO1	Discuss the various concepts of malware analysis and their technologies used.	I	K2	1,2,8,9	1,2
CO2	Apply the skills necessary to carry out independent analysis of modern malware samples using static analysis techniques	II	K3	1,2,3,5,8,9	1,2
CO3	Apply the knowledge to carry out malware analysis of using dynamic analysis techniques	III	K3	1,2,3,5,8,9	1,2
CO4	Implement experimentation on Malware behaviour analysis	III	K3	1,2,3,5,8,9,10	1,2
CO5	Explain the methods and techniques used by professional malware analysts	IV	K2	1,2,8,9	1,2
CO6	Illustrate the concept of Android malware analysis their architecture, and App development	V	K3	1,2,3,5,8,9,10	1,2

**CO-PO Mapping**

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1	-	-	-	-	-	1	1	-	-	-	1	2
CO2	3	2	1	-	2	-	-	1	1	-	-	-	1	2
CO3	3	2	1	-	2	-	-	1	1	-	-	-	1	2
CO4	3	2	1	-	2	-	-	1	1	1	-	-	1	2
CO5	2	1	-	-	-	-	-	1	1	-	-	-	1	2
CO6	3	2	1	-	2	-	-	1	1	1	-	-	1	2

<b>20ITV13</b>	<b>PRINCIPLES OF PROGRAMMING LANGUAGES</b>	<b>L</b> <b>3</b>	<b>T</b> <b>0</b>	<b>P</b> <b>0</b>	<b>C</b> <b>3</b>
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**Objectives:**

- To understand and describe syntax and semantics of programming languages
- To understand data, data types, and basic statements
- To understand call-return architecture and ways of implementing them
- To understand object-orientation, concurrency, and event and ling in programming languages
- To develop programs in non-procedural programming paradigms.

**PRE-REQUISITE:** NIL

<b>UNIT I</b>	<b>SYNTAX AND SEMANTICS</b>	<b>9</b>			
Evolution of programming languages – describing syntax – context-free grammars – attribute grammars – describing semantics – lexical analysis – parsing – recursive-descent – bottom-up					
<b>UNIT II</b>	<b>DATA, DATA TYPES, AND BASIC STATEMENTS</b>	<b>9</b>			
Names–variables–binding–type checking –scope–scope rules–life time and garbage collection – primitive data types – strings – array types – associative arrays – record types – union types – pointers and references – Arithmetic expressions – overloaded operators – type conversions – relational and boolean expressions – assignment statements – mixed mode assignments – control					
<b>UNIT III</b>	<b>SUBPROGRAMS AND IMPLEMENTATIONS</b>	<b>9</b>			
Subprograms – design issues – local referencing – parameter passing – overloaded methods – generic methods – design issues for functions – semantics of call and return – implementing simple subprograms–stack and dynamic local variables–nested subprograms–blocks–					
<b>UNIT IV</b>	<b>OBJECT ORIENTATION, CONCURRENCY, AND EVENT HANDLING</b>	<b>9</b>			
Object-orientation – design issues for OOP languages – implementation of object-oriented constructs – concurrency – semaphores – monitors – message passing – threads – statement level concurrency–exception handling–event handling.					
<b>UNIT V</b>	<b>FUNCTIONAL AND LOGIC PROGRAMMING LANGUAGES</b>	<b>9</b>			
Introduction to lambda calculus –fundamentals of functional programming languages – Programming with Scheme–Programming with ML–Introduction to logic and logic programming– Programming with Prolog–multi-paradigm languages					

**TOTAL: 45 PERIODS**

**TEXT BOOKS :**

1. Robert W. Sebesta, "Concepts of Programming Languages", Twelfth Edition (Global Edition), Pearson, 2022.
2. Scott, "Programming Language Pragmatics", Fourth Edition, Elsevier, 2018.

**REFERENCES:**

1. R.KentDybvig,“TheSchemeprogramminglanguage”,FourthEdition,PrenticeHall,2011.
2. Jeffrey D. Ullman,“ Elements of ML programming”, Second Edition, Pearson, 1997
3. W.F.Clocksinn and C.S.Mellish, “Programming in Prolog: Using the ISO Standard” Fifth Edition, Springer,2003.

**OUTCOMES:**

**AT THE END OF THE COURSE, LEARNERS WILL BE ABLE TO:**

Course Name : PRINCIPLES OF PROGRAMMING LANGUAGES		Course Code : 20ITV13												
CO	Course Outcomes	Unit	K-CO	POs	PSOs									
CO1	Explain the syntax ,semantics and parsing of programming languages	I	K2	1,2,8,9	1,2									
CO2	Use data, data types, and basic statements of programming languages	II	K3	1,2,3,8,9,10	1,2									
CO3	Identify the issues of subprograms and apply the relevant concepts to subprograms implementation	III	K3	1,2,3,8,9,10	1,2									
CO4	Demonstrate the basic concepts of object-oriented programming and concurrency using semaphores monitors	IV	K3	1,2,3,8,9,10,12	1,2									
CO5	Illustrate the mechanism of threads and exception handling	IV	K3	1,2,3,8,9,10,12	1,2									
CO6	Compare features and applications of functional and logic programming language	V	K4	1,2,3,4,8,9,10,12	1,2									
CO-PO Mapping														
CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1	-	-	-	-	-	1	1	-	-	-	2	2
CO2	3	2	1	-	-	-	-	1	1	1	-	-	2	2
CO3	3	2	1	-	-	-	-	1	1	1	-	-	2	2
CO4	3	2	1	-	-	-	-	1	1	1	-	2	2	2
CO5	3	2	1	-	-	-	-	1	1	1	-	2	2	2
CO6	3	3	2	1	-	-	-	1	1	1	-	2	2	2
C	3	2	1	1	-	-	-	1	1	1	-	2	2	2

<b>20CSV23</b>	<b>UI AND UX DESIGN</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>2</b>	<b>0</b>	<b>2</b>	<b>3</b>

**OBJECTIVES:**

- To provide a sound knowledge in UI & UX
- To understand the need for UI and UX
- To understand the various Research Methods used in Design
- To explore the various Tools used in UI & UX

**PRE-REQUISITE: NIL**

**UNIT – I FOUNDATIONS OF DESIGN 6**

UI vs. UX Design - Core Stages of Design Thinking - Divergent and Convergent Thinking - Brainstorming and Game storming - Observational Empathy.

**Lab Component: 6**

1. Designing a Responsive layout for an societal application
2. Brainstorming feature for proposed product
3. Defining the Look and Feel of the new Project

**UNIT – II FOUNDATIONS OF UI DESIGN 6**

Visual and UI Principles - UI Elements and Patterns - Interaction Behaviors and Principles – Branding - Style Guides.

**Lab Component: 6**

1. Exploring various UI Interaction Patterns
2. Developing an interface with proper UI Style Guides

**UNIT – III FOUNDATIONS OF UX DESIGN 6**

Introduction to User Experience - Why You Should Care about User Experience – Understanding User Experience - Defining the UX Design Process and its Methodology - Research in User Experience Design - Tools and Method used for Research - User Needs and its Goals - Know about Business Goal.

**LabComponent: 6**

1. Exploring various open source collaborative interface Platform
2. Hands on Design Thinking Process for a new product

**UNIT – IV WIREFRAMING, PROTOTYPING AND TESTING 6**

Sketching Principles - Sketching Red Routes - Responsive Design – Wireframing – Creating Wireflows - Building a Prototype - Building High-Fidelity Mockups - Designing Efficiently with Tools - Interaction Patterns - Conducting Usability Tests - Other Evaluative User Research Methods - Synthesizing Test Findings - Prototype Iteration.

**Lab Component: 6**

1. Developing Wireflow diagram for application using open source software.
2. Create a Sample Pattern Library for that product (Mood board, Fonts, Colors based on UI principles)

**UNIT – V RESEARCH, DESIGNING, IDEATING, & INFORMATION ARCHITECTURE 6**

Identifying and Writing Problem Statements - Identifying Appropriate Research Methods – Creating Personas - Solution Ideation - Creating User Stories - Creating Scenarios - Flow Diagrams – Flow Mapping - Information Architecture.

**LabComponent:**

**6**

1. Conduct end-to-end user research - User research, creating personas, Ideation process (User stories, Scenarios), Flow diagrams, Flow Mapping
2. Sketch, design with popular tool and build a prototype and perform usability testing and identify improvements

**TOTAL: 60 PERIODS**

**TEXT BOOKS:**

1. Joel Marsh, "UX for Beginners", O'Reilly , 2022
2. Jon Yablonski, "Laws of UX using Psychology to Design Better Product & Services" O'Reilly 2021

**REFERENCES:**

1. Jenifer Tidwell, Charles Brewer, Aynne Valencia, "Designing Interface" 3 rd Edition , O'Reilly 2020
2. Steve Schoger, Adam Wathan "Refactoring UI", 2018
3. Steve Krug, "Don't Make Me Think, Revisited: A Commonsense Approach to Web & Mobile", Third Edition, 2015.
4. <https://www.nngroup.com/articles/>
5. <https://www.interaction-design.org/literature.>

**OUTCOMES:**

**AT THE END OF THE COURSE, LEARNERS WILL BE ABLE TO:**

Course Name : UI AND UX DESIGN		Course Code : 20CSV23												
CO	Course Outcomes	Unit	K-CO	POs	PSOs									
CO1	Differentiate divergent and convergent thinking and explain brainstorming and game storming	I	K2	1,2	2									
CO2	Discuss the fundamental needs of UI design	II	K2	1,2,8,9	2									
CO3	Illustrate methods and tools to the process of UX design for research	III	K2	1,2,8,9	2									
CO4	Explain the sketching principles, responsive design and wire framing	IV	K2	1,2,8,9	2									
CO5	Discuss the design of UI and UX prototyping and testing with suitable tools	IV	K2	1,2,8,9	2									
CO6	Identifying and writing problem statements, appropriate research methods and creating scenarios	V	K2	1,2,8,9	2									
CO-PO Mapping														
CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1	-	-	-	-	-	-	-	-	-	-	-	1
CO2	2	1	-	-	-	-	-	1	1	-	-	-	-	1
CO3	2	1	-	-	-	-	-	1	1	-	-	-	-	1
CO4	2	1	-	-	-	-	-	1	1	-	-	-	-	1
CO5	2	1	-	-	-	-	-	1	1	-	-	-	-	1
CO6	2	1	-	-	-	-	-	1	1	-	-	-	-	1

<b>20CSV31</b>	<b>CLOUD SERVICE MANAGEMENT</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

**OBJECTIVES:**

- Introduce Cloud Service Management terminology, definition & concepts
- Compare and contrast cloud service management with traditional IT service management
- Identify strategies to reduce risk and eliminate issues associated with adoption of cloud services
- Illustrate the benefits and drive the adoption of cloud-based services to solve real world problems

**PRE-REQUISITE : NIL**

**UNIT - I CLOUD SERVICE MANAGEMENT FUNDAMENTALS 9**

Cloud Ecosystem, The Essential Characteristics, Basics of Information Technology Service Management and Cloud Service Management, Service Perspectives, Cloud Service Models, Cloud Service Deployment Models.

**UNIT - II CLOUD SERVICES STRATEGY 9**

Cloud Strategy Fundamentals, Cloud Strategy Management Framework, Cloud Policy, Key Driver for Adoption, Risk Management, IT Capacity and Utilization, Demand and Capacity matching, Demand Queueing, Change Management, Cloud Service Architecture.

**UNIT - III CLOUD SERVICE MANAGEMENT 9**

Cloud Service Reference Model, Cloud Service Life Cycle, Basics of Cloud Service Design, Dealing with Legacy Systems and Services, Benchmarking of Cloud Services, Cloud Service Capacity Planning, Cloud Service Deployment and Migration, Cloud Marketplace, Cloud Service Operations Management.

**UNIT - IV CLOUD SERVICE ECONOMICS 9**

Pricing models for Cloud Services, Freemium, Pay Per Reservation, Pay per User, Subscription based Charging, Procurement of Cloud-based Services, Capex vs Opex Shift, Cloud service Charging, Cloud Cost Models.

**UNIT - V CLOUD SERVICE GOVERNANCE & VALUE 9**

IT Governance Definition, Cloud Governance Definition, Cloud Governance Framework, Cloud Governance Structure, Cloud Governance Considerations, Cloud Service Model Risk Matrix, Understanding Value of Cloud Services, Measuring the value of Cloud Services, Balanced Scorecard, Total Cost of Ownership.

**TOTAL: 45 PERIODS**

**TEXT BOOKS:**

1. Cloud Service Management and Governance: Smart Service Management in Cloud Era by Enamul Haque, Enel Publications
2. Cloud Computing: Concepts, Technology & Architecture by Thomas Erl, Ricardo Puttini, Zaigham Mohammad 2013
3. Cloud Computing Design Patterns by Thomas Erl, Robert Cope, Amin Naserpour

**REFERENCES:**

1. Economics of Cloud Computing by Praveen Ayyappa, LAP Lambert Academic Publishing
2. Mastering Cloud Computing Foundations and Applications Programming Rajkumar Buyya, Christian Vechhiola, S. Thamarai Selvi.

**OUTCOMES:**

**AT THE END OF THE COURSE, LEARNERS WILL BE ABLE TO:**

<b>Course Name :CLOUD SERVICE MANAGEMENT</b>		<b>Course Code :20CSV31</b>			
<b>CO</b>	<b>Course Outcomes</b>	<b>Unit</b>	<b>K-CO</b>	<b>POs</b>	<b>PSOs</b>
<b>CO1</b>	Discuss the fundamentals of cloud service management	I	K2	1,2	2
<b>CO2</b>	Describe the cloud service strategies like cloud policy, risk management and change management etc.,	II	K2	1,2,8,9	2
<b>CO3</b>	Explain the life cycle and benchmarks of cloud services	III	K2	1,2,8,9	2
<b>CO4</b>	Illustrate deployment and migration of cloud services	III	K2	1,2,8,9	2
<b>CO5</b>	Discuss the economic based cloud services	IV	K2	1,2,8,9,10	2
<b>CO6</b>	Explain the strong theoretical foundation leading to cloud service governance & measuring the value of cloud-based services	V	K2	1,2,8,9,10	2

**CO-PO Mapping**

<b>COs</b>	<b>PO1</b>	<b>PO2</b>	<b>PO3</b>	<b>PO4</b>	<b>PO5</b>	<b>PO6</b>	<b>PO7</b>	<b>PO8</b>	<b>PO9</b>	<b>PO10</b>	<b>PO11</b>	<b>PO12</b>	<b>PSO1</b>	<b>PSO2</b>
<b>CO1</b>	2	1	-	-	-	-	-	-	-	-	-	-	-	2
<b>CO2</b>	2	1	-	-	-	-	-	1	1	-	-	-	-	2
<b>CO3</b>	2	1	-	-	-	-	-	1	1	-	-	-	-	2
<b>CO4</b>	2	1	-	-	-	-	-	1	1	-	-	-	-	2
<b>CO5</b>	2	1	-	-	-	-	-	1	1	1	-	-	-	2
<b>CO6</b>	2	1	-	-	-	-	-	1	1	1	-	-	-	2

<b>20ITV43</b>	<b>SOFTWARE TESTING AND AUTOMATION</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		3	0	0	3

**Objectives:**

- To understand the basics of software testing
- To learn how to do the testing and planning effectively
- To build test cases and execute them
- To focus on wide aspects of testing and understanding multiple facets of testing
- To get an insight about test automation and the tools used for test automation

**PRE-REQUISITE: NIL**

**UNIT I FOUNDATIONS OF SOFTWARE TESTING 9**

Black-Box Testing and White-Box Testing, Software Testing Life Cycle, V-model of Software Testing, Program Correctness and Verification, Reliability versus Safety, Failures, Errors and Faults (Defects), Software Testing Principles, Program Inspections, Stages of Testing: Unit Testing, Integration Testing, System Testing

**UNIT II TEST PLANNING 9**

The Goal of Test Planning, High Level Expectations, Intergroup Responsibilities, Test Phases, Test Strategy, Resource Requirements, Tester Assignments, Test Schedule, Test Cases, Bug Reporting, Metrics and Statistics.

**UNIT III TEST DESIGN AND EXECUTION 9**

Test Objective Identification, Test Design Factors, Requirement identification, Testable Requirements, Modeling a Test Design Process, Modeling Test Results, Boundary Value Testing, Equivalence Class Testing, Path Testing, Data Flow Testing, Test Design Preparedness Metrics, Test Case Design Effectiveness, Model-Driven Test Design, Test Procedures, Test Case Organization and Tracking, Bug Reporting, Bug Life Cycle.

**UNIT IV ADVANCED TESTING CONCEPTS 9**

Performance Testing: Load Testing, Stress Testing, Volume Testing, Fail-Over Testing, Recovery Testing, Configuration Testing, Compatibility Testing, Usability Testing, Testing the Documentation, Security testing, Testing in the Agile Environment, Testing Web and Mobile

**UNIT V TEST AUTOMATION AND TOOLS 9**

Automated Software Testing, Automate Testing of Web Applications, Selenium: Introducing Web Driver and Web Elements, Locating Web Elements, Actions on Web Elements, Different Web Drivers, Understanding Web Driver Events, Testing: Understanding Testing.xml, Adding Classes, Packages, Methods to Test, Test Reports.

**TOTAL: 45 PERIODS**

**TEXTBOOKS:**

1. Yogesh Singh, "Software Testing", Cambridge University Press, 2012

2. Unmesh Gundecha, Satya Avasarala, "Selenium WebDriver 3 Practical Guide" - Second Edition 2018

**REFERENCES:**

1. Glenford J. Myers, Corey Sandler, Tom Badgett, The Art of Software Testing, 3rd Edition, 2012, John Wiley & Sons, Inc.
2. Ron Patton, Software testing, 2nd Edition, 2006, Sams Publishing
3. Paul C. Jorgensen, Software Testing: A Craftsman’s Approach, Fourth Edition, 2014, Taylor & Francis Group.
4. Carl Cocchiario, Selenium Framework Design in Data-Driven Testing, 2018, Packt Publishing
5. Elfriede Dustin, Thom Garrett, Bernie Gaurf, Implementing Automated Software Testing, 2009, Pearson Education, Inc.
6. Satya Avasarala, Selenium WebDriver Practical Guide, 2014, Packt Publishing.
7. Varun Menon, TestNg Beginner's Guide, 2013, Packt Publishing.

**OUTCOMES:**

**AT THE END OF THE COURSE, LEARNERS WILL BE ABLE TO:**

<b>Course Name : SOFTWARE TESTING AND AUTOMATION</b>		<b>Course Code :20ITV43</b>			
<b>CO</b>	<b>Course Outcomes</b>	<b>Unit</b>	<b>K-CO</b>	<b>POs</b>	<b>PSOs</b>
<b>CO1</b>	Discuss the basic concepts of software testing and the need for software testing	I	K2	1,2,8,9	2
<b>CO2</b>	Explain test planning and different activities involved in test planning	II	K2	1,2,8,9	2
<b>CO3</b>	Identify the test objectives and apply different method of test strategies	III	K3	1,2,3,5,8,9,10	2
<b>CO4</b>	Apply advanced testing concepts like Fail-Over testing, usability testing, security testing etc.	IV	K3	1,2,3,5,8,9,10	2
<b>CO5</b>	Describe the Testing methods for web and mobile applications	IV	K2	1,2,8,9,10	2
<b>CO6</b>	Use automatic software testing tools like Selenium web driver for automating web-based application testing	V	K3	1,2,3,5,8,9,10	2

**CO-PO Mapping**

<b>CO</b>	<b>PO1</b>	<b>PO2</b>	<b>PO3</b>	<b>PO4</b>	<b>PO5</b>	<b>PO6</b>	<b>PO7</b>	<b>PO8</b>	<b>PO9</b>	<b>PO10</b>	<b>PO11</b>	<b>PO12</b>	<b>PSO1</b>	<b>PSO2</b>
<b>CO1</b>	2	1	-	-	-	-	-	2	2	-	-	-	-	2
<b>CO2</b>	2	1	-	-	-	-	-	2	2	-	-	-	-	2
<b>CO3</b>	3	2	1	-	2	-	-	2	2	1	-	-	-	2
<b>CO4</b>	3	2	1	-	2	-	-	2	2	1	-	-	-	2
<b>CO5</b>	2	1	-	-	-	-	-	2	2	1	-	-	-	2
<b>CO6</b>	3	2	1	-	2	-	-	2	2	1	-	-	-	2
<b>C</b>	3	2	1	-	2	-	-	2	2	1	-	-	-	2





1. Create Maven Build pipeline in Azure
2. Run regression tests using Maven Build pipeline in Azure

**TOTAL:60 PERIODS**

**TEXTBOOKS:**

1. Roberto Vormittag, "A Practical Guide to Git and GitHub for Windows Users: From Beginner to Expert in Easy Step-By-Step Exercises", Second Edition, Kindle Edition, 2016.
2. Jason Cannon, "Linux for Beginners: An Introduction to the Linux Operating System and Command Line", Kindle Edition, 2014

**REFERENCES:**

1. Hands-On Azure Devops: Cidc Implementation For Mobile, Hybrid, And Web Applications Using Azure Devops And Microsoft Azure: CICD Implementation for DevOps and Microsoft Azure (English Edition) Paperback – 1 January 2020 by Mitesh Soni
2. Jeff Geerling, "Ansible for DevOps: Server and configuration management
3. David Johnson, "Ansible for DevOps: Everything You Need to Know to Use Ansible for DevOps", Second Edition, 2016.
4. Mariot Tsitoara, "Ansible Beginning Git and GitHub: A Comprehensive Guide to Version Control, Project Management, and Teamwork for the New Developer", Second Edition, 2019

<b>20ITV81</b>	<b>REINFORCEMENT LEARNING TECHNIQUES</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

**Objectives:**

- To introduce the fundamentals of Reinforcement Learning
- To illustrate model-based prediction and control using dynamic programming
- To illustrate model-free prediction and control
- To introduce planning and learning with tabular methods
- To explain approximation of a value function

**PRE-REQUISITE:NIL**

**UNIT I INTRODUCTION 9**

Introduction to Reinforcement learning, examples - Elements of reinforcement learning - Limitations and Scope- An extended example - multi-armed bandits - k-armed bandit problem - action-value methods - the 10-armed testbed - incremental implementation - tracking a nonstationary problem - optimistic initial values - upper-confidence-bound action selection - associative search

**UNIT II MARKOV DECISION PROCESS AND MODEL-BASED PREDICTION AND CONTROL 9**

Finite Markov Decision Process - The Agent–Environment Interface - Goals and Rewards - Returns and Episodes - Unified Notation for Episodic and Continuing Tasks - Policies and Value Functions - Optimal Policies and Optimal Value Functions - Optimality and Approximation - Dynamic Programming - Policy Evaluation (Prediction) - Policy Improvement - Policy Iteration - Value Iteration - Generalized Policy Iteration - Efficiency of Dynamic Programming - Asynchronous Dynamic Programming

**UNIT III MODEL-FREE PREDICTION AND CONTROL 9**

Model-free learning - Model-free prediction - Monte Carlo methods - Monte Carlo Prediction - Monte Carlo Estimation of Action Values - Temporal-Difference Learning - TD Prediction - Advantages of TD Prediction Methods - Optimality of TD(0) - n-step Bootstrapping - n-step TD Prediction - n-step Sarsa - Model-free control - Monte Carlo Control - Monte Carlo Control without Exploring Starts - Off policy learning - Importance sampling - Off-policy Monte Carlo Control - Sarsa: On-policy TD Control - Q-learning: Off-policy TD control

**UNIT IV PLANNING AND LEARNING WITH TABULAR METHODS 9**

Models and planning - Dyna: Integrated Planning, Acting and Learning - When the model is wrong - Prioritized Sweeping - Real-time Dynamic Programming - Monte Carlo Tree Search

**UNIT V VALUE FUNCTION APPROXIMATION 9**

On-policy Prediction with Approximation - Value Function Approximation - The Prediction Objective (VE) - Stochastic-gradient and Semi-gradient Methods - Linear Methods - Least-Squares TD.

**TOTAL:45PERIODS**

**TEXTBOOKS:**

1. Richard S. Sutton and Andrew G. Barto, Reinforcement Learning: An introduction, 2nd edition, The MIT Press, 2015.
2. Martijn van Otterlo, Marco Wiering, Reinforcement Learning: State-of-the-Art, Springer Verlag Berlin Heidelberg, 2012.
3. Artificial Intelligence: A Modern Approach, Stuart J. Russell and Peter Norvig, 3rd edition, Pearson, 2015.

**REFERENCES:**

1. Good fellow, Y. Bengio, A. Courville, Deep Learning, MIT Press Ltd., 2016.
2. Reinforcement Learning with MATLAB, Math Works Inc., 2020.

<b>20CSV74</b>	<b>AGILE METHODOLOGIES</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

**OBJECTIVES:**

- To Provide iterative, incremental development process leads to faster delivery of more useful software.
- To provide a good understanding of software design and a set of software technologies and APIs.
- To do a detailed examination and demonstration of Agile development and testing techniques and Analyze the essence of agile development methods.
- To understand the benefits and pitfalls of working in an Agile team and Develop prototyping in the software process..
- To understand Agile development and testing.

**Pre-requisite:** NIL

**UNIT - I FUNDAMENTALS OF AGILE 9**

The Genesis of Agile – Introduction and background – Agile Manifesto and Principles – Overview of Scrum – Extreme Programming – Feature Driven development – Lean Software Development – Agile project management – Design and development practices in Agile projects - Continuous Integration – Refactoring - Pair Programming - Simple Design - AgileTools.

**UNIT - II AGILE SCRUM FRAMEWORK 9**

Introduction to Scrum – Project phases – Agile Estimation – Planning game –Product backlog – Sprint backlog - Iteration planning – User story definition –Characteristics and content of user stories – Acceptance tests and Verifying stories – Project velocity – Burndown chart – Sprint planning and retrospective – Daily scrum – Scrum roles – Product Owner - Scrum Master - Scrum Team - Scrum case study - Tools for Agile project management.

**UNIT - III AGILE REQUIREMENTS ENGINEERING AND TESTING 9**

Overview of RE Using Agile – Managing Unstable Requirements – Requirements Elicitation – Agile Requirements Abstraction Model – Requirements Management in Agile Environment – Concurrency in Agile Requirements Generation – The Agile lifecycle and its impact on testing –Test Driven Development (TDD) – acceptance tests and scenarios – Planning and managing testing cycle – Exploratory testing - Risk based testing - Regression tests - Test Automation – Tools to support the Agile tester.

**UNIT - IV AGILE SOFTWARE DESIGN AND DEVELOPMENT 9**

Agile design practices- Role of design Principles including Single Responsibility Principle- Open Closed Principle- Liskov Substitution Principle – Interface Segregation Principles- Dependency Inversion Principle in Agile Design - Need and significance of Refactoring- Refactoring Techniques- Continuous Integration - Automated build tools - Version control.

**UNIT - V QUALITY ASSURANCE AND INDUSTRYTRENDS 9**

Agile Product Development – Agile Metrics – Feature Driven Development (FDD) – Financial and Production Metrics in FDD – Agile Approach to Quality Assurance – Agile Approach in Global Software Development. Agile applicability-Agile in Distributed teams – Business benefits –Challenges in Agile – Risks and Mitigation.

**TOTAL: 45 PERIODS**

**TEXT BOOKS:**

1. Hazza and Dubinsky, Agile Software Engineering, Series: Undergraduate Topics in Computer Science, Springer, 2009
2. Ken Schawber, Mike Beedle, Agile Software Development with Scrum, Pearson, 2008.
3. Robert C.Martin, Agile Software Development, Principles, Patterns and Practices, Prentice Hall, 2002.

**REFERENCES:**

1. Lisa Crispin, Janet Gregory, "AgileTesting: A Practical Guide for Testers and AgileTeams", Addison Wesley, 2008
2. Kevin C. Desouza, Agile Information Systems: Conceptualization, Construction, and Management, Butterworth Heinemann, 2007
3. Alistair Cockburn, Agile Software Development: The Cooperative Game", Addison Wesley, 2006.
4. Mike Cohn Publisher, "User Stories Applied: For Agile Software", Addison Wesley, 2004
5. Craig Larman, Agile and Iterative Development: A Manager's Guide, Addison Wesley, 2004.

<b>20CSV84</b>	<b>VIRTUAL REALITY AND AUGMENTED REALITY</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

**OBJECTIVES:**

- To learn rapidly evolving and commercially viable field of computer science.
- To become familiar with geometric modeling and computer graphics.
- To learn various types of Hardware and Software in virtual Reality systems

**PRE-REQUISITE:NIL**

**UNIT - I INTRODUCTION TO VIRTUAL REALITY 9**

Virtual Reality and Virtual Environment: Introduction-Computer graphics-Real time computer graphics-Flight Simulation-Virtual environment requirement-benefits of virtual reality-Historical development of VR-Scientific Landmark.

**UNIT - II AUGMENTED REALITY 9**

Taxonomy-technology and features of augmented reality-difference between AR and VR-Challenges with AR-AR systems and functionality-Augmented reality method-visualization techniques for augmented reality-enhancing interactivity in AR environments-evaluating AR systems.

**UNIT - III COMPUTER GRAPHICS AND GEOMETRIC MODELING 9**

Introduction-The Virtual world space-positioning the virtual observer-The perspective projection-Human vision-Stereo perspective projection- Colour theory-Geometrical Transformations-Introduction-frames of reference-Modeling transformations-scaling the VE-Collision detection.

**UNIT - IV DEVELOPMENT TOOLS AND FRAMEWORK 9**

Human factors-Hardware-Software-The somatic senses-Sensor hardware-Head coupled displays-Acoustic hardware-Integrated VR systems-Modeling virtual world-Physical simulation.

**UNIT - V AUGMENTED AND VIRTUAL REALITY APPLICATION 9**

Virtual Reality Applications: Introduction – Engineering – Entertainment-Education- The Future: Introduction – Virtual environments – modes of interaction. Case study on Oculus Rift - Head mounted display.

**TOTAL: 45 PERIODS**

**TEXT BOOKS:**

1. Jernej Barbic-Mirabelle D’Cruz Marc Erich Latoschik, Melslater Patrick Bourdot Edition 2017.
2. Timothy Jung M.claudia tom Diek Philip A.Rauschnabel 2019

**REFERENCES:**

1. Grigore C. Burdea, Philippe Coiffet , Virtual Reality Technology, Wiley 2016
2. Alan B. Craig, Understanding Augmented Reality, Concepts and Applications, Morgan A. Kaufmann, 2013
3. Alan Craig, William Sherman and Jeffrey Will, Developing Virtual Reality Applications,
4. Foundations of Effective Design, Morgan Kaufmann, 2009.
5. John Vince, “Virtual Reality Systems “, Pearson Education Asia, 2007.

**OUTCOMES:**  
**AT THE END OF THE COURSE, LEARNERS WILL BE ABLE TO:**

Course Name : VIRTUAL REALITY AND AUGMENTED REALITY										Course Code :20CSV84				
CO	Course Outcomes									Unit	K-CO	POs	PSOs	
CO1	Explain the Virtual Reality and Environment, Virtual Reality Requirements and benefits									I	K2	1,2,8,9	1,2	
CO2	Illustrate the visualization techniques for augmented reality									II	K2	1,2,8,9, 10	1,2	
CO3	Discuss the concept of Computer Graphics And Geometric Modeling									III	K2	1,2,8,9	1,2	
CO4	Use various types of Hardware and software in virtual Reality systems									IV	K3	1,2,3,8,9, 12	1,2	
CO5	Apply Development Tools And Framework for Virtual Reality									IV	K3	1,2,3, 5,6,8,9, 12	1,2	
CO6	Analyze and Design a system or process to meet given specifications with Realistic Engineering Constraints									V	K4	1,2,3,4, 5,6,8,9, 10, 12	1,2	
<b>CO-PO Mapping</b>														
CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1	-	-	-	-	-	1	1	-	-	-	2	3
CO2	2	1	-	-	-	-	-	1	1	-	-	-	2	3
CO3	2	1	-	-	-	-	-	1	1	-	-	-	2	3
CO4	3	2	1	-	-	-	-	1	1	1	-	1	2	3
CO5	3	2	1	-	2	1	-	2	2	1	-	1	2	3
CO6	3	3	2	1	1	1	-	2	2	2	-	1	2	3
<b>C</b>	3	2	1	1	1	1	-	1	1	1	-	1	2	3

<b>20ADV14</b>	<b>DATA AND INFORMATION SECURITY</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

**COURSE OBJECTIVES:**

- To understand the basics of Information Security
- To know the legal, ethical and professional issues in Information Security
- To equip the students' knowledge on digital signature, email security and web security

**UNIT-I INTRODUCTION 9**

History, What is Information Security?, Critical Characteristics of Information, NSTISSC Security Model, Components of an Information System, Securing the Components, Balancing Security and Access, The SDLC, The Security SDLC

**UNIT- II SECURITY INVESTIGATION 9**

Need for Security, Business Needs, Threats, Attacks, Legal, Ethical and Professional Issues - An Overview of Computer Security - Access Control Matrix, Policy-Security policies, Confidentiality policies, Integrity policies and Hybrid policies

**UNIT- III DIGITAL SIGNATURE AND AUTHENTICATION 9**

Digital Signature and Authentication Schemes: Digital Signature-Digital Signature Schemes and their Variants- Digital Signature Standards-Authentication: Overview- Requirements Protocols - Applications - Kerberos -X.509 Directory Services

**UNI-IV E-MAIL AND IP SECURITY 9**

E-mail and IP Security: Electronic mail security: Email Architecture -PGP – Operational Descriptions- Key management- Trust Model- S/MIME.IP Security: Overview- Architecture - ESP, AH Protocols IPsec Modes – Security association - Key management.

**UNIT-V WEB SECURITY 9**

Web Security: Requirements- Secure Sockets Layer- Objectives-Layers -SSL secure Communication- Protocols - Transport Level Security. Secure Electronic Transaction- Entities DS Verification-SET processing.

**TOTAL:45 PERIODS**

**TEXTBOOKS**

1. Fundamentals and Applications of Renewable Energy | Indian Edition, by Mehmet Kanoglu, Yunus A. Cengel, John M. Cimbala, cGraw Hill; First edition (10 December 2020), ISBN- 10 : 9390385636
2. Renewable Energy Sources and Emerging Technologies, by Kothari, Prentice Hall India Learning Private Limited; 2nd edition (1 January 2011), ISBN-10 : 8120344707

**REFERENCES:**

1. Godfrey Boyle, "Renewable Energy, Power for a Sustainable Future", Oxford University Press, U.K., 2012.
2. Rai.G.D., "Non-Conventional Energy Sources", Khanna Publishers, New Delhi, 2014.
3. Sukhatme.S.P., "Solar Energy: Principles of Thermal Collection and Storage", Tata McGraw Hill Publishing Company Ltd., New Delhi, 2009.
4. Tiwari G.N., "Solar Energy – Fundamentals Design, Modelling and applications", Alpha Science Intl Ltd, 2015.
5. Twidell, J.W. & Weir A., "Renewable Energy Resources", EFN Spon Ltd., UK, 2015

<b>20ITV24</b>	<b>QUANTUM COMPUTING</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

**Objectives:**

- To know the background of classical computing and quantum computing.
- To learn the fundamental concepts behind quantum computation.
- To study the details of quantum mechanics and its relation to Computer Science.
- To gain knowledge about the basic hardware and mathematical models of quantum computation.
- To learn the basics of quantum information and the theory behind it.

**PRE-REQUISITE:NIL**

**UNITI QUANTUM COMPUTING BASIC CONCEPTS 9**

Complex Numbers - Linear Algebra - Matrices and Operators - Global Perspectives Postulates of Quantum Mechanics – Quantum Bits - Representations of Qubits - Superpositions

**UNITII QUANTUM GATES AND CIRCUITS 9**

Universal logic gates - Basic single qubit gates - Multiple qubit gates - Circuit development - Quantum error correction

**UNITIII QUANTUM ALGORITHMS 9**

Quantum parallelism - Deutsch’s algorithm - The Deutsch–Jozsa algorithm - Quantum Fourier transform and its applications - Quantum Search Algorithms: Grover’s Algorithm

**UNITIV QUANTUM INFORMATION THEORY 9**

Data compression - Shannon’s noiseless channel coding theorem - Schumacher’s quantum noiseless channel coding theorem - Classical information over noisy quantum channels

**UNITV QUANTUM CRYPTOGRAPHY 9**

Classical cryptography basic concepts - Private key cryptography - Shor’s Factoring Algorithm - Quantum Key Distribution - BB84 - Ekart 91

**TOTAL:45PERIODS**

**TEXTBOOKS:**

1. Parag K Lala, Mc Graw Hill Education, “Quantum Computing, A Beginners Introduction”, First edition (1 November 2020).
2. Michael A. Nielsen, Issac L. Chuang, “Quantum Computation and Quantum Information”, Tenth Edition, Cambridge University Press, 2010.
3. Chris Bernhardt, The MIT Press; Reprint edition (8 September 2020), “Quantum Computing for Everyone”.

**REFERENCES:**

1. Scott Aaronson, “Quantum Computing Since Democritus”, Cambridge University Press, 2013.
2. N. David Mermin, “Quantum Computer Science: An Introduction”, Cambridge University Press, 2007.

<b>20ITV42</b>	<b>CRYPTOCURRENCY AND BLOCKCHAIN TECHNOLOGIES</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

**Objectives:**

- To understand the basics of Blockchain
- To learn Different protocols and consensus algorithms in Blockchain
- To learn the Blockchain implementation frameworks
- To understand the Blockchain Applications
- To experiment the Hyperledger Fabric, Ethereum networks

**PRE-REQUISITE:**Nil

**UNIT I INTRODUCTION TO BLOCKCHAIN 9**

Blockchain- Public Ledgers, Blockchain as Public Ledgers - Block in a Blockchain, Transactions- The Chain and the Longest Chain - Permissioned Model of Blockchain, Cryptographic -Hash Function, Properties of a hash function-Hash pointer and Merkle tree.

**UNIT II BITCOIN AND CRYPTOCURRENCY 9**

A basic crypto currency, Creation of coins, Payments and double spending, FORTH – the precursor for Bitcoin scripting, Bitcoin Scripts , Bitcoin P2P Network, Transaction in Bitcoin Network, Block Mining, Block propagation and block relay

**UNIT III BITCOIN CONSENSUS 9**

Bitcoin Consensus, Proof of Work (PoW)- Hashcash PoW , Bitcoin PoW, Attacks on PoW ,monopoly problem- Proof of Stake- Proof of Burn - Proof of Elapsed Time - Bitcoin Miner, Mining Difficulty, Mining Pool-Permissioned model and use cases

**UNIT IV HYPERLEDGER FABRIC & ETHEREUM 9**

Architecture of Hyperledger fabric v1.1- chain code- Ethereum: Ethereum network, EVM, Transaction fee, Mist Browser, Ether, Gas, Solidity

**UNIT V BLOCKCHAIN APPLICATIONS 9**

Smart contracts, Truffle Design and issue- DApps- NFT. Blockchain Applications in Supply Chain Management, Logistics, Smart Cities, Finance and Banking, Insurance,etc- Case Study.

**TOTAL:45PERIODS**

**TEXTBOOKS:**

1. Bashir and Imran, Mastering Blockchain: Deeper insights into decentralization, cryptography, Bitcoin, and popular Blockchain frameworks, 2017.
2. Andreas Antonopoulos, “Mastering Bitcoin: Unlocking Digital Cryptocurrencies”,

**REFERENCES:**

1. Daniel Drescher, "Blockchain Basics", First Edition, Apress, 2017
2. Arvind Narayanan, Joseph Bonneau, Edward Felten, Andrew Miller, and Steven Goldfeder. Bitcoin and cryptocurrency technologies: a comprehensive introduction. Princeton University Press, 2016
3. Melanie Swan, "Blockchain: Blueprint for a New Economy", O'Reilly, 2015
4. Ritesh Modi, "Solidity Programming Essentials: A Beginner's Guide to Build Smart Contracts for Ethereum and Blockchain", Packt Publishing
5. Handbook of Research on Blockchain Technology, published by Elsevier Inc. ISBN: 9780128198162, 2020.

<b>20ITV64</b>	<b>3D PRINTING AND DESIGN</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

**Objectives:**

- To discuss on basics of 3D printing
- To explain the principles of 3D printing technique
- To explain and illustrate inkjet technology
- To explain and illustrate laser technology
- To discuss the applications of 3D printing

**PRE-REQUISITE: NIL**

**UNIT I INTRODUCTION 9**

Introduction; Design considerations – Material, Size, Resolution, Process; Modelling and viewing - 3D; Scanning; Model preparation – Digital; Slicing; Software; File formats

**UNIT II PRINCIPLE 9**

Processes – Extrusion, Wire, Granular, Lamination, Photopolymerisation; Materials - Paper, Plastics, Metals, Ceramics, Glass, Wood, Fiber, Sand, Biological Tissues, Hydrogels, Graphene; Material Selection - Processes, applications, limitations;

**UNIT III INKJET TECHNOLOGY 9**

Printer - Working Principle, Positioning System, Print head, Print bed, Frames, Motion control; Print head Considerations – Continuous Inkjet, Thermal Inkjet, Piezoelectric Drop-On-Demand; Material Formulation for jetting; Liquid based fabrication – Continuous jet, Multijet; Powder based

**UNIT IV LASER TECHNOLOGY 9**

Light Sources – Types, Characteristics; Optics – Deflection, Modulation; Material feeding and flow

– Liquid, powder; Printing machines – Types, Working Principle, Build Platform, Print bed

**UNIT V INDUSTRIAL APPLICATIONS 9**

Product Models, manufacturing – Printed electronics, Biopolymers, Packaging, Healthcare, Food, Medical, Biotechnology, Displays; Future trends;

TOTAL: 45PERIODS

**TEXTBOOKS:**

1. Christopher Barnatt, 3D Printing: The Next Industrial Revolution, CreateSpace Independent Publishing Platform, 2013.
2. Ian M. Hutchings, Graham D. Martin, Inkjet Technology for Digital Fabrication, John Wiley & Sons, 2013.

**REFERENCES:**

1. Chua, C.K., Leong K.F. and Lim C.S., Rapid prototyping: Principles and applications, second edition, World Scientific Publishers, 2010
2. Ibrahim Zeid, Mastering CAD CAM Tata McGraw-Hill Publishing Co., 2007
3. Joan Horvath, Mastering 3D Printing, APress, 2014

<b>20SCV54</b>	<b>CYBERSECURITY</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

**OBJECTIVES:**

- To understand various types of cyber-attacks and cyber-crimes
- To learn threats and risks within context of the cyber security
- To have an overview of the cyber laws & concepts of cyber forensics
- To study the defensive techniques against these attacks

**PRE-REQUISITE: NIL**

**UNIT-I INTRODUCTION 9**  
 Basic Cyber Security Concepts, layers of security, Vulnerability, threat, Harmful acts, Internet Governance – Challenges and Constraints, Computer Criminals, CIA Triad, Assets and Threat, motive of attackers, active attacks, passive attacks, Software attacks, hardware attacks, Cyber Threats- Cyber Warfare, Cyber Crime, Cyber terrorism, Cyber Espionage, etc.

**UNIT- II CYBERFORENSICS 9**  
 Historical background of Cyber forensics, Digital Forensics Science, The Need for Computer Forensics, Cyber Forensics and Digital evidence, Forensics Analysis of Email, Digital Forensics Lifecycle, Forensics Investigation, Challenges in Computer Forensics

**UNIT-III CYBERCRIME: MOBILE AND WIRELESS DEVICES 9**  
 Introduction, Proliferation of Mobile and Wireless Devices, Trends in Mobility, Credit card Frauds in Mobile and Wireless Computing Era, Security Challenges Posed by Mobile Devices, Registry Settings for Mobile Devices, Authentication service Security, Attack on Mobile/Cell Phones

**UNIT-IV PRIVACY ISSUES 9**  
 Privacy Issues: Basic Data Privacy Concepts: Fundamental Concepts, Data Privacy Attacks, Data linking and profiling, privacy policies and their specifications, privacy policy languages, privacy in different domains- medical, financial, etc

**UNIT-V CYBERCRIME 9**  
 Cybercrime: Examples and Mini-Cases Examples: Official Website of Maharashtra Government Hacked, Indian Banks Lose Millions of Rupees, Parliament Attack, Pune City Police Bust Nigerian Racket, e-mails spoofing instances. Mini-Cases: The Indian Case of online Gambling, An Indian Case of Intellectual Property Crime, Financial Frauds in Cyber Domain.

**TOTAL: 45 PERIODS**

**TEXTBOOKS:**

**KLNCE UG CSE(IoT) R2020 (AY 2023-2024 admitted)**

1. Nina Godbole and Sunit Belpure, Cyber Security Understanding Cyber Crimes, Computer Forensics and Legal Perspectives, Wiley, 2013
2. B.B.Gupta, D.P.Agrawal, Haoxiang Wang, Computer and Cyber Security: Principles, Algorithm, Applications, and Perspectives, CRC Press, 2018.

**REFERENCES:**

1. Cyber Security Essentials, James Graham, Richard Howard and Ryan Otson, CRCPress,2016
2. Chwan-Hwa(John)Wu,J.DavidIrwin,IntroductiontoComputerNetworksandCybersecurity,CRC PressT&F Group,2013.

**OUTCOMES:**

**AT THE END OF THE COURSE, LEARNERS WILL BE ABLE TO:**

Course Name : CYBER SECURITY		Course Code : 20SCV54												
CO	Course Outcomes	Unit	K-CO	POs	PS Os									
C303.1	Identify the fundamental concepts of cyber security and the layers of cyber security based on real time scenarios	I	K3	1,2,3,6,8,9,12	1									
C303.2	Illustrate the process of digital forensics, analysis and challenges in computer forensics	II	K4	1,2,3,4,6,8,9,12	1									
C303.3	Analyze the security challenges and prevention measures for the security attacks on mobile and wireless devices	III	K4	1,2,3,4,6,8,9,12	1									
C303.4	Discuss the concepts of privacy Attacks, Data linking and profiling	III	K2	1,2,6,8,9,10,12	1									
C303.5	Explain the privacy policies and their specifications in various domains	IV	K2	1,2,6,8,9,10,12	1									
C303.6	Infer the category of the cyber security attacks and analyze its security measures	V	K4	1,2,3,4,6,8,9,12	1									
CO-PO Mapping														
COs	PO 1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
C303.1	3	2	1	-	-	3	-	2	2	2	-	2	1	1
C303.2	3	3	2	1	-	3	-	2	2	2	-	2	1	1
C303.3	3	3	2	1	-	3	-	2	2	2	-	2	1	1
C303.4	2	1	-	-	-	3	-	2	2	2	-	2	1	1
C303.5	2	1	-	-	-	3	-	2	2	2	-	2	1	1
C303.6	3	3	2	1	-	3	-	2	2	2	-	2	1	1

<b>20ADV15</b>	<b>BUSINESS INTELLIGENCE SYSTEM</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

**OBJECTIVES:**

- To understand the Analytics Life Cycle.
- To comprehend the process of acquiring Business Intelligence
- To understand various types of analytics for Business Forecasting
- To model the supply chain management for analytics.
- To apply analytics for different functions of a business

**PRE-REQUISITE:** NIL

<b>UNIT I</b>	<b>INTRODUCTION TO BUSINESS ANALYTICS</b>	<b>9</b>
Analytics and Data Science – Analytics Life Cycle – Types of Analytics – Business Problem Definition – Data Collection – Data Preparation – Hypothesis Generation – Modeling – Validation and Evaluation – Interpretation –Deployment and Iteration		
<b>UNIT II</b>	<b>BUSINESS INTELLIGENCE</b>	<b>9</b>
Data Warehouses and Data Mart - Knowledge Management – Types of Decisions – Decision Making Process- Decision Support Systems –Business Intelligence – OLAP–, Analytic functions		
<b>UNIT III</b>	<b>BUSINESS FORECASTING</b>	<b>9</b>
Introduction to Business Forecasting and Predictive analytics - Logic and Data Driven Models –Data Mining and Predictive Analysis Modeling–Machine Learning for Predictive analytics.		
<b>UNIT IV</b>	<b>HR &amp; SUPPLY CHAIN ANALYTICS</b>	<b>9</b>
HumanResources–PlanningandRecruitment–TrainingandDevelopment- Supplychainnetwork - Planning Demand, Inventory and Supply – Logistics – Analytics applications in HR &Supply Chain		
<b>UNIT V</b>	<b>MARKETING&amp; SALES ANALYTICS</b>	<b>9</b>
Marketing Strategy, Marketing Mix, Customer Behavior– selling Process – Sales Planning –Analytics applications in Marketing and Sales		
<b>TOTAL:</b>		<b>45PERIODS</b>

**OUTCOMES:**

**On Completion of the course, the students should be able to:**

1. Explain the real world business problems and model with analytical solutions.
2. Identify the business processes for extracting Business Intelligence
3. Apply predictive analytics for business fore-casting
4. Apply analytics for supply chain and logistics management
5. Use analytics for marketing and sales.
6. Discuss the application layer concepts

**REFERENCES:**

1. R. EvansJames, Business Analytics, 2017
2. RNPrasad,, Fundamentals of Business Analytics, 2016
3. PhilipKotler and KevinKeller, Marketing Management, 15thedition,PHI,2016
4. VSPRAO, Human Resource Management, 3rdEdition, ExcelBooks,2010.
5. MahadevanB,“OperationsManagement-

<b>20ADV25</b>	<b>DATA COMMUNICATION AND COMPUTER NETWORKS</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

**OBJECTIVES:**

- To introduce the fundamental various types of computer networks.
- To demonstrate the TCP/IP and OSI models with merits and demerits
- To explore the various layers of OSI Model
- To introduce UDP and TCP Models.

**UNIT-I DATA COMMUNICATIONS 9**

Components–Direction of Dataflow– Networks– Components and Categories–Types of Connections – Topologies –Protocols and Standards – ISO / OSI model, Example Networks such as ATM, Frame Relay, ISDN Physical layer: Transmission modes, Multiplexing,Transmission Media, Switching, Circuit Switched Networks, Datagram Networks, Virtual Circuit Networks.

**UNIT- II DATA LINK LAYER 9**

Introduction, Framing, and Error– Detection and Correction– Parity– LRC – CRC Hamming code, Flow and Error Control, Noiseless Channels, Noisy Channels, HDLC, Point to Point Protocols. 111Medium Access sub layer: ALOHA, CSMA/CD, LAN –Ethernet IEEE802.3, IEEE802.5– IEEE802.11,Randomaccess,Controlledaccess,Channelization

**UNIT- III NETWORK LAYER 9**

Logical Addressing, Inter networking,Tunneling, Address mapping, ICMP,IGMP,Forwarding,Uni-Cast Routing Protocols, Multi cast Routing Protocols.

**UNI-IV TRANSPORT LAYER 9**

Process to Process Delivery, UDP and TCP protocols, Data Traffic, Congestion, Congestion Control, QoS, Integrated Services, Differentiated Services, QoS in Switched Networks.

**UNIT-V APPLICATION LAYER 9**

Domain namespace, DNS in internet, electronic mail, SMTP, FTP, WWW, HTTP, SNMP.

**TOTAL:45PERIODS**

**OUTCOMES:**

**On Completion of the course, the students should be able to:**

1. Familiarize the basic layers and its functions in computer networks
2. Evaluate the performance of a network
3. Concepts of the basics of how data flows from one node to another
4. Analyze and design routing algorithms
5. Design protocols for various functions in the network
6. Know about the working of various application layer protocols

**TEXTBOOKS**

1. Data Communications and Networking, BehrouzA. Forouzan, Fourth EditionTMH,2006.
2. ComputerNetworks,AndrewSTanenbaum,4th Edition.Pearson Education, PHI

## REFERENCES

1. Data communications and Computer Networks, P.C .Gupta, PHI.
2. An Engineering Approach to Computer Networks, S. Keshav, 2nd Edition, PearsonEducation.
3. Understanding communications and Networks, 3rd Edition, W.A. Shay, Cengage Learning.
4. Computer Networking: A Top-Down Approach Featuring the Internet. James F.Kurose & Keith W. Ross, 3 rd Edition, Pearson Education.
5. Data and Computer Communication, William Stallings, Sixth Edition, Pearson Education, 2000.

<b>20ADV34</b>	<b>NEURAL NETWORKS AND DEEP LEARNING</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>2</b>	<b>0</b>	<b>2</b>	<b>3</b>

**COURSE OBJECTIVES:**

- To understand the basics in deep neural networks
- To understand the basics of associative memory and unsupervised learning networks
- To apply CNN architectures of deep neural networks
- To analyze the key computations underlying deep learning, then use them to build and train deep neural networks for various tasks.
- To apply generative models for suitable applications.

**UNIT-I INTRODUCTION 6**  
 Neural Networks-Application Scope of Neural Networks-Artificial Neural Network: An Introduction- Evolution of Neural Networks-Basic Models of Artificial Neural Network- Important Terminologies of ANNs-Supervised Learning Network

**UNIT -II ASSOCIATIVE MEMORY AND UNSUPERVISED LEARNING NETWORKS 6**  
 Training Algorithms for Pattern Association-Auto associative Memory Network-Hetero associative Memory Network-Bidirectional Associative Memory (BAM)-Iterative Auto associative Memory Networks-Fixed Weight Competitive Nets (MAXNET, Hamming Network)-Kohonen Self-Organizing Feature Maps.

**UNIT -III THIRD-GENERATION NEURAL NETWORKS 6**  
 Convolutional Neural Networks-Deep Learning Neural Networks-Extreme Learning Machine Model- Convolutional Neural Networks: The Convolution Operation – Motivation – Pooling – Variants of the basic Convolution Function – Efficient Convolution Algorithms

**UNIT -IV DEEP FEED FORWARD NETWORKS 6**  
 A Probabilistic Theory of Deep Learning- Gradient Learning – Chain Rule and Backpropagation Regularization: Dataset Augmentation – Noise Robustness -Early Stopping, Bagging and Dropout.

**UNIT V RECURRENT NEURAL NETWORKS 6**  
 Recurrent Neural Networks: Introduction – Recursive Neural Networks – Bidirectional RNNs – Deep Recurrent Networks – Applications: Image Generation, Image Compression, Natural Language Processing.

**30 PERIODS**

**LAB EXPERIMENTS:**

**30 PERIODS**

1. Implement simple vector addition in TensorFlow.
2. Implement a regression model in Keras.
3. Implement a perceptron in TensorFlow/Keras Environment.
4. Implement a Feed-Forward Network in TensorFlow/Keras.
5. Implement character and Digit Recognition using ANN.
6. Implement an Image Classifier using CNN in TensorFlow/Keras.
7. Perform Sentiment Analysis using RNN
8. Recommendations system from sales data using Deep Learning

**TOTAL: 60 PERIODS**

**COURSE OUTCOMES:**

**At the end of this course, the students will be able to:**

1. Understand the basic models of ANN
2. Apply Convolution Neural Network for Image Classification.
3. Understand the basics of associative memory and unsupervised learning networks.
4. Apply CNN and its variants for suitable applications.
5. Analyze the key computations underlying deep learning and use them to build and train deep neural networks for various tasks.
6. Apply Recurrent Neural Network and its variants for text analysis

**TEXTBOOKS:**

1. Ian Goodfellow, Yoshua Bengio, Aaron Courville, "Deep Learning", MIT Press, 2016.
2. Francois Chollet, "Deep Learning with Python", Second Edition, Manning Publications, 2021.

**REFERENCES:**

1. Introduction to Neural Networks Using Matlab 6.0 - S. N. Sivanandam, S. N. Deepa Aurélien Géron, "Hands-On Machine Learning with Scikit-Learn and TensorFlow", O'Reilly, 2018.
2. Josh Patterson, Adam Gibson, "Deep Learning: A Practitioner's Approach", O'Reilly Media, 2017.
3. Charu C. Aggarwal, "Neural Networks and Deep Learning: A Textbook", Springer International Publishing, 1st Edition, 2018.
4. Learn Keras for Deep Neural Networks, Jojo Moolayil, Apress, 2018
5. Deep Learning Projects Using TensorFlow 2, Vinita Silaparasetty, Apress, 2020
6. Deep Learning with Python, FRANÇOIS CHOLLET, MANNING SHELF TER ISLAND, 2017. SRajasekaran, GAVijayalakshmi Pai, "Neural Networks, Fuzzy Logic and Genetic Algorithm, Synthesis and Applications", PHI Learning, 2017.
7. Pro Deep Learning with TensorFlow, Santanu Pattanayak, Apress, 2017
8. James A Freeman, David M S Kapura, "Neural Networks Algorithms, Applications, and Programming Techniques", Addison Wesley, 2003

<b>20ADV45</b>	<b>ROBOTIC PROCESS AUTOMATION</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

**OBJECTIVES:**

- To understand the basic concepts of Robotic Process Automation.
- To expose to the key RPA design and development strategies and methodologies.
- To learn the fundamental RPA logic and structure.
- To explore the Exception Handling, Debugging and Logging operations in RPA.
- To learn to deploy and Maintain the software bot.

**PRE-REQUISITE:** NIL

**UNIT - I INTRODUCTION TO ROBOTIC PROCESS AUTOMATION 9**

Emergence of Robotic Process Automation (RPA), Evolution of RPA, Differentiating RPA from Automation - Benefits of RPA - Application areas of RPA, Components of RPA, RPA Platforms. Robotic Process Automation Tools - Templates, User Interface, Domains in Activities, Workflow Files

**UNIT - II AUTOMATION PROCESS ACTIVITIES 9**

Sequence, Flowchart & Control Flow: Sequencing the Workflow, Activities, Flowchart, Control Flow for Decision making. Data Manipulation: Variables, Collection, Arguments, Data Table, Clipboard management, File operations Controls: Finding the control, waiting for a control, Act on a control, UiExplorer, Handling Events

**UNIT- III APP INTEGRATION, RECORDING AND SCRAPING 9**

App Integration, Recording, Scraping, Selector, Workflow Activities. Recording mouse and keyboard actions to perform operation, Scraping data from website and writing to CSV. Process Mining

**UNI - IV EXCEPTION HANDLING AND CODE MANAGEMENT 9**

Exception handling, Common exceptions, Logging- Debugging techniques, Collecting crashdumps, Error reporting. Code management and maintenance: Project organization, Nesting workflows, Reusability, Templates, Commenting techniques, State Machine.

**UNIT - V DEPLOYMENT AND MAINTENANCE 9**

Publishing using publish utility, Orchestration Server, Control bots, Orchestration Server to deploy bots, License management, Publishing and managing updates. RPA Vendors - Open Source RPA, Future of RPA

**TOTAL: 45 PERIODS**

**OUTCOMES:**

**On Completion of the course, the students should be able to:**

- CO1: Understand the robotic process automation and its applications
- CO2: Illustrate control flows and work flows for the target process
- CO3: Demonstrate recording, web scraping and process mining by automation
- CO4: Determine exception handling in automation processes
- CO5: Understand Code management and maintenance in automation
- CO6: Understand the Orchestrator for controlling of automated bots.

**TEXT BOOKS**

1. Learning Robotic Process Automation: Create Software robots and automate business processes with the leading RPA tool - UiPath by Alok Mani Tripathi, PacktPublishing, 2018.
2. Tom Taulli , “The Robotic Process Automation Handbook: A Guide to Implementing RPA Systems”, Apress publications, 2020.

**REFERENCES:**

1. Frank Casale (Author), Rebecca Dilla (Author), Heidi Jaynes (Author), Lauren Livingston(Author), Introduction to Robotic Process Automation: a Primer, Institute of Robotic Process Automation, Amazon Asia-Pacific Holdings Private Limited, 2018
2. Richard Murdoch, Robotic Process Automation: Guide To Building Software Robots,Automate Repetitive Tasks & Become An RPA Consultant, Amazon Asia-Pacific Holdings Private Limited, 2018
3. A Gerardus Blokdyk, “Robotic Process Automation Rpa A Complete Guide “ , 2020

<b>20ADV55</b>	<b>TEXT AND SPEECH ANALYSIS</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

**OBJECTIVES:**

- Understand natural language processing basics
- Apply classification algorithms to text documents
- Build question-answering and dialogue systems
- Develop a speech recognition system
- Develop a speech synthesizer

**UNIT-I NATURAL LANGUAGE BASICS 9**

Foundations of natural language processing – Language Syntax and Structure- Text Preprocessing and Wrangling – Text tokenization – Stemming – Lemmatization – Removing stop- words – Feature Engineering for Text representation – Bag of Words model- Bag of N-Grams model – TF-IDF model

**UNIT- II TEXT CLASSIFICATION 9**

Vector Semantics and Embeddings -Word Embeddings - Word2Vec model – Glove model – FastText model – Overview of Deep Learning models – RNN – Transformers – Overview of Text summarization and Topic Models

**UNIT- III QUESTION ANSWERING AND DIALOGUE SYSTEMS 9**

Information retrieval – IR-based question answering – knowledge-based question answering – language models for QA – classic QA models – chatbots – Design of dialogue systems -- evaluating dialogue systems

**UNI-IV TEXT-TO-SPEECH SYNTHESIS 9**

Overview. Text normalization. Letter-to-sound. Prosody, Evaluation. Signal processing - Concatenative and parametric approaches, WaveNet and other deep learning-based TTS systems

**UNIT-V AUTOMATIC SPEECH RECOGNITION 9**

Speech recognition: Acoustic modelling – Feature Extraction - HMM, HMM-DNN systems

**TOTAL: 45 PERIODS**

**OUTCOMES:**

**On Completion of the course, the students should be able to:**

1. Explain existing and emerging deep learning architectures for text and speech processing
2. Apply deep learning techniques for NLP tasks,
3. Understand the language modeling and machine translation
4. Explain coreference and coherence for text processing
5. Build question-answering systems, chatbots and dialogue systems
6. Apply deep learning models for building speech recognition and text-to-speech systems

**TEXTBOOKS**

1. Daniel Jurafsky and James H. Martin, "Speech and Language Processing: An Introduction to Natural Language Processing, Computational Linguistics, and Speech Recognition", Third Edition, 2022.

**REFERENCES:**

1. DipanjanSarkar, "Text Analytics with Python: A Practical Real-World approach to Gaining Actionable insights from your data", APress,2018.
2. TanveerSiddiqui, Tiwary U S, "Natural Language Processing and Information Retrieval", Oxford University Press, 2008.
3. LawrenceRabiner, Biing-Hwang Juang, B. Yegnanarayana, "Fundamentals of Speech Recognition" 1st Edition, Pearson, 2009.
4. Steven Bird, Ewan Klein, and Edward Loper, "Natural language processing with Python", O'REILLY.

<b>20ITV65</b>	<b>FUZZY LOGIC AND APPLICATIONS</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

**OBJECTIVES:**

- To impart knowledge on fuzzy logic principles
- To understand models of ANN
- To explain the concepts of fuzzy sets are introduced and their role in applications of semantic interpreters, control systems and reasoning system
- To use the fuzzy logic and neural network for application related to design

**PRE-REQUISITE:NIL**

**UNITI INTRODUCTION TO FUZZY LOGIC PRINCIPLES 9**

Basic concepts of fuzzy set theory – operations of fuzzy sets – properties of fuzzy sets – Crisp relations – Fuzzy relational equations – operations on fuzzy relations – fuzzy systems – propositional logic – Inference – Predicate Logic – Inference in predicate logic

**UNITII ADVANCED FUZZY LOGIC APPLICATIONS 9**

Fuzzy logic controllers – principles – review of control systems theory – various industrial applications of FLC adaptive fuzzy systems – fuzzy decision making – Multi objective decision making – fuzzy classification – means clustering – fuzzy pattern recognition

**UNITIII INTRODUCTION TO ARTIFICIAL NEURAL NETWORKS 9**

Fundamentals of neural networks – model of an artificial neuron – neural network architectures – Learning methods – Taxonomy of Neural network architectures – Standard back propagation algorithms – selection of various parameters – variations Applications of back propagation algorithms.

**UNITIV OTHER ANN ARCHITECTURES 9**

Associative memory – exponential BAM – Associative memory for real coded pattern pairs – Applications adaptive resonance theory – introduction – ART 1 – ART2 – Applications – neural networks based on competition – kohenen self organizing maps –learning vector quantization – counter propagation networks – industrial

**UNITV RECENT ADVANCES 9**

Fundamentals of genetic algorithms – genetic modeling – hybrid systems – integration of fuzzy logic, neural networks and genetic algorithms – non-traditional optimization techniques like ant colony optimization – Particle swarm optimization and artificial

**TOTAL:45PERIODS**

**TEXTBOOKS:**

- 1.S.Rajasekaran.G.A.Vijayalakshmi Pai “Neural Networks, fuzzy logic and genetic algorithms”, prentice hall of India private limited, 2003
2. Timothy J.Ross, “Fuzzy logic with engineering applications”, McGraw Hill, 1995
3. Zurada J.M. “Introduction to artificial neural systems”, Jaico publishing house, 1994

**REFERENCES:**

1. Klir.G, Yuan B.B. “Fuzzy sets and fuzzy logic prentice Hall of India private limited, 1997.
2. Laurance Fausett, “Fundamentals of neural networks”, Prentice hall, 1992
3. Gen, M. and R. Cheng “Genetic algorithm and engineering design”, john wiley 1997

**OUTCOMES:**

**AT THE END OF THE COURSE, LEARNERS WILL BE ABLE TO:**

Course Name: FUZZY LOGIC AND APPLICATIONS		Course Code : 20ITV65												
CO	Course Outcomes	Unit	K-CO	POs	PSOs									
CO1	Understand basic knowledge of the fuzzy sets, operations and their properties.	I	K2	1,2										
CO2	Understand the fundamental concepts of Fuzzy functions and Fuzzy logic	II	K2	1,2,8,10										
CO3	Apply the concepts of Fuzzy sets in image processing, pattern reorganization and decision making	III	K2	1,2,3	1,2									
CO4	Understand the fundamental of neural network and architecture	III	K2	1,2,8,10										
CO5	Understand the advanced neural network and architecture	IV	K2	1,2										
CO6	Apply non-traditional optimization techniques in design and manufacturing applications.	V	K3	1,2,3,8,10	1,2									
CO-PO Mapping														
CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1												
CO2	2	1						2		2				
CO3	3	2	1											1
CO4	2	1						2		2			1	
CO5	2	1												
CO6	3	2	1					2		2			1	1

<b>20ADV75</b>	<b>ETHICS AND AI</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

**OBJECTIVES:**

- Study the morality and ethics in AI
- Learn about the Ethical initiatives in the field of artificial intelligence
- Study about AI standards and Regulations
- Study about social and ethical issues of Robot Ethics
- Study about AI and Ethics- challenges and opportunities

**UNIT-I INTRODUCTION 9**

Definition of morality and ethics in AI-Impact on society-Impact on human psychology-Impact on the legal system-Impact on the environment and the planet-Impact on trust

**UNIT- II ETHICAL INITIATIVES IN AI 9**

International ethical initiatives-Ethical harms and concerns-Case study: health care robots, Autonomous Vehicles, Warfare and weaponization

**UNIT- III AI STANDARDS AND REGULATION 9**

ModelProcessforAddressingEthicalConcernsDuringSystemDesign-  
TransparencyofAutonomous Systems-Data Privacy Process- Algorithmic Bias  
Considerations -OntologicalStandardforEthicallyDrivenRoboticsandAutomationSystems

**UNI-IV ROBOETHICS: SOCIAL AND ETHICAL IMPLICATION OF ROBOTICS 9**

Robot-Roboethics- Ethics and Morality- Moral Theories-Ethics in Science and Technology -  
Ethical Issues in an ICT Society- Harmonization of Principles- Ethics and Professional  
Responsibility- Roboethics Taxonomy.

**UNIT-V AI AND ETHICS- CHALLENGES AND OPPORTUNITIES 9**

Challenges - Opportunities- ethical issues in artificial intelligence- Societal Issues  
Concerning the Application of Artificial Intelligence in Medicine- decision-making role in  
industries-National and International Strategies on AI.

**TOTAL: 45 PERIODS**

**OUTCOMES:**

**On Completion of the course, the students should be able to:**

1. Learn about morality and ethics in AI
2. Acquire the knowledge of real time application ethics, issues and its challenges.
3. Understand the ethical harms and ethical initiatives in AI
4. Learn about AI standards and Regulations like AI Agent, Safe Design of Autonomous and Semi-Autonomous Systems
5. Understand the concepts of Roboethics and Morality with professional responsibilities.
6. Learn about the societal issues in AI with National and International Strategies on AI

**TEXTBOOKS**

1. Y. Eleanor Bird, Jasmin Fox-Skelly, Nicola Jenner, Ruth Larbey, Emma Weitkamp and Alan Winfield ,”The ethics of artificial intelligence: Issues and initiatives”, EPRS | European Parliamentary Research Service Scientific Foresight Unit (STOA) PE 634.452 – March 2020
2. Patrick Lin, Keith Abney, George A Bekey,” Robot Ethics: The Ethical and Social Implications of Robotics”, The MIT Press- January 2014.

**REFERENCES:**

1. Towards a Code of Ethics for Artificial Intelligence (Artificial Intelligence: Foundations, Theory, and Algorithms) by Paula Boddington, November 2017
2. Mark Coeckelbergh,” AI Ethics”, The MIT Press Essential Knowledge series, April 2020

<b>20ADV85</b>	<b>HEALTH CARE ANALYTICS</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

**OBJECTIVES:**

- Understand the health data formats, health care policy and standards
- Learn the significance and need of data analysis and data visualization
- Understand the health data management frameworks
- Learn the use of machine learning and deep learning algorithms in healthcare
- Apply healthcare analytics for critical care applications

**UNIT-I INTRODUCTION TO HEALTHCARE ANALYSIS 9**

Overview - History of Healthcare Analysis Parameters on medical care systems- Health care policy- Standardized code sets – Data Formats – Machine Learning Foundations: Tree Like reasoning , Probabilistic reasoning and Bayes Theorem, Weighted sum approach.

**UNIT- II ANALYTICS ON MACHINE LEARNING 9**

Machine Learning Pipeline – Pre-processing –Visualization – Feature Selection – Training model parameter – Evaluation model : Sensitivity , Specificity , PPV ,NPV, FPR ,Accuracy , ROC , Precision Recall Curves , Valued target variables –Python: Variables and types, Data Structures and containers , Pandas Data Frame :Operations – Scikit –Learn : Pre-processing , Feature Selection.

**UNIT- III HEALTH CARE MANAGEMENT 9**

IOT- Smart Sensors – Migration of Healthcare Relational database to NoSQL Cloud Database – Decision Support System – Matrix block Cipher System – Semantic Framework Analysis – Histogram bin Shifting and Rc6 Encryption – Clinical Prediction Models – Visual Analytics for Healthcare

**UNI-IV HEALTHCARE AND DEEP LEARNING 9**

Introduction on Deep Learning – DFF network CNN- RNN for Sequences – Biomedical Image and Signal Analysis – Natural Language Processing and Data Mining for Clinical Data – Mobile Imaging and Analytics – Clinical Decision Support System

**UNIT-V CASE STUDIES 9**

Predicting Mortality for cardiology Practice –Smart Ambulance System using IOT –Hospital Acquired Conditions (HAC) program- Healthcare and Emerging Technologies – ECG Data Analysis

**TOTAL:45 PERIODS**

**OUTCOMES:**

**On Completion of the course, the students should be able to:**

1. Use machine learning and deep learning algorithms for health data analysis
2. Apply the data management techniques for healthcare data
3. Evaluate the need of healthcare data analysis in e-healthcare, telemedicine and other critical care applications
4. Demonstrate health data analytics for real time applications
5. Understand emergency care system using health data analysis
6. Apply health care analytics in Healthcare and Emerging Technologies

**REFERENCES:**

1. ChandanK.Reddy, Charu C. Aggarwal, "Health Care data Analysis", First edition, CRC, 2015.
2. Vikas Kumar, "Health Care Analysis Made Simple", Packt Publishing, 2018.
3. NilanjanDey, AmiraAshour , Simon James Fong, ChintanBhatl, "Health Care Data Analysis and Management, First Edition, Academic Press, 2018.
4. Hui Jang, Eva K.Lee, "HealthCare Analysis : From Data to Knowledge to Healthcare Improvement", First Edition, Wiley, 2016.
5. Kulkarni ,Siarry, Singh ,Abraham, Zhang, Zomaya , Baki, "Big Data Analytics in HealthCare", Springer, 2020.