

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



Estd: 1994

**FINAL YEAR**  
**CURRICULUM AND SYLLABUS**  
**REGULATIONS 2020**  
**For Under Graduate Program**

i

**B.E. COMPUTER SCIENCE AND ENGINEERING**  
**(CYBER SECURITY)**  
**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 develop competent professionals specialized in the field of cyber security through Quality education and research.

### **MISSION OF THE DEPARTMENT**

To produce skilled cyber security professionals by leveraging technological advancements and research initiatives in collaboration with industry and society by inculcating innovative technical education and ethical principles



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### **PROGRAM EDUCATIONAL OBJECTIVES (PEOs)**

**PEO 1 :** To Contribute effectively to the society by applying principles of Cyber security for analyzing the real world problems to produce optimal and sustainable technical solutions

**PEO 2:** To adapt an ever changing technologies by applying Engineering Principles

**PEO 3:** To build professionalism, team work, effective communication, ethical values and leadership qualities

### **PROGRAM SPECIFIC OUTCOMES (PSOs):**

**PSO1.** To develop data, resource and asset protection strategies for organizations, processes and peoples through cyber security-centric skills

**PSO2.** To apply computer knowledge continuously in the areas of networking, cryptography and web development to meet the industry requirements



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### PROGRAM OUTCOMES

#### Program Outcomes (POs)

**PO1: Engineering Knowledge:** Apply knowledge of mathematics, natural science, computing, engineering fundamentals and an engineering specialization as specified in WK1 to WK4 respectively to develop to the solution of complex engineering problems.

**PO2: Problem Analysis:** Identify, formulate, review research literature and analyze complex engineering problems reaching substantiated conclusions with consideration for sustainable development. (WK1 to WK4)

**PO3: Design/Development of Solutions:** Design creative solutions for complex engineering problems and design/develop systems/components/processes to meet identified needs with consideration for the public health and safety, whole-life cost, net zero carbon, culture, society and environment as required. (WK5)

**PO4: Conduct Investigations of Complex Problems:** Conduct investigations of complex engineering problems using research-based knowledge including design of experiments, modelling, analysis & interpretation of data to provide valid conclusions. (WK8).

**PO5: Engineering Tool Usage:** Create, select and apply appropriate techniques, resources and modern engineering & IT tools, including prediction and modelling recognizing their limitations to solve complex engineering problems. (WK2 and WK6)

**PO6: The Engineer and The World:** Analyze and evaluate societal and environmental aspects while solving complex engineering problems for its impact on sustainability with reference to economy, health, safety, legal framework, culture and environment. (WK1, WK5, and WK7)

**PO7: Ethics:** Apply ethical principles and commit to professional ethics, human values, diversity and inclusion; adhere to national & international laws. (WK9)

**PO8: Individual and Collaborative Team work:** Function effectively as an individual, and as a member or leader in diverse/multi-disciplinary teams.

**PO9: Communication:** Communicate effectively and inclusively within the engineering community and society at large, such as being able to comprehend and write effective reports and design documentation, make effective presentations considering cultural, language, and learning differences

**PO10: Project Management and Finance:** Apply knowledge and understanding of engineering management principles and economic decision-making and apply these to one's own work, as a member and leader in a team, and to manage projects and in multidisciplinary environments.

#### **PO11: Life- Long Learning:**

Recognize the need for, and have the preparation and ability for i) independent and life-long learning ii) adaptability to new and emerging technologies and iii) critical thinking in the broadest context of technological change. (WK8)



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## **REGULATIONS 2020**

**For Under Graduate Program**

**B.E. COMPUTER SCIENCE AND ENGINEERING (CYBER SECURITY)**

**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)** includes Project Work and/or Internship, Seminar, Professional Practices, Case Study and Industrial/Practical Training.
- VIII. **Mandatory (MC) Courses** 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 (CYBER SECURITY)**

**REGULATIONS - 2020**

**CURRICULUM AND SYLLABUS**

**CHOICE BASED CREDIT SYSTEM**

**SEMESTER VII**

S. No.	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
<b>THEORY</b>								
1	20SC701	Ethical Hacking	PC	3	3	0	0	3
2		Professional Elective V	PE	3	3	0	0	3
3		Professional Elective VI	PE	3	3	0	0	3
4		Open Elective II	OE	3	3	0	0	3
5		Management Elective	HS	3	3	0	0	3
<b>PRACTICAL</b>								
6	20SC7L1	Ethical Hacking Laboratory	PC	4	0	0	4	2
7	20SC7L2	Mini Project	EEC	4	0	0	4	2
<b>TOTAL</b>				<b>23</b>	<b>15</b>	<b>0</b>	<b>8</b>	<b>19</b>

**SEMESTER VIII**

S. No.	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
<b>PRACTICAL</b>								
1	20SC8L1	Project Work	EEC	20	0	0	20	10
<b>TOTAL</b>				<b>20</b>	<b>0</b>	<b>0</b>	<b>20</b>	<b>10</b>

**PROFESSIONAL ELECTIVE (PE) : VERTICALS**

<b>Vertical I</b>	<b>Vertical II</b>	<b>Vertical III</b>	<b>Vertical IV</b>	<b>Vertical V</b>
<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**

<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	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

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

<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	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 Block chain 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**

<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	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	Crypto currency and Block chain 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 and 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 II (OE II)**

S. No.	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
1	20OE106	Fundamentals of Product Design	OE	3	3	0	0	3
2.	20OE108	Industrial Safety Practices	OE	3	3	0	0	3
3.	20OE206	Fundamentals of Fibre Optics and Lasers	OE	3	3	0	0	3
4.	20OE305	Fundamentals of Image Processing	OE	3	3	0	0	3
5.	20OE306	Consumer Electronics	OE	3	3	0	0	3
6.	20OE308	Introduction to VLSI Technology	OE	3	3	0	0	3
7.	20OE507	Concepts of Ethical Hacking	OE	3	3	0	0	3
8.	20OE605	Lean Manufacturing Practices	OE	3	3	0	0	3
9.	20OE706	Industrial computer Network	OE	3	3	0	0	3
10.	20OE708	Instrumentation for Agro food industry	OE	3	3	0	0	3

**KLNCE UG CSE(CS) R 2020 (AY 2023-2024 admitted)**

**MANAGEMENT ELECTIVE**

<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	20HS5A1	Management Concepts and Organizational Behaviour	HS	3	3	0	0	3
2.	20HS5A2	Industrial Marketing	HS	3	3	0	0	3
3.	20HS6A1	Intellectual Property Rights	HS	3	3	0	0	3
4.	20HS6B1	Project Management and Entrepreneurship	HS	3	3	0	0	3
5.	20HS7A2	Total Quality Management	HS	3	3	0	0	3
6.	20HS8A1	Human Relations at Work	HS	3	3	0	0	3
7.	20HS8B2	Economics for Engineers	HS	3	3	0	0	3

**OPEN ELECTIVE II (VII SEMESTER) - 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	20OEA05	Essentials of Network Security	OE	3	0	0	0	3
2.	20OEA06	Ethical Hacking Basics	OE	3	3	0	0	3
3.	20OEA07	Fundamental of Cyber Forensics	OE	3	3	0	0	3
4.	20OEA08	Cyber Law and Policies	OE	3	3	0	0	3

<b>20SC701</b>	<b>ETHICAL HACKING</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>0</b>	<b>0</b>	<b>0</b>	<b>3</b>

**OBJECTIVES:**

- To understand the basics of computer based vulnerabilities.
- To explore different foot printing, reconnaissance and scanning methods.
- To expose the enumeration and vulnerability analysis methods.
- To understand hacking options available in Web and wireless applications.
- To explore the options for network protection.
- To practice tools to perform ethical hacking to expose the vulnerabilities.

**UNIT - I INTRODUCTION 9**

Ethical Hacking Overview - Role of Security and Penetration Testers .- Penetration-Testing Methodologies- Laws of the Land - Overview of TCP/IP- The Application Layer - The Transport Layer - The Internet Layer - IP Addressing .- Network and Computer Attacks - Malware - Protecting Against Malware Attacks.- Intruder Attacks - Addressing Physical Security

**UNIT - II FOOT PRINTING, RECONNAISSANCE AND SCANNING NETWORKS 9**

Footprinting Concepts - Footprinting through Search Engines, Web Services, Social Networking Sites, Website, Email - Competitive Intelligence - Footprinting through Social Engineering - Footprinting Tools - Network Scanning Concepts - Port-Scanning Tools - Scanning Techniques - Scanning Beyond IDS and Firewall

**UNIT - III ENUMERATION AND VULNERABILITY ANALYSIS 9**

Enumeration Concepts - NetBIOS Enumeration – SNMP, LDAP, NTP, SMTP and DNS Enumeration - Vulnerability Assessment Concepts - Desktop and Server OS Vulnerabilities - Windows OS Vulnerabilities - Tools for Identifying Vulnerabilities in Windows- Linux OS Vulnerabilities- Vulnerabilities of Embedded Oss

**UNIT - IV SYSTEM HACKING 9**

Hacking Web Servers - Web Application Components- Vulnerabilities - Tools for Web Attackers and Security Testers Hacking Wireless Networks - Components of a Wireless Network – Wardriving- Wireless Hacking - Tools of the Trade

**UNIT - V NETWORK PROTECTION SYSTEMS 9**

Access Control Lists. - Cisco Adaptive Security Appliance Firewall - Configuration and Risk Analysis Tools for Firewalls and Routers - Intrusion Detection and Prevention Systems - Network-Based and Host-Based IDSs and IPSs - Web Filtering - Security Incident Response Teams – Honeypots

**TOTAL: 45 PERIODS**

**TEXT BOOKS**

1. Michael T. Simpson, Kent Backman, and James E. Corley, Hands-On Ethical Hacking and Network Defense, Course Technology, Delmar Cengage Learning, 2010.
2. The Basics of Hacking and Penetration Testing - Patrick Engebretson, SYNGRESS, Elsevier, 2013.
3. The Web Application Hacker’s Handbook: Finding and Exploiting Security Flaws, Dafydd Stuttard and Marcus Pinto, 2011.

**REFERENCES**

1. Black Hat Python: Python Programming for Hackers and Pentesters, Justin Seitz , 2014.

**OUTCOMES:**

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

Course Name : ETHICAL HACKING										Course Code : 20SC701				
CO	Course Outcomes										Unit	K-CO	POs	PSOs
C401.1	Understand the basics of computer based vulnerabilities										1	K2	1,2,8,9,10	1
C401.2	Learn the concepts of foot printing, reconnaissance and scanning methods										2	K2	1,2,8,9,10	1
C401.3	Demonstrate the enumeration and vulnerability										3	K3	1,2,3,8,9,10	1
C401.4	Illustrate the various hacking options in Web and wireless applications.										4	K3	1,2,3,8,9,10	1
C401.5	Acquire knowledge on the options for network protection										5	K3	1,2,3,8,9,10,12	1
C401.6	Use tools to perform ethical hacking to expose the vulnerabilities										5	K3	1,2,3,5,8,9,10,12	1
CO-PO Mapping														
CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
C401.1	2	1	-	-	-	-	-	1	1	1	-	-	1	-
C401.2	2	1	-	-	-	-	-	1	1	1	-	-	1	-
C401.3	3	2	1	-	-	-	-	1	1	1	-	-	1	-
C401.4	3	2	1	-	-	-	-	1	1	1	-	-	1	-
C401.5	3	2	1	-	-	-	-	1	1	1	-	2	1	-
C401.6	3	2	1	-	2	-	-	1	1	1	-	2	1	-

<b>20SC7L1</b>	<b>ETHICAL HACKING 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 express knowledge on basics of computer based vulnerabilities To gain understanding on different foot printing, reconnaissance and scanning methods.
- To demonstrate the enumeration and vulnerability analysis methods.
- To gain knowledge on hacking options available in Web and wireless applications.
- To acquire knowledge on the options for network protection.
- To use tools to perform ethical hacking to expose the vulnerabilities

**LIST OF EXPERIMENTS:**

1. Install Kali or Backtrack Linux / Metasploitable/ Windows XP
2. Practice the basics of reconnaissance.
3. Using FOCA / Search Diggity tools, extract metadata and expanding the target list.
4. Aggregates information from public databases using online free tools like Paterva's Maltego.
5. Information gathering using tools like Robtex.
6. Scan the target using tools like Nessus.
7. View and capture network traffic using Wireshark.
8. Automate dig for vulnerabilities and match exploits using Armitage.

**TOTAL: 60 PERIODS**

**LAB EQUIPMENT FOR A BATCH OF 30 STUDENTS**

**Software Requirements:**

- Kalior Backtrack Linux, Metasploitable, Windows XP  
 FOCA : <http://www.informatica64.com/foca.aspx>  
 Nessus : <http://www.tenable.com/products/nessus>  
 Wireshark : <http://www.wireshark.org>  
 Armitage : <http://www.fastandeasyhacking.com/>

**OUTCOMES:**

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

Course Name : ETHICAL HACKING LABORATORY						Course Code : 20SC7L1								
CO	Course Outcomes					Exp.	K-CO	POs			PSOs			
C406.1	Installation of tools for Ethical Hacking					1	K3	1,2,3,5,8,9,10,12			1			
C406.2	Demonstrate the concepts of foot printing, reconnaissance and scanning methods					2	K3	1,2,3,5,8,9,10,12			1			
C406.3	Demonstrate the enumeration and vulnerability					3,4	K3	1,2,3,5,8,9,10,12			1			
C406.4	Illustrate the various hacking options in Web and wireless applications.					5	K3	1,2,3,5,8,9,10,12			1			
C406.5	Analyze the various options for network protection					6,7	K3	1,2,3,5,8,9,10,12			1			
C406.6	Use tools to implement ethical hacking to expose the vulnerabilities					8	K3	1,2,3,5,8,9,10,12			1			
CO-PO Mapping														
CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
C406.1	3	2	1	-	2	-	-	2	2	2	-	2	2	-
C406.2	3	2	1	-	2	-	-	2	2	2	-	2	2	-
C406.3	3	2	1	-	2	-	-	2	2	2	-	2	2	-
C406.4	3	2	1	-	2	-	-	2	2	2	-	2	2	-
C406.5	3	2	1	-	2	-	-	2	2	2	-	2	2	-
C406.6	3	2	1	-	2	-	-	2	2	2	-	2	2	-

**20SC7L2**

**MINI PROJECT**

<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 develop the ability to solve a specific problem right from its identification and literature review till the successful solution of the same.
- To train the students in preparing project reports and to face reviews and viva voce examination

The students in a group of 3 to 4, works on a topic approved by the head of the department under the guidance of a faculty member and prepares a comprehensive project report after completing the work to the satisfaction of the supervisor. The progress of the project is evaluated based on a minimum of three reviews. The first and second review will be evaluated by a three member internal committee. The review committee may be constituted by the Head of the Department. A project report is required at the end of the semester. The project work is evaluated based on third review's oral presentation and the submission of project report, before the internal examiners which was constituted by the Head of the Department.

**TOTAL: 60 PERIODS**

**OUTCOMES:**

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

<b>Course Name : MINI PROJECT</b>						<b>Course Code : 20SC7L2</b>								
<b>CO</b>	<b>Course Outcomes</b>					<b>Exp.</b>	<b>K-CO</b>	<b>POs</b>			<b>PSOs</b>			
<b>C407.1</b>	Identify a problem and its applicability along with suitable domain.					-	K3	1,2,3,6,7,8,9,10, 11,12			1,2			
<b>C407.2</b>	Analyze and formulate project modules and identified constraints based on environmental and societal impact.					-	K4	1,2,3,4,5,6,7,8,9,10,11,12			1,2			
<b>C407.3</b>	Select efficient tools and methods for designing and implementing project modules					-	K4	1,2,3,4,5,6,7,8,9,10,11,12			1,2			
<b>C407.4</b>	Propose an effective solution for the problem identified with the help of developed methodology and tools					-	K6	1,2,3,4,5,6,7,8,9,10,11,12			1,2			
<b>C407.5</b>	Summarize all the modules through effective integration and testing.					-	K5	1,2,3,4,5,6,7,8,9,10,11,12			1,2			
<b>C407.6</b>	Illustrate the completed task and compile the project report.					-	K4	1,2,3,4,5,6,7,8,9,10,11,12			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>C407.1</b>	3	2	1	-	-	3	3	3	3	3	2	2	3	3
<b>C407.2</b>	3	3	2	1	2	3	3	2	2	2	3	2	3	3
<b>C407.3</b>	3	3	2	1	3	2	2	2	2	2	3	2	3	3
<b>C407.4</b>	3	3	3	3	3	3	3	2	2	2	3	2	3	3
<b>C407.5</b>	3	3	3	2	3	3	3	2	2	2	3	2	3	3
<b>C407.6</b>	3	3	2	1	1	1	1	3	3	3	2	2	3	3

<b>20SC8L1</b>	<b>PROJECT WORK</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>0</b>	<b>0</b>	<b>20</b>	<b>10</b>

**OBJECTIVES:**

- To develop the ability to solve a specific problem right from its identification and literature review till the successful solution of the same.
- To train the students in preparing project reports and to face reviews and viva voce examination

The students in a group of 3 to 4 works on a topic approved by the head of the department under the guidance of a faculty member and prepares a comprehensive project report after completing the work to the satisfaction of the supervisor. The progress of the project is evaluated based on a minimum of three reviews. The review committee may be constituted by the Head of the Department. A project report is required at the end of the semester. The project work is evaluated based on oral presentation and the project report jointly by external and internal examiners constituted by the Head of the Department

**TOTAL: 300 PERIODS**

**OUTCOMES:**

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

Course Name : PROJECT WORK		Course Code : 20SC8L1			
CO	Course Outcomes	Exp.	K-CO	POs	PSOs
<b>C408.1</b>	Identify a domain and problem by applying required domain knowledge.	-	K3	1,2,3,6,7,8,9,10,11,12	1,2
<b>C408.2</b>	Analyze and categorize executable project modules including real time project constraints based on environmental and societal impact.	-	K4	1,2,3,4,5,6,7,8,9,10,11,12	1,2
<b>C408.3</b>	Examine efficient tools and methods for designing and implementing project modules.	-	K4	1,2,3,4,5,6,7,8,9,10,11,12	1,2
<b>C408.4</b>	Develop effective solution for the problem identified with the help of proposed methodology and tools	-	K6	1,2,3,4,5,6,7,8,9,10,11,12	1,2
<b>C408.5</b>	Assess all the modules through effective integration, optimization and testing.	-	K5	1,2,3,4,5,6,7,8,9,10,11,12	1,2
<b>C408.6</b>	Elaborate the completed task and compile the project report.	-	K4	1,2,3,4,5,6,7,8,9,10,11,12	1,2

**CO-PO Mapping**

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
<b>C408.1</b>	3	2	1	-	-	3	3	3	3	3	2	2	3	3
<b>C408.2</b>	3	3	2	1	2	3	3	2	2	2	3	2	3	3
<b>C408.3</b>	3	3	2	1	3	2	2	2	2	2	3	2	3	3
<b>C408.4</b>	3	3	3	3	3	3	3	2	2	2	3	2	3	3
<b>C408.5</b>	3	3	3	2	3	3	3	2	2	2	3	2	3	3
<b>C408.6</b>	3	3	2	1	1	1	1	3	3	3	2	2	3	3

<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. Data Security 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								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							1	K2	1,2,8,9			1,2	
CO2	Apply the concept of virtualization and its types							2	K3	1,2,3,5,8,9,10			1,2	
CO3	Explain the various types of virtualization infrastructure							3	K2	1,2,8,9			1,2	
CO4	Use Docker in cloud environment							3	K3	1,2,3,5,8,9,10			1,2	
CO5	Develop and deploy services on the cloud and set up a cloud environment							4	K3	1,2,3,8,9,10			1,2	
CO6	Explain security challenges in the cloud environment							5	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	-	-	-	-	-	2	2	-	-	-	2	2
CO2	3	2	1	-	2	-	-	2	2	2	-	-	2	2
CO3	2	1	-	-	-	-	-	2	2	-	-	-	2	2
CO4	3	2	1	-	2	-	-	2	2	2	-	-	2	2
CO5	3	2	1	-	-	-	-	2	2	2	-	-	2	2
CO6	2	1	-	-	-	-	-	2	2	-	-	-	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

**DATA WAREHOUSING, BUSINESS ANALYSIS AND ON-LINE** **9**

**UNIT - I ANALYTICAL PROCESSING (OLAP)**

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. 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.

<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	1	K2	1,2	1,2									
<b>CO2</b>	Describe various pre-processing and visualization techniques for data analysis	2	K2	1,2,8,9	1,2									
<b>CO3</b>	Apply frequent pattern and association rule mining techniques	3	K3	1,2,3,8,9	1,2									
<b>CO4</b>	Select and apply an appropriate classification algorithm for labeled data	4	K3	1,2,3,8,9,12	1,2									
<b>CO5</b>	Apply various clustering techniques for unlabeled data	4	K3	1,2,3,8,9,12	1,2									
<b>CO6</b>	Apply learning and clustering algorithms using data mining tools	5	K3	1,2,3,8,9,12	1,2									
<b>CO-PO Mapping</b>														
<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	-	-	-	-	-	2	2	-	-	-	2	1
<b>CO3</b>	3	2	1	-	-	-	-	2	2	-	-	-	2	1
<b>CO4</b>	3	2	1	-	-	-	-	2	2	-	-	1	2	1
<b>CO5</b>	3	2	1	-	-	-	-	2	2	-	-	1	2	1
<b>CO6</b>	3	2	1	-	-	-	-	2	2	-	-	1	2	1

<b>20CSV31</b>	<b>CLOUD SERVICES 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 Queuing, 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						1	K2	1,2			2		
<b>CO2</b>	Describe the cloud service strategies like cloud policy, risk management and change management etc.,						2	K2	1,2,8,9			2		
<b>CO3</b>	Explain the life cycle and benchmarks of cloud services						3	K2	1,2,8,9			2		
<b>CO4</b>	Illustrate deployment and migration of cloud services						3	K2	1,2,8,9			2		
<b>CO5</b>	Discuss the economic based cloud services						4	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						5	K2	1,2,8,9,10			2		
<b>CO-PO Mapping</b>														
<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>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:**

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

**PRE-REQUISITE: NIL**

**UNIT - I INTRODUCTION TO SOFTWARE DEFINED NETWORK 9**  
 SDN Origins and Evolution – Introduction – Why SDN? - Centralized and Distributed Control and Data Planes - The Genesis of SDN

**UNIT - II OPEN FLOW AND SDN CONTROLLERS 9**  
 Open Flow Specification – Drawbacks of Open SDN, SDN via APIs, SDN via Hypervisor Based Overlays – SDN via Opening up the Device – SDN Controllers – General Concepts.

**UNIT - III DATA CENTERS 9**  
 Multitenant and Virtualized Multitenant Data Center – SDN Solutions for the Data Center Network – VLANs – EVPN – VxLAN – NVGRE

**UNIT - IV SDN PROGRAMMING 9**  
 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

**UNIT - V SDN FRAMEWORK 9**  
 Juniper SDN Framework – IETF SDN Framework – Open Daylight Controller – Floodlight Controller – Bandwidth Calendaring – Data Center Orchestration

**TOTAL: 45 PERIODS**

**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.									1	K2	1, 2, 8, 9	1	
CO2	Discuss the open flow specification and different controllers of SDN.									2	K2	1, 2, 8, 9	1	
CO3	Describe various Data centers and SDN solutions for the Data Center networks.									3	K2	1, 2,8, 9	1	
CO4	Develop various applications of SDN using current languages and tools.									4	K3	1, 2, 3, 8, 9	1	
CO5	Explain the various concepts of Network function virtualization in SDN programming.									4	K2	1, 2, 8, 9	1	
CO6	Explain different framework and controller used in SDN									5	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	-

<b>20ADV51</b>	<b>STORAGE 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:**

- Characterize the functionalities of logical and physical components of storage
- Describe various storage networking technologies
- Identify different storage virtualization technologies
- Discuss the different backup and recovery strategies
- Understand common storage management activities and solutions

**PRE-REQUISITE: NIL**

**UNIT - I STORAGE SYSTEMS 9**

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

**UNIT - II INTELLIGENT STORAGE SYSTEMS AND RAID 5**

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.

**UNIT- III STORAGE NETWORKING TECHNOLOGIES AND 13**

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

**UNI - IV BACKUP, ARCHIVE AND REPLICATION 12**

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).

**UNIT - V SECURING STORAGE INFRASTRUCTURE 6**

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.

**TOTAL: 45 PERIODS**

**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 storage Management

**TEXT BOOKS**

1. EMC Corporation, Information Storage and Management, Wiley, India
2. Jon Tate, Pall Beck, Hector Hugo Ibarra, Shanmuganathan Kumaravel and Libor Miklas, Introduction to Storage Area Networks, Ninth Edition, IBM - Redbooks, December 2017

**REFERENCES:**

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

<b>20ITV63</b>	<b>INFORMATION RETRIEVAL 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 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 : 20ITV63</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	1	K2	1, 2, 8, 9	1,2									
<b>CO2</b>	Discuss various information retrieval models	2	K2	1, 2,8,9	1,2									
<b>CO3</b>	Apply appropriate method of classification or clustering	3	K3	1, 2, 3, 8,9	1,2									
<b>CO4</b>	Explain the Web Search Engine architecture and ranking functions	4	K2	1, 2,8,9	1,2									
<b>CO5</b>	Discuss Web Link Analysis algorithms and advanced search	4	K2	1, 2,8,9	1,2									
<b>CO6</b>	Illustrate recommendation techniques and develop content-based Recommender Systems	5	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



**TEXT BOOKS:**

1. Raj Kumar Buyya , James Broberg, AndrzejGoscinski, "Cloud Computing": Wiley 2013
2. Dave shackleford, "Virtualization Security", SYBEX a wiley Brand 2013.
3. Mather, Kumaraswamy and Latif, "Cloud Security and Privacy", OREILLY 2011

**REFERENCES:**

1. Mark C. Chu-Carroll "Code in the Cloud",CRC Press, 2011
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 : SECURITY AND PRIVACY IN CLOUD</b>		<b>Course Code : 20SCV71</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 fundamental concepts of cloud security	1	K2	1,2,8,9	1,2									
<b>CO2</b>	Illustrate the various cloud security design for cloud	2	K2	1,2,8,9	1,2									
<b>CO3</b>	Apply data protection strategies for cloud	2	K3	1,2,5,8,9,10	1,2									
<b>CO4</b>	Identify the cloud requirements, storage and network access control options	3	K2	1,2,8,9	1,2									
<b>CO5</b>	Explain the different types of architectural and design considerations for security in the cloud.	4	K2	1,2,8,9	1,2									
<b>CO6</b>	Explain the various risks, audit and monitoring mechanisms in the cloud.	5	K2	1,2,8,9	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	-	-	-	1	1
<b>CO2</b>	2	1	-	-	-	-	-	1	1	-	-	-	1	1
<b>CO3</b>	3	2	1	-	1	-	-	1	1	-	-	-	1	1
<b>CO4</b>	2	1	-	-	-	-	-	1	1	-	-	-	1	1
<b>CO5</b>	2	1	-	-	-	-	-	1	1	-	-	-	1	1
<b>CO6</b>	2	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>
		<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 non-stationary problem - optimistic initial values - upper-confidence-bound action

**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: 45 PERIODS**

**TEXT BOOKS :**

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.

**OUTCOMES:**

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

Course Name: REINFORCEMENT LEARNING TECHNIQUES										Course Code : 20ITV81				
CO	Course Outcomes									Unit	K-CO	POs	PSOs	
CO1	Understand basic concepts of reinforcement learning									1	K2	1,2		
CO2	Perform model-based prediction and control using dynamic programming									2	K2	1,2,3,8,10		
CO3	Apply model-free prediction and control									3	K2	1,2,3	1,2	
CO4	Comprehend the use of tabular methods									4	K2	1,2,3,8,10	1,2	
CO5	Understand how a value function can be approximated									5	K2	1,2		
CO6	Apply Stochastic-gradient and Semi-gradient Methods for value function approximation									6	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	3	2	1					2		2				
CO3	3	2	1											
CO4	3	2	1					2		2			1	1
CO5	2	1												
CO6	3	2	1					2		2			1	1

<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

**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

**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,

**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.	1	K2	1, 2, 8,9	2
CO2	Discuss about modeling and knowledge representation using ontology of social network.	2	K2	1, 2, 8,9	2
CO3	Illustrate the extraction and mining communities in web social networks.	3	K2	1, 2, 8,9	2
CO4	Illustrate the various methods for predicting human behaviour in social communities.	4	K2	1, 2, 8,9	2
CO5	Describe the privacy issues in trust network analysis.	4	K2	1, 2, 8,9	2
CO6	Make use of visualization techniques for social network applications	5	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

<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 SAFETY AND LIVENESS REQUIREMENT 9**

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

**UNIT 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.									1	K2	1, 2, 8, 9	1,2	
CO2	Ability to develop model for synchronous, asynchronous, continuous and discrete systems.									2	K2	1, 2, 8,9,10	1,2	
CO3	Ability to identify safety specifications and critical properties of Cyber Physical Systems.									3	K2	1, 2, 5, 8, 9	1,2	
CO4	Ability to design and analyze the stability of hybrid systems.									4	K2	1, 2, 5, 8, 9,10	1,2	
CO5	Ability to apply automata for timed systems.									5	K2	1, 2, 5, 8, 9	1.2	
CO6	Ability to understand Zeno Behaviors									5	K2	1, 2, 5, 8, 9	1,2	
CO-PO Mapping														
CO	PO1	PO2	PO 3	PO 4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO1 2	PSO 1	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

<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.

**REFERENCES:**

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:**

<b>Course Name : DIGITAL AND MOBILE FORENSICS</b>		<b>Course Code : 20SCV32</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 various digital forensics process	1	K2	1,2	1,2									
<b>CO2</b>	Discuss various digital crime and investigation methods.	2	K2	1,2,8,9	1,2									
<b>CO3</b>	Illustrate the digital forensic readiness and challenges in digital forensic	3	K2	1,2,8,9	1,2									
<b>CO4</b>	Identify and extract digital evidence from iOS devices.	4	K2	1,2,8,9	1,2									
<b>CO5</b>	Discuss the basics of Android forensics	5	K2	1,2,8,9	1,2									
<b>CO6</b>	Apply needed tools in Android devices	5	K3	1,2,3,5,8,9,10	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	2
<b>CO2</b>	2	1	-	-	-	-	-	1	1	-	-	-	1	2
<b>CO3</b>	2	1	-	-	-	-	-	1	1	-	-	-	1	2
<b>CO4</b>	2	1	-	-	-	-	-	1	1	-	-	-	1	2
<b>CO5</b>	2	1	-	-	-	-	-	1	1	-	-	-	1	2
<b>CO6</b>	3	2	1	-	1	-	-	1	1	1	-	-	1	2

<b>20ITV42 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: 45 PERIODS**

**TEXT BOOKS :**

1. Bashir and Imran, Mastering Blockchain: Deeper insights into decentralization, cryptography, Bitcoin, and popular Blockchain frameworks, 2017.
2. Andreas Antonopoulos, "Mastering Bitcoin: Unlocking Digital Crypto currencies", 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. 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
6. Handbook of Research on Blockchain Technology, published by Elsevier Inc. ISBN: 9780128198162, 2020.

**OUTCOMES:**

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

<b>Course Name: CRYPTOCURRENCY AND BLOCKCHAIN TECHNOLOGIES</b>		<b>Course Code : 20ITV42</b>												
<b>CO</b>	<b>Course Outcomes</b>	<b>Unit</b>	<b>K-CO</b>	<b>POs</b>	<b>PSOs</b>									
<b>CO1</b>	Understand emerging abstract models for Block chain Technology	1	K2	1,2										
<b>CO2</b>	Identify major research challenges and technical gaps existing between theory and practice in the crypto currency domain.	2	K2	1,2, 8,10										
<b>CO3</b>	Understand the function of Block chain as a method of securing distributed ledgers, how consensus on their contents is achieved	3	K2	1,2										
<b>CO4</b>	Apply hyper ledger Fabric and Ethereum platform to implement the Block chain	4	K2	1,2,3,8,10	1,2									
<b>CO5</b>	Understand emerging abstract models for Block chain Technology	5	K2	1,2										
<b>CO6</b>	Apply block chain concepts in supply chain management	6	K3	1,2,3,8,10	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>
CO1	2	1												
CO2	2	1					2		2					
CO3	2	1												
CO4	3	2	1				2		2				1	1
CO5	3	2	1											
CO6	2	1					2		2				1	1

<b>20SCV52</b>	<b>WEB APPLICATION 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 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 Micro service 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 Beginners 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. Ravi Das and Greg Johnson, Testing and Securing Web Applications, 2021, Taylor & Francis Group, LLC.
3. Prabath Siriwardena, Advanced API Security, 2020, Apress Media LLC, USA.
4. Malcom McDonald, Web Security for Developers, 2020, No Starch Press, Inc.
5. Allen Harper, Shon Harris, Jonathan Ness, Chris Eagle, Gideon Lenkey, and Terron Williams Grey Hat Hacking: The Ethical Hacker's Handbook, Third Edition, 2011, The McGraw-Hill Companies.

Course Name : WEB APPLICATION SECURITY										Course Code : 20SCV52				
CO	Course Outcomes									Unit	K-CO	POs	PSOs	
CO1	Explain the fundamental concept of Web application security									1	K2	1,2,8,9	2	
CO2	Discuss Microsoft security development lifecycle, security process and software assurance maturity model									2	K2	1,2,8,9	2	
CO3	Illustrate API security using session cookies, token based authentication and encryption									3	K3	1,2,3,5,8,9	2	
CO4	Describe various vulnerability assessments tools in web application									4	K2	1,2,8,9	2	
CO5	Illustrate different type of penetration tests to identify security weaknesses in web application									5	K3	1,2,3,8,9	2	
CO6	Explain various hacking techniques and tools in web application									5	K2	1,2,5,8,9	2	
CO-PO Mapping														
COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1	-	-	-	-	-	2	2	-	-	-	-	2
CO2	2	1	-	-	-	-	-	2	2	-	-	-	-	2
CO3	3	2	1	-	1	-	-	2	2	-	-	-	-	2
CO4	2	1	-	-	-	-	-	2	2	-	-	-	-	2
CO5	3	2	1	-	-	-	-	2	2	-	-	-	-	2
CO6	2	1	-	-	1	-	-	2	2	-	-	-	-	2



**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	PSOs
CO1	Identify various vulnerabilities related to memory attacks and low level attacks.										1	2	1,2	1
CO2	Apply security principles in software development and secure design.										2	3	1,2,3,8,9	1
CO3	Discuss the risk factors in software systems and risk assessment techniques.										3	2	1,2,8,9	1
CO4	Apply various testing techniques related to software security in the testing phase of software development										4	3	1,2,3,8,9	1
CO5	Discuss the web application security , bypassing Firewalls and tools for penetration testing.										4	2	1,2,8,9	1
CO6	Illustrate secure project management and its framework.										5	3	1,2,3,8,9,10	1
CO-PO Mapping														
CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1		-	-	-	-	2	2	1	-	-	2	-
CO2	3	2	1	-	-	-	-	2	2	1	-	-	2	-
CO3	2	1		-	-	-	-	2	2	1	-	-	2	-
CO4	3	2	1	-	-	-	-	2	2	1	-	-	2	-
CO5	2	1		-	-	-	-	2	2	1	-	-	2	-
CO6	3	2	1	-	-	-	-	2	2	1	-	-	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**

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 Hogg, "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.									1	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									2	K3	1,2,3,5,8,9	1,2	
CO3	Apply the knowledge to carry out malware analysis of using dynamic analysis techniques									3	K3	1,2,3,5,8,9	1,2	
CO4	Implement experimentation on Malware behaviour analysis									3	K3	1,2,3,5,8,9,10	1,2	
CO5	Explain the methods and techniques used by professional malware analysts									4	K2	1,2,8,9	1,2	
CO6	Illustrate the concept of Android malware analysis their architecture, and App development									5	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>T</b>	<b>P</b>	<b>C</b>
		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

**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**

**UNIT I SYNTAX AND SEMANTICS 9**

Evolution of programming languages – describing syntax – context-free grammars – attribute grammars – describing semantics – lexical analysis – parsing – recursive-descent – bottom-up parsing.

**UNIT II DATA, DATA TYPES, AND BASIC STATEMENTS 9**

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

**UNIT III SUBPROGRAMS AND IMPLEMENTATIONS 9**

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–dynamic scoping

**UNIT IV OBJECT-ORIENTATION, CONCURRENCY, AND EVENT HANDLING 9**

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.

**UNIT V FUNCTIONAL AND LOGIC PROGRAMMING LANGUAGES 9**

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:**

<b>Course Name : PRINCIPLES OF PROGRAMMING LANGUAGES</b>											<b>Course Code : 20ITV13</b>				
<b>CO</b>	<b>Course Outcomes</b>										<b>Unit</b>	<b>K-CO</b>	<b>POs</b>	<b>PSOs</b>	
<b>CO1</b>	Describe syntax and semantics of programming languages										1	K2	1,2	1,2	
<b>CO2</b>	Illustrate different data types and statements for the programming language.										2	K3	1,2,3,8,9	1,2	
<b>CO3</b>	Develop simple and nested sub-programs										3	K3	1,2,3,8,9,10	1,2	
<b>CO4</b>	Make use of semaphores and monitors concept to implement basic concepts of object-oriented programming										4	K3	1,2,3,8,9,10	1,2	
<b>CO5</b>	Illustrate the mechanism of threads and exception handling.										4	K3	1,2,3,8,9	1,2	
<b>CO6</b>	Compare features, applications of functional and logic programming language.										5	K2	1,2,8,9,10	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	2	
<b>CO2</b>	3	2	1	-	-	-	-	2	2	-	-	-	1	2	
<b>CO3</b>	3	2	1	-	-	-	-	2	2	1	-	-	1	2	
<b>CO4</b>	3	2	1	-	-	-	-	2	2	1	-	-	1	2	
<b>CO5</b>	3	2	1	-	-	-	-	2	2	-	-	-	1	2	
<b>CO6</b>	2	1	-	-	-	-	-	2	2	1	-	-	1	2	

20CSV23

UI AND UX DESIGN

L	T	P	C
2	0	2	3

**Objectives :**

1. To provide a sound knowledge in UI & UX
2. To understand the need for UI and UX
3. To understand the various Research Methods used in Design
4. 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.

**Lab Component:**

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.

**Lab Component:**

6

1. Conduct end-to-end user research - User research, creating personas, Ideation

process (User stories, Scenarios), Flow diagrams, Flow Mapping  
 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/> <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	1	K2	1,2	2									
CO2	Discuss the fundamental needs of UI design	2	K2	1,2,8,9	2									
CO3	Illustrate methods and tools to the process of UX design for research	3	K2	1,2,8,9	2									
CO4	Explain the sketching principles, responsive design and wire framing	4	K2	1,2,8,9	2									
CO5	Discuss the design of UI and UX prototyping and testing with suitable tools	4	K2	1,2,8,9	2									
CO6	Identifying and writing problem statements, appropriate research methods and creating scenarios	5	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 SERVICES 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**

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 SERVICES 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	1	K2	1,2	2									
<b>CO2</b>	Describe the cloud service strategies like cloud policy, risk management and change management etc.,	2	K2	1,2,8,9	2									
<b>CO3</b>	Explain the life cycle and benchmarks of cloud services	3	K2	1,2,8,9	2									
<b>CO4</b>	Illustrate deployment and migration of cloud services	3	K2	1,2,8,9	2									
<b>CO5</b>	Discuss the economic based cloud services	4	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	5	K2	1,2,8,9,10	2									
<b>CO-PO Mapping</b>														
<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>
		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

**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 Applications.

**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**

**TEXT BOOKS :**

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:**

Course Name : SOFTWARE TESTING AND AUTOMATION										Course Code : 20ITV43				
CO	Course Outcomes									Unit	K-CO	POs	PSOs	
CO1	Discuss the basic concepts of software testing and the need for software testing									1	K2	1,2,8,9	2	
CO2	Explain test planning and different activities involved in test planning									2	K2	1,2,8,9	2	
CO3	Identify the test objectives and apply different method of test strategies									3	K3	1,2,3,5,8,9,10	2	
CO4	Apply advanced testing concepts like Fail-Over testing, usability testing, security testing etc.									4	K3	1,2,3,5,8,9,10	2	
CO5	Describe the Testing methods for web and mobile applications									4	K2	1,2,8,9,10	2	
CO6	Use automatic software testing tools like Selenium web driver for automating web-based application testing									5	K3	1,2,3,5,8,9,10	2	
CO – PO Mapping														
CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1	-	-	-	-	-	2	2	-	-	-	-	2
CO2	2	1	-	-	-	-	-	2	2	-	-	-	-	2
CO3	3	2	1	-	2	-	-	2	2	1	-	-	-	2
CO4	3	2	1	-	2	-	-	2	2	1	-	-	-	2
CO5	2	1	-	-	-	-	-	2	2	1	-	-	-	2
CO6	3	2	1	-	2	-	-	2	2	1	-	-	-	2

<b>20CSV61</b>	<b>COMPUTER VISION</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 fundamental concepts related to Image formation and processing.
- To learn feature detection, matching and detection
- To become familiar with feature based alignment and motion estimation
- To develop skills on 3D reconstruction
- To understand image based rendering and recognition

**PRE-REQUISITE: NIL**

**UNIT I INTRODUCTION TO IMAGE FORMATION AND PROCESSING 9**

Computer Vision - Geometric primitives and transformations - Photometric image formation - The digital camera - Point operators - Linear filtering - More neighborhood operators - Fourier transforms - Pyramids and wavelets - Geometric transformations - Global optimization.

**UNIT II FEATURE DETECTION, MATCHING AND SEGMENTATION 9**

Points and patches - Edges - Lines - Segmentation - Active contours - Split and merge - Mean shift and mode finding - Normalized cuts - Graph cuts and energy-based methods.

**UNIT III FEATURE-BASED ALIGNMENT & MOTION ESTIMATION 9**

2D and 3D feature-based alignment - Pose estimation - Geometric intrinsic calibration - Triangulation - Two-frame structure from motion - Factorization - Bundle adjustment - Constrained structure and motion - Translational alignment - Parametric motion - Spline-based motion - Optical

**UNIT IV 3D RECONSTRUCTION 9**

Shape from X - Active range finding - Surface representations - Point-based representations - Volumetric representations - Model-based reconstruction - Recovering texture maps and albedos

**UNIT V IMAGE-BASED RENDERING AND RECOGNITION 9**

View interpolation Layered depth images - Light fields and Lumi graphs - Environment mattes - Video-based rendering-Object detection - Face recognition - Instance recognition - Category

**TOTAL: 45 PERIODS**

**TEXT BOOKS :**

1. Richard Szeliski, "Computer Vision: Algorithms and Applications", Springer- Texts in Computer Science, Second Edition, 2022.
2. Computer Vision: A Modern Approach, D. A. Forsyth, J. Ponce, Pearson Education, Second Edition, 2015.

**REFERENCES:**

1. Richard Hartley and Andrew Zisserman, Multiple View Geometry in Computer Vision, Second Edition, Cambridge University Press, March 2004.
2. Christopher M. Bishop; Pattern Recognition and Machine Learning, Springer, 2006
3. E. R. Davies, Computer and Machine Vision, Fourth Edition, Academic Press, 2012.

**OUTCOMES:**

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

Course Name: COMPUTER VISION										Course Code : 20CSV61				
CO	Course Outcomes									Unit	K-CO	POs	PSOs	
CO1	Understand basic knowledge, theories and methods in image processing and computer vision.									1	K2	1,2, 8,10		
CO2	Implement basic and some advanced image processing techniques in Open CV.									2	K2	1,2,3,		
CO3	Apply 2D feature-based based image alignment, segmentation and motion estimations.									3	K2	1,2,3, 8,10	1,2	
CO4	Apply 3D image reconstruction techniques									4	K2	1,2,3	1,2	
CO5	Understand the innovative image processing concepts									5	K2	1,2, 8,10		
CO6	Develop innovative image processing and computer vision applications.									6	K3	1,2,3	1,2	
CO-PO Mapping														
CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1						2		2				
CO2	3	2	1											
CO3	3	2	1					2		2			1	1
CO4	3	2	1										1	1
CO5	2	1						2		2				
CO6	3	2	1										1	1

<b>20ITV73</b>	<b>DEVOPS</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>2</b>	<b>0</b>	<b>2</b>	<b>4</b>

**Objectives :**

- To introduce DevOps terminology, definition & concepts
- To understand the different Version control tools like Git, Mercurial
- To understand the concepts of Continuous Integration/ Continuous Testing/ Continuous Deployment)
- To understand Configuration management using Ansible
- Illustrate the benefits and drive the adoption of cloud-based Devops tools to solve real world problems

**PRE-REQUISITE: NIL**

**UNIT I INTRODUCTION TO DEVOPS 6**

Devops Essentials - Introduction To AWS, GCP, Azure - Version control systems: Git and

**Lab Component: 6**

1. Install Jenkins in Cloud
2. Install Ansible and configure ansible roles and to write playbook

**UNIT II COMPILE AND BUILD USING MAVEN & GRADLE 6**

Introduction, Installation of Maven, POM files, Maven Build lifecycle, Build phases(compile build, test, package) Maven Profiles, Maven repositories(local, central, global),Maven plugins, Maven create and build Artificats, Dependency management, Installation of

**Lab Component: 6**

1. Build a simple application using Gradle

**UNIT III CONTINUOUS INTEGRATION USING JENKINS 6**

Install & Configure Jenkins, Jenkins Architecture Overview, Creating a Jenkins Job, Configuring a Jenkins job, Introduction to Plugins, Adding Plugins to Jenkins, Commonly used plugins (Git Plugin, Parameter Plugin, HTML Publisher, Copy Artifact and Extended choice parameters). Configuring Jenkins to work with java, Git and Maven, Creating a

**Lab Component: 6**

1. Create CI pipeline using Jenkins
2. Create a CD pipeline in Jenkins and deploy in Cloud

**UNIT IV CONFIGURATION MANAGEMENT USING ANSIBLE 6**

Ansible Introduction, Installation, Ansible master/slave configuration, YAML basics, Ansible modules, Ansible Inventory files, Ansible playbooks, Ansible Roles, adhoc commands in ansible.

**Lab Component: 6**

1. Create an Ansible playbook for a simple web application infrastructure

**UNIT V BUILDING DEVOPS PIPELINES USING AZURE 6**

Create Github Account, Create Repository, Create Azure Organization, Create a new pipeline, Build a sample code, Modify azure-pipelines.yaml file.

**Lab Component: 6**

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

**TOTAL:60 PERIODS**

**TEXT BOOKS :**

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. 1.Hands-On Azure Devops: Cicd 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. 2.Jeff Geerling, “Ansible for DevOps: Server and configuration management for humans”, First Edition, 2015.
3. 3.David Johnson, “Ansible for DevOps: Everything You Need to Know to Use Ansible for DevOps”, Second Edition, 2016.
4. 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

**OUTCOMES:**

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

Course Name : DEVOPS		Course Code : 20ITV73												
CO	Course Outcomes	Unit	K-CO	POs	PSOs									
CO1	Understand different actions performed through Version control tools like Git.	1	K2	1,2,8,10										
CO2	Perform Continuous Integration and Continuous Testing and Continuous Deployment using Jenkins by building and automating test cases using Maven & Gradle	2	K2	1,2										
CO3	Perform Automated Continuous Deployment	3	K2	1,2,8,10										
CO4	Do configuration management using Ansible	4	K2	1,2										
CO5	Understand to leverage Cloud-based DevOps tools using Azure DevOps	5	K2	1,2,5,8,10	1,2									
CO6	Implement the Devop pipeline using Azure	6	K3	1,2,3,5	1,2									
CO-PO Mapping														
CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1						2		2				
CO2	2	1												
CO3	2	1						2		2				
CO4	2	1												
CO5	2	1			2			2		2			1	1
CO6	3	2	1		2								1	1

<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>

**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
- To understand the IP and Web security.
- To understand the need of security in Database Management systems and to learn how to secure Database Management systems

**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 -EMAIL 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. Michael E Whitman and Herbert J Mattord, “Principles of Information Security, Course Technology, 6th Edition, 2017.
2. Stallings William. Cryptography and Network Security: Principles and Practice, Seventh Edition, Pearson Education, 2017.

**REFERENCES:**

1. Harold F. Tipton, Micki Krause Nozaki,, “Information Security Management Handbook, Volume 6, 6th Edition, 2016.
2. Stuart McClure, Joel Scrambray, George Kurtz, “Hacking Exposed”, McGraw- Hill, Seventh Edition, 2012.
3. Matt Bishop, “Computer Security Art and Science, Addison Wesley Reprint Edition, 2015.
4. Behrouz A Forouzan, Debdeep Mukhopadhyay, Cryptography And network security, 3rd Edition, . McGraw-Hill Education, 2015.

<b>Course Name :DATA AND INFORMATION SECURITY</b>		<b>Course Code :20ADV14</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 basics of data and information security	1	K2	1,2,8,9	2									
<b>CO2</b>	Discuss the legal, ethical and professional issues in information security	2	K2	1,2,8,9	2									
<b>CO3</b>	Illustrate the availability security policies in information security	2	K2	1,2,3,8,9,10	2									
<b>CO4</b>	Identify the various authentication schemes to simulate different applications.	3	K3	1,2,8,9,10	2									
<b>CO5</b>	Explain various security practices and system security standards	4	K2	1,2,8,9	2									
<b>CO6</b>	Make use of Web security protocols for E-Commerce applications	5	K3	1,2,3,8,9	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	-	-	-	-	-	2	2	-	-	-	-	2
<b>CO2</b>	2	1	-	-	-	-	-	2	2	-	-	-	-	2
<b>CO3</b>	2	1	-	-	-	-	-	2	2	2	-	-	-	2
<b>CO4</b>	3	2	1	-	-	-	-	2	2	2	-	-	-	2
<b>CO5</b>	2	1	-	-	-	-	-	2	2	-	-	-	-	2
<b>CO6</b>	3	2	1	-	-	-	-	2	2	-	-	-	-	2

<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**

**UNIT I QUANTUM COMPUTING BASIC CONCEPTS 9**

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

**UNIT II QUANTUM GATES AND CIRCUITS 9**

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

**UNIT III QUANTUM ALGORITHMS 9**

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

**UNIT IV 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

**UNIT V QUANTUM CRYPTOGRAPHY 9**

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

**TOTAL: 45 PERIODS**

**TEXT BOOKS :**

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.

**OUTCOMES:**

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

<b>Course Name: QUANTUM COMPUTING</b>		<b>Course Code : 20ITV24</b>													
<b>CO</b>	<b>Course Outcomes</b>	<b>Unit</b>	<b>K-CO</b>	<b>POs</b>	<b>PSOs</b>										
<b>CO1</b>	Understand the basics of quantum computing.	1	K2	1,2, 8,10											
<b>CO2</b>	Understand the background of Quantum Mechanics.	2	K2	1,2,											
<b>CO3</b>	Analyze the computation models.	3	K2	1,2,3,4, 8,10											
<b>CO4</b>	Model the circuits using quantum computation. Environments and frameworks.	4	K2	1,2,3	1,2										
<b>CO5</b>	Understand the quantum operations such as noise and error–correction.	5	K2	1,2, 8,10											
<b>CO6</b>	Implement the Quantum operations	6	K3	1,2,3	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						2		2					
<b>CO2</b>	2	1													
<b>CO3</b>	3	3	2	1				2		2					
<b>CO4</b>	3	2	1										1	1	
<b>CO5</b>	2	1						2		2					
<b>CO6</b>	3	2	1										1	1	

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

**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

**Lab Component: 6**

1. Implement simple vector addition in Tensor Flow.
2. Implement a regression model in Keras.

**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.

**Lab Component: 6**

1. Implement a perceptron in Tensor Flow/Keras Environment.
2. Implement a Feed-Forward Network in Tensor Flow/Keras.

**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

**Lab Component: 6**

1. Implement an Image Classifier using CNN in Tensor Flow/Keras

**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.

**Lab Component: 6**

1. Implement character and Digit Recognition using ANN

**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.

**Lab Component:      6**

1. Perform Sentiment Analysis using RNN
2. Recommendation system from sales data using Deep Learning

**TOTAL: 60 PERIODS**

**TEXT BOOKS:**

1. Ian Good fellow, 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
2. Aurélien Géron, “Hands-On Machine Learning with Scikit-Learn and TensorFlow” Oreilly, 2018.
3. Josh Patterson, Adam Gibson, “Deep Learning: A Practitioner’s Approach”, O’Reilly Media, 2017.
4. Charu C. Aggarwal, “Neural Networks and Deep Learning: A Textbook”, Springer International Publishing, 1st Edition, 2018.
5. Learn Keras for Deep Neural Networks, Jojo Moolayil, Apress,2018
6. Deep Learning Projects Using TensorFlow 2, Vinita Silaparasetty, Apress, 2020
7. Deep Learning with Python, FRANÇOIS CHOLLET, MANNING SHELTER ISLAND,2017.
8. S Rajasekaran, G A Vijayalakshmi Pai, “Neural Networks, FuzzyLogic and Genetic Algorithm, Synthesis and Applications”, PHI Learning, 2017.
9. Pro Deep Learning with TensorFlow, Santanu Pattanayak, Apress,2017
10. James A Freeman, David M S Kapura, “Neural Networks Algorithms, Applications, and Programming Techniques”, Addison Wesley, 2003

**OUTCOMES:**

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

Course Name : NEURAL NETWORKS AND DEEP LEARNING										Course Code : 20ADV34				
CO	Course Outcomes									Unit	K-CO	POs	PSOs	
CO1	Describe the scope of the neural network and explain the basic models of Artificial Neural Network									I	K2	1,2	1,2	
CO2	Illustrate the different types of associative memory networks									II	K2	1,2,8,9,10	1,2	
CO3	Apply conventional neural network model and its algorithms									III	K3	1,2,3,8,9,10	1,2	
CO4	Use deep learning components to build and train deep neural networks for various tasks									IV	K3	1,2,3,8,9,10	1,2	
CO5	Apply Recurrent Neural Network and its variants for text analysis									V	K3	1,2,3,8,9,10	1,2	
CO6	Utilize the applications of neural networks and deep learning for image compression and Natural Language Processing									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	-	-	-	-	-	-	-	-	-	-	2	1
CO2	2	1	-	-	-	-	-	2	2	2	-	-	2	1
CO3	3	2	1	-	-	-	-	2	2	2	-	-	2	1
CO4	3	2	1	-	-	-	-	2	2	2	-	-	2	1
CO5	3	2	1	-	-	-	-	2	2	2	-	-	2	1
CO6	3	2	1	-	2	-	-	2	2	2	-	-	2	1

<b>20SCV54</b>	<b>CYBER 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 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 CYBER FORENSICS 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 CYBER CRIME: 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, Attacks 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-mail 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**

**TEXT BOOKS:**

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, CRC Press, 2016
2. Chwan-Hwa (John) Wu, J. David Irwin, Introduction to Computer Networks and Cyber security, CRC Press T&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				PSOs		
CO1	Identify the fundamental concepts of cyber security and the layers of cyber security based on real time scenarios					1	K3	1,2,3,6,8,9,12				1		
CO2	Illustrate the process of digital forensics, analysis and challenges in computer forensics					2	K4	1,2,3,4,6,8,9,12				1		
CO3	Analyze the security challenges and prevention measures for the security attacks on mobile and wireless devices					3	K4	1,2,3,4,6,8,9,12				1		
CO4	Discuss the concepts of privacy Attacks, Data linking and profiling					4	K2	1,2,6,8,9,10,12				1		
CO5	Explain the privacy policies and their specifications in various domains					4	K2	1,2,6,8,9,10,12				1		
CO6	Infer the category of the cyber security attacks and analyze its security measures					5	K4	1,2,3,4,6,8,9,12				1		
CO - PO Mapping														
COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1	-	-	3	-	2	2	2	-	2	1	1
CO2	3	3	2	1	-	3	-	2	2	2	-	2	1	1
CO3	3	3	2	1	-	3	-	2	2	2	-	2	1	1
CO4	2	1	-	-	-	3	-	2	2	2	-	2	1	1
CO5	2	1	-	-	-	3	-	2	2	2	-	2	1	1
CO6	3	3	2	1	-	3	-	2	2	2	-	2	1	1

<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 fabrication – Colourjet.

**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 Movement, Support structures;

**UNIT V INDUSTRIAL APPLICATIONS 9**

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

**TOTAL: 45 PERIODS**

**TEXT BOOKS :**

1. Christopher Barnett, 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

**OUTCOMES:**

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

Course Name : 3D PRINTING AND DESIGN							Course Code : 20ITV64							
CO	Course Outcomes						Unit	K-CO	POs			PSOs		
CO1	Outline and examine the basic concepts of 3D printing technology						1	K2	1,2,8,10					
CO2	Outline 3D printing workflow`						2	K2	1,2					
CO3	Explain and categorize the concepts and working principles of 3D printing using inkjet technique						3	K2	1,2,8,10					
CO4	Explain and categorize the working principles of 3D printing using laser technique						4	K2	1,2					
CO5	Explain various method for designing and modeling for industrial applications						5	K2	1,2,8,10					
CO6	Explain the future trends in 3D design						6	K3	1,2			1,2		
CO-PO Mapping														
COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1						2		2				
CO2	2	1												
CO3	2	1						2		2				
CO4	2	1												
CO5	2	1						2		2			1	1
CO6	2	1											1	1



**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,

**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

**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:**

<b>Course Name : VIRTUAL REALITY AND AUGMENTED REALITY</b>		<b>Course Code : 20CSV84</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 Virtual Reality and Environment, Virtual Reality Requirements and benefits	1	K2	1,2,8,9	1,2									
<b>CO2</b>	Illustrate the visualization techniques for augmented reality	2	K2	1,2,8,9, 10	1,2									
<b>CO3</b>	Discuss the concept of Computer Graphics And Geometric Modeling	3	K2	1,2,8,9	1,2									
<b>CO4</b>	Use various types of Hardware and software in virtual Reality systems	4	K3	1,2,3,8,9, 12	1,2									
<b>CO5</b>	Apply Development Tools And Framework for Virtual Reality	4	K3	1,2,3, 5,6,8,9, 12	1,2									
<b>CO6</b>	Analyze and Design a system or process to meet given specifications with Realistic Engineering Constraints	5	K4	1,2,3,4, 5,6,8,9, 10, 12	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	3
<b>CO2</b>	2	1	-	-	-	-	-	1	1	-	-	-	2	3
<b>CO3</b>	2	1	-	-	-	-	-	1	1	-	-	-	2	3
<b>CO4</b>	3	2	1	-	-	-	-	1	1	1	-	1	2	3
<b>CO5</b>	3	2	1	-	2	1	-	2	2	1	-	1	2	3
<b>CO6</b>	3	3	2	1	1	1	-	2	2	2	-	1	2	3

<b>20ADV15</b>	<b>BUSINESS INTELLIGENCE SYETEM</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**

**UNIT - I INTRODUCTION TO BUSINESS ANALYTICS 9**

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

**UNIT - II BUSINESS INTELLIGENCE 9**

Data Warehouses and Data Mart - Knowledge Management – Types of Decisions – Decision Making Process- Decision Support Systems –Business Intelligence –OLAP–, Analytic functions

**UNIT - III BUSINESS FORECASTING 9**

Introduction to Business Forecasting and Predictive analytics - Logic and Data Driven Models –Data Mining and Predictive Analysis Modeling–Machine Learning for Predictive analytics.

**UNIT - IV HR & SUPPLY CHAIN ANALYTICS 9**

HumanResources–PlanningandRecruitment–TrainingandDevelopment-Supplychainnetwork - Planning Demand, Inventory and Supply – Logistics – Analytics applications in HR &Supply Chain

**UNIT - V MARKETING& SALES ANALYTICS 9**

Marketing Strategy, Marketing Mix, Customer Behavior– selling Process – Sales Planning – Analytics applications in Marketing and Sales

**TOTAL: 45 PERIODS**

**REFERENCES:**

1. R. EvansJames, Business Analytics, 2017
2. RNPrasad, [Seema Acharya](#), 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-TheoryandPractice”,3rdEdition,PearsonEducation, 2018.

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

Course Name : Business Intelligence System		CourseCode:20ADV15												
CO	Course Outcomes	Unit	K-CO	POs	PSOs									
CO1	Explain the real world business problems and model with analytical solutions.	I	K2	1,2,9,10,12	2									
CO2	Identify the business processes for extracting Business Intelligence	II	K2	1,2,9,10,12	2									
CO3	Apply predictive analytics for business fore-casting	III	K3	1,2,3,9,10,12	2									
CO4	Apply analytics for supply chain and logistics management	IV	K3	1,2,3,9,10,12	2									
CO5	Use analytics for marketing and sales	V	K2	1,2,9,10,12	2									
CO6	Discuss the applications in Marketing and Sales	V	K2	1,2,9,10,12	2									
CO-PO Mapping														
CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1	-	-	-	-	-	-	2	2	-	2	-	2
CO2	2	1	-	-	-	-	-	-	2	2	-	2	-	2
CO3	3	2	1	-	-	-	-	-	2	2	-	2	-	2
CO4	3	2	1	-	-	-	-	-	2	2	-	2	-	2
CO5	2	1	-	-	-	-	-	-	2	2	-	2	-	2
CO6	2	1	-	-	-	-	-	-	2	2	-	2	-	2

<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.

**PRE-REQUISITE:NIL**

**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.

**UNIT - 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: 45 PERIODS**

**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.

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

<b>Course Name: DATA COMMUNICATION AND COMPUTER NETWORKS</b>		<b>CourseCode:20ADV25</b>												
<b>CO</b>	<b>Course Outcomes</b>	<b>Unit</b>	<b>K-CO</b>	<b>POs</b>	<b>PSOs</b>									
CO1	Demonstrate the basic layers and its functions in computer networks	I	K3	1,2,3,10,11	-									
CO2	Evaluate the performance of a network	II	K3	1,2,3,10,11	-									
CO3	Concepts of the basics of how data flows from one node to another	II	K2	1,2,10,11	-									
CO4	Analyze and design routing algorithms	III	K3	1,2,3,10,11	-									
CO5	Design protocols for various functions in the network	IV	K3	1,2,3,10,11	-									
CO6	Know about the working of various application layer protocols	V	K2	1,2,10,11	-									
<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>
CO1	3	2	1	-	-	-	-	-	-	2	2	-	-	-
CO2	3	2	1	-	-	-	-	-	-	2	2	-	-	-
CO3	2	1	-	-	-	-	-	-	-	2	2	-	-	-
CO4	3	2	1	-	-	-	-	-	-	2	2	-	-	-
CO5	3	2	1	-	-	-	-	-	-	2	1	-	-	-
CO6	2	1	-	-	-	-	-	-	-	2	2	-	-	-

<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

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

Exception handling, Common exceptions, Logging- Debugging techniques, Collecting crash dumps, 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 deploybots, License management, Publishing and managing updates. RPA Vendors -Open Source RPA, Future of RPA

**TOTAL: 45 PERIODS**

**TEXT BOOKS**

1. Learning Robotic Process Automation: Create Software robots and automate business processes with the leading RPA tool - UiPath by Alok Mani Tripathi, Packt Publishing, 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

**OUTCOMES:**

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

Course Name :ROBOTIC PROCESS AUTOMATION									Course Code :20ADV45					
CO	Course Outcomes								Unit	K-CO	POs	PSOs		
CO1	Understand the robotic process automation and its applications								I	K2	1,2,9,10,12	1		
CO2	Illustrate control flows and work flows for the target process								II	K2	1,2,9,10,12	1		
CO3	Demonstrate recording, web scraping and process mining by automation								III	K3	1,2,3,9,10,12	1		
CO4	Determine exception handling in automation processes								IV	K3	1,2,3,9,10,12	1		
CO5	Understand Code management and maintenance in automation								IV	K2	1,2,9,10,12	1		
CO6	Understand the Orchestrator for controlling of automated bots.								V	K2	1,2,9,10,12	1		
CO – PO														
CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO.1	2	1	-	-	-	-	-	-	1	1	-	1	2	-
CO.2	2	1	-	-	-	-	-	-	1	1	-	1	2	-
CO.3	3	2	1	-	-	-	-	-	1	1	-	2	2	-
CO.4	3	2	1	-	-	-	-	-	1	1	-	2	2	-
CO.5	2	1	-	-	-	-	-	-	1	1	-	1	2	-
CO.6	2	1	-	-	-	-	-	-	1	1	-	1	2	-



<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 and manufacture.

**PRE-REQUISITE: NIL**

**UNIT I 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 – fuzzy logic principles – fuzzy quantifiers – fuzzy inference – fuzzy rule based systems – fuzzification and defuzzification – types.

**UNIT II 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 –image processing applications – systactic recognition – fuzzy optimization

**UNIT III 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

**UNIT IV 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 – kohonen self organizing maps –learning vector quantization – counter propagation networks – industrial applications.

**UNIT V 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 immune systems – applications in design and manufacturing.

**TOTAL: 45 PERIODS**

**TEXT BOOKS :**

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:**

<b>Course Name: FUZZY LOGIC AND APPLICATIONS</b>		<b>Course Code : 20ITV65</b>												
<b>CO</b>	<b>Course Outcomes</b>	<b>Unit</b>	<b>K-CO</b>	<b>POs</b>	<b>PSOs</b>									
<b>CO1</b>	Understand basic knowledge of the fuzzy sets, operations and their properties.	1	K2	1,2										
<b>CO2</b>	Understand the fundamental concepts of Fuzzy functions and Fuzzy logic	2	K2	1,2,8,10										
<b>CO3</b>	Apply the concepts of Fuzzy sets in image processing, pattern reorganization and decision making	2	K2	1,2,3	1,2									
<b>CO4</b>	Understand the fundamental of neural network and architecture	3	K2	1,2,8,10										
<b>CO5</b>	Understand the advanced neural network and architecture	4	K2	1,2										
<b>CO6</b>	Apply non-traditional optimization techniques in design and manufacturing applications.	5	K3	1,2,3,8,10	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												
<b>CO2</b>	2	1						2		2				
<b>CO3</b>	3	2	1											1
<b>CO4</b>	2	1						2		2			1	
<b>CO5</b>	2	1												
<b>CO6</b>	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**

Model Process for Addressing Ethical Concerns During System Design- Transparency of Autonomous Systems-Data Privacy Process- Algorithmic Bias Considerations Ontological Standard for Ethically Driven Robotics and Automation Systems

**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 INTRODUCTIONINTRODUCTION 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

**UNIT 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**

**TEXT BOOKS:**

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.

**REFERENCES:**

1. Nilanjan Dey, Amira Ashour , Simon James Fong, ChintanBhatl, “Health Care Data Analysis and Management, First Edition, Academic Press, 2018.

2. Hui Jang, Eva K.Lee, "HealthCare Analysis : From Data to Knowledge to Healthcare Improvement", First Edition, Wiley, 2016.
3. Kulkarni ,Siarry, Singh ,Abraham, Zhang, Zomaya , Baki, "Big Data Analytics in HealthCare", Springer, 2020.

**OUTCOMES:**

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

Course Name: HEALTH CARE ANALYTICS					Course Code:20ADV85									
CO	Course Outcomes				Unit	K-CO	POs		PSOs					
CO1	Explain the machine learning and deep learning algorithms for health data analysis				1	K2	1,2,9,12		1					
CO2	Evaluate the need of healthcare data analysis in e-healthcare, telemedicine and other critical care applications				2	K3	1,2,3,5,12		1					
CO3	Discuss the data management techniques for healthcare data				3	K2	1,2,9,12		1					
CO4	Apply health data analytics for real time applications				4	K3	1,2,9,12		1					
CO5	Understand emergency care system using health data analysis				4	K2	1,2,9,12		1					
CO6	Apply health care analytics in Healthcare and Emerging Technologies				5	K3	1,2,3,9,12		1					
CO-PO Mapping														
CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1	-	-	-	-	-	-	2		-	2	2	1
CO2	3	2	1	-	2	-	-	-			-	2	1	3
CO3	2	1	-	-	-	-	-	-	2		-	2	-	3
CO4	3	2	1	-	-	-	-	-	2		-	2	-	3
CO5	2	1	-	-	-	-	-	-	2		-	2	3	-
CO6	3	2	1	-	2	-	-	-	2		-	2	3	-

<b>20HS5A1</b>	<b>MANAGEMENT CONCEPTS &amp; ORGANIZATIONAL BEHAVIOR</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 enable the students to study the evolution of Management, to study the functions and principles of management and to learn the application of the principles in an organization with a perspective to diagnose and effectively handle human behavior.

**PRE-REQUISITE:NIL**

**UNIT-I INTRODUCTION TO MANAGEMENT 9**

Origin - Definition of management -Nature & Characteristics of management - Scope of management - Importance of Management - Difference between administration & management- Levels of management -Functions of Management - Principles of management - Management by objectives - Management by exception .

**UNIT-II PLANNINGAND ORGANIZING 9**

Definitions of planning -Nature of planning - Importance of planning - Limitations of planning - Process / steps of planning -Elements of planning - Decision making - Characteristics of decision making - Process / steps of decision making-Nature of Organisation-Principles of Organisation - Advantages of Organisation - Process / steps of Organisation - Formal & Informal Organisation - Organisational Structure (Types) - Organisation chart - delegation - Process / steps of delegation - Centralisation - De-Centralisation

**UNIT - III CO-ORDINATION AND CONTROLLING 9**

Definition of Co-ordination - characteristics of Co-ordination - Benefits of Co-ordination - Problems in Coordination -Techniques of Co-ordination - Definition of controlling - characteristics of control function – Control process –Communication - Characteristics of Communication - Process of Communication - Formal & Informal Communication - Upward & Downward Communication - Sideward Communication – Written Communication -Barriers in

**UNIT - IV INDIVIDUÁL BEHAVIOUR 9**

Meaning of Organizational behavior, contributing disciplines, importance of organizational behavior, Perception and Learning - Personality and Individual Differences - Motivation theories and Job Performance - Values, Attitudes and Beliefs - Communication Types- Process - Barriers - Making Communication Effective.

**UNIT - V GROUP BEHAVIOUR 9**

Groups and Teams: Definition, Difference between groups and teams, Stages of Group Development, Group Cohesiveness, Types of teams, Group Dynamics - Leadership - Styles - Approaches - Power and Politics .

**TOTAL: 45 PERIODS**

**OUTCOMES:**

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

On the successful completion of the course, student will be able to:

1. Explain Management principles into management practices and Managers manage business in global context with different strategies and to determine the effective ways of controlling, and decision making.
2. Understand and explain all the managerial functions.
3. Demonstrate the applicability of the concept of organizational behavior to understand the behavior of people in the organization and management of individual behavior in the organization.
4. Analyze the complexities associated with management of the group behavior in the organization.
5. Demonstrate how the organizational behavior can integrate in understanding the motivation (why) behind behavior of people in the organization.
6. Managerial functions like planning, organizing, staffing, leading & controlling and have same basic knowledge on international aspect of management and the degree to which one can make an individual to think beyond self.

**REFERENCES:**

1. Stephen P. Robins, Organizational Behavior, Pearson Education, Edition 16, 2022.
2. Steven L. Mc Shane, Mary Ann Von Glinow, et al. Organizational Behavior, Edition 9, 2022
3. PC Tripathi, PN Reddy, Ashish Bajpai, Principles of Management, Tata McGraw Hill,

20HS5A2	INDUSTRIAL MARKETING	L	T	P	C
		3	0	0	3

**OBJECTIVES:**

- To study the basics of Industrial Marketing.
- To know about the Management of Industrial Marketing
- To understand the methods of Strategic Planning and Implementation process.
- To learn the process of Logistics, Marketing Control and Channel Optimization

**PRE-REQUISITE:NIL**

**UNIT-I Basics of Industrial Marketing 9**

Introduction to Industrial Marketing- Industrial versus Consumer Marketing- Economics of Industrial Demand Classification of Industrial Customers- Unique Characteristics of Organizational Procurement-Purchasing in Government Units

**UNIT-II Management of Industrial Marketing 9**

Industrial Buying Behaviour in Indian context- Conceptualization of Buying Behavior-Stages in Buying Uncertainty Management in Industrial Marketing- Purchasing Agents in Industrial Buying-Negotiation in Industrial Marketing

**UNIT - III Strategic Planning and Implementation 9**

Process of Strategic Planning-Macro and Micro Variables Used to Segment Industrial Marketing- Managing the Development of Strategic Planning- Understanding Strategy Formulation and Strategy Implementation Industrial Marketing Strategy Components - Industrial Marketing Research for New Product Development Industrial Marketing Strategy in India.

**UNIT - IV Logistics, Marketing Control and Channel Optimization 9**

Marketing Logistics- Physical Distribution and Customer Services- Marketing Control Channel Participants-Channel Functions and Dual Channels-Choosing the Right Distributor-Distribution and Manufacturers' Representatives

**UNIT - V Pricing and Sales Force Planning 9**

Price: A Crucial Element in Product Strategy- The nature of Derived Demand- Segregation of New Product Cost- Pricing in Industrial Marketing- Segregation of New Product Cost - Industrial Product Pricing in India Development of Industrial Sales Force-Motivation of Sales Force- Effective Use of Sales Compensation

**TOTAL: 45 PERIODS**

**OUTCOMES:**

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

- Compare industrial vs consumer marketing and the classifications of industrial customers.
- Develop Negotiation and buying techniques for industrial products .

- Formulate strategic plan and implementation methods.
- Develop techniques of Logistics, Marketing Control and Channel Optimization
- Identify Pricing tactics and Sales Force Planning techniques
- Manage the entire industrial marketing process.

**REFERENCES:**

1. Industrial Marketing: A Process of Creating and Maintaining Exchange by krishnamacharyulu Csg,Lalitha R, Publisher: Jaico Book House,
2. Industrial Marketing by Ghosh, Publisher: Oxford University Press,2019
3. Industrial Marketing 2e by K. K. Havaldar, Publisher: Tata McGraw-Hill Publishing Company limited,2016
4. Industrial Marketing Management by Govindarajan, Vikas Publishing House.2018
5. Industrial Marketing by Phadtare -M. T, Prentice Hall of India Private Limited ,2020

<b>20HS6B1</b>	<b>PROJECT MANAGEMENT AND ENTREPRENEURSHIP</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		3	0	0	3

**OBJECTIVES:**

- To make them understand the concepts of project management for planning to execution of projects.
- To develop and strengthen entrepreneurial quality and motivation in students and to impart basic entrepreneurial skills and understanding to run a business efficiently and effectively.

**PRE-REQUISITE: NIL**

**UNIT - I PROJECT MANAGEMENT 9**

Project management: meaning, scope & importance, role of project manager - Project life-cycle and Project appraisal - project feasibility report- Technical appraisal, Environmental appraisal, Market appraisal and Managerial appraisal.

**UNIT - II PROJECT FINANCING 9**

Project cost estimation & working capital requirements - sources of funds - capital budgeting - Risk & uncertainty in project evaluation - preparation of projected financial statements viz. Projected balance sheet - projected income statement - projected funds & cash flow statements - Preparation of detailed project report - Project finance.

**UNIT - III ENTREPRENEURSHIP 9**

Entrepreneurship need and scope - Entrepreneurial competencies and traits - Factors affecting entrepreneurial development - Entrepreneurial motivation (Mc Clelland's Achievement motivation theory) - conceptual model of entrepreneurship - entrepreneur vs. intrapreneur - Classification of entrepreneurs - Entrepreneurial Development Programmes.

**UNIT - IV ENTREPRENEURIAL IDEA AND INNOVATION 9**

Introduction to Innovation - Entrepreneurial Idea Generation and Identifying Business Opportunities - Management skills for Entrepreneurs and managing for Value Creation - Creating and Sustaining Enterprising Model - Organizational Effectiveness.

**UNIT - V SOCIAL ENTREPRENEURSHIP 9**

Social Sector Perspectives and Social Entrepreneurship - Social Entrepreneurship Opportunities and Successful Models - Social Innovations and Sustainability - Marketing Management for Social Ventures - Risk Management in Social Enterprises - Legal Framework for Social Ventures.

**TOTAL: 45 PERIODS**

**TEXT BOOKS:**

1. Robert D. Hisrich, Michael P. Peters and Dean A. Shepherd, "Entrepreneurship", McGraw Hill Education, Tenth Edition, 2018.
2. Peter F. Drucker, "Innovation and Entrepreneurship", Harper Business, 2006.

**REFERENCES:**

1. Anil K. Gupta, "Grassroots Innovation: Minds on the Margin Are Not Marginal Minds", Random House, 2016.
2. V.S.P.Rao, "Business, Entrepreneurship and Management", Vikas Publishing, 2014.
3. Rajeev Roy, "Entrepreneurship", Oxford University Press, 2011.

4. Roman Pichler, “Agile Product Management with Scrum Creating Products That Customers Love”, Pearson India, 2013.
5. John M. Nicholas and Herman Steyn, “Project Management for Engineering, Business and Technology”, A Butterworth-Heinemann Title, Fourth Edition, 2011

**OUTCOMES:**

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

<b>Course Name : Project Management and Entrepreneurship</b>		<b>Course Code : 20HS6B1</b>												
<b>CO</b>	<b>Course Outcomes</b>	<b>Unit</b>	<b>K-CO</b>	<b>POs</b>	<b>PSOs</b>									
CO1	Conclude the project characteristics and various stages of a project.	1	K6	8,9,10,11										
CO2	Compile the conceptual clarity about project organization and feasibility.	2	K5	8,9,10,11										
CO3	Apply the risk management plan and analyze the role of stakeholders.	3	K3	8,9,10,11										
CO4	Analyze the social responsibility for an entrepreneurship.	4	K4	7,8,9,10,11										
CO5	Interpret the gain knowledge to overcome the factors affecting small-scale business.	4	K3	8,9,10,11										
CO6	Formulate a new small-scale business.	5	K6	7,8,9,10,11										
<b>CO-PO Mapping</b>														
<b>COs</b>	<b>PO 1</b>	<b>PO 2</b>	<b>PO 3</b>	<b>PO 4</b>	<b>PO 5</b>	<b>PO 6</b>	<b>PO 7</b>	<b>PO8</b>	<b>PO9</b>	<b>PO 10</b>	<b>PO1 1</b>	<b>PO1 2</b>	<b>PSO 1</b>	<b>PSO 2</b>
CO1								2	2	2	3			
CO2								2	2	2	3			
CO3								2	2	2	3			
CO4							3	2	2	2	3			
CO5								2	2	2	3			
CO6							3	2	2	2	3			



**TEXT BOOKS:**

1. K.V.Nithyananda, "Intellectual Property Rights: Protection and Management", Cengage Learning India Pvt. Ltd., 2019.
2. P.Neeraj and D.Khusdeep, "Intellectual Property Rights", PHI Learning Pvt. Ltd., 2014.

**REFERENCES:**

1. V.K.Ahuja, "Law Relating to Intellectual Property Rights", Lexis Nexis, Third Edition, 2017.
2. Journal of Intellectual Property Rights (JIPR): NISCAIR
3. Cell for IPR Promotion and Management (<http://cipam.gov.in/>)
4. World Intellectual Property Organization (<https://www.wipo.int/about-ip/en/>)
5. Office of the Controller General of Patents, Designs & Trademarks (<http://www.ipindia.nic.in/>)

<b>Course Name : Intellectual Property Rights</b>		<b>Course Code : 20HS6A1</b>													
<b>CO</b>	<b>Course Outcomes</b>	<b>Unit</b>	<b>K-CO</b>	<b>POs</b>	<b>PSOs</b>										
CO1	Explain the fundamental aspects of Intellectual property Rights which plays a major role in development and management of innovative projects in industries.	1	K2	6,7,8,10,11,12											
CO2	Describe the patents, patent regime in India and abroad and registration aspects.	2	K2	6,7,8,10,11,12											
CO3	Describe the copyrights and its related rights and registration aspects.	3	K2	6,7,8,10,11,12											
CO4	Explain the trademarks and registration	4	K2	6,7,8,10,11,12											
CO5	Explain the Design, Geographical Indication (GI), Plant Variety and Layout Design Protection and their registration aspects.	5	K2	6,7,8,10,11,12											
CO6	Analyze the current trends in IPR and Government steps in fostering IPR.	5	K2	6,7,8,10,11,12											
<b>CO-PO Mapping</b>															
<b>CO</b>	<b>PO 1</b>	<b>PO 2</b>	<b>PO 3</b>	<b>PO 4</b>	<b>PO 5</b>	<b>PO 6</b>	<b>PO 7</b>	<b>PO 8</b>	<b>PO 9</b>	<b>PO 10</b>	<b>PO 11</b>	<b>PO 12</b>	<b>PSO 1</b>	<b>PSO 2</b>	<b>PSO 3</b>
CO1						1	1	1		1	1	1			
CO2						1	1	1		1	1	1			
CO3						1	1	1		1	1	1			
CO4						1	1	1		1	1	1			
CO5						1	1	1		1	1	1			
CO6						1	1	1		1	1	1			

<b>20HS7A2</b>	<b>TOTAL QUALITY 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:**

- To understand TQM Concepts and importance of customers.
- To know about TQM Principles, understand about employee involvement and supplier partnership.
- To understand six sigma, Traditional tools, New tools, Benchmarking and FMEA.
- To understand Control charts, Taguchi Quality Loss function, QFD, TPM and Performance measures.
- To understand the various elements of Quality Management System and Environment Management System.

**PREREQUISITE: NIL**

**UNIT - I INTRODUCTION 9**

Quality – Need, Evolution, Definitions, Dimensions of product and service quality. TQM - Basic concepts, Framework, Contributions of Deming, Juran and Crosby, Barriers. Quality statements, Customer satisfaction, Customer complaints, Customer retention, Costs of quality

**UNIT - II TQM PRINCIPLES 9**

Strategic quality planning, Quality Councils, Employee involvement, Motivation, Empowerment, Teamwork, Quality circles, Recognition and Reward, Performance appraisal, Continuous process improvement - PDCA cycle, 5S, Kaizen, Supplier partnership, Supplier selection, Supplier Rating.

**UNIT - III TQM TOOLS AND TECHNIQUES I 9**

Traditional tools of quality, New management tools. Six sigma: Concepts, Methodology, applications to manufacturing, service sector including IT, Bench marking, Reason to bench mark, Bench marking process, FMEA - Stages, Types.

**UNIT - IV TQM TOOLS AND TECHNIQUES II 9**

Control Charts, Process Capability, Quality Function Development (QFD), Taguchi quality loss function, TPM - Concepts, improvement needs, Performance measures.

**UNIT - V QUALITY SYSTEMS 9**

Need for ISO 9000, ISO 9001-2008 Quality System, Elements, Documentation, Quality Auditing, QS 9000 - ISO 14000, Concepts, Requirements and Benefits, TQM Implementation in manufacturing and service sectors

**TOTAL : 45 PERIODS**

**TEXT BOOKS:**

1. Dale H. Besterfield, et al., "Total quality Management", Pearson Education Asia, 5th Edition, 2018.
2. James R. Evans and William M. Lindsay, "The Management and Control of Quality", Cengage Learning, 8th Edition, 2012.
3. Suganthi.L and Anand Samuel, "Total Quality Management", Prentice Hall (India) Pvt. Ltd., 2nd Edition, 2006.

**REFERENCES:**

1. Joel.E. Ross, "Total Quality Management – Text and Cases", CRC Press, 5th Edition, 2017.
2. Kiran.D.R, "Total Quality Management: Key concepts and case studies, Butterworth – Heinemann Ltd, 1st Edition, 2016.
3. Oakland, J.S. "TQM – Text with Cases", Butterworth – Heinemann Ltd., Oxford, 3rd Edition, 2012.
4. Janakiraman. B and Gopal .R.K., "Total Quality Management - Text and Cases", Prentice Hall (India) Pvt. Ltd., 1st Edition, 2006.
5. Brue G, "Six Sigma for Managers", Tata-McGraw Hill, 2nd Edition, 2002.

**OUTCOMES:**

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

Course Name : Total Quality Management									Course Code : 20HS7A2						
CO	Course Outcomes								Unit	K-CO	POs	PSOs			
CO1	Explain basic concepts, TQM framework, Barriers Benefits of TQM and importance of customers								1	K2	1,5,6,8 -12				
CO2	Explain the TQM Principles, understand the importance of employee involvement and supplier partnership								2	K2	1,5, 6,8 -12				
CO3	Explain the basics of Six Sigma, Traditional tools, New tools ,								3	K2	1,5,6,8 -12				
CO4	Explain the process of Benchmarking and FMEA.								3	K2	1,5,6,8 -12				
CO5	Explain process capability, QFD, TPM, Taguchi quality loss function and performance measures								4	K2	1,5,6,8 -12				
CO6	Explain the Quality system ISO 9000, ISO 14000, Audit, Certification process and implementation of TQM in manufacturing and service sectors								5	K2	1,6,7,8-12				
CO-PO Mapping															
COs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2	PSO 3
CO1	1				1	2		2	2	2	2	1			
CO2	1				2	2		2	2	2	2	1			
CO3	1				2	2		2	2	2	2	1			
CO4	1				2	2		2	2	2	2	1			
CO5	1				2	2		2	2	2	2	1			
CO6	1				-	2	2	2	2	2	2	1			

<b>20HS8A1</b>	<b>HUMAN RELATIONS AT WORK</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		3	0	0	3

**OBJECTIVES:**

- To create awareness of human relations at work its relationship with self.
- To create awareness about the processes involved in interaction with people at work.
- To understand the importance of psychological and physical health in maintaining human relations at work and progressing in career.

**PRE-REQUISITE : NIL**

**UNIT-I INTRODUCTION TO HUMAN RELATIONS 9**

Understanding and Managing Yourself – Human Relations and You – Self-Esteem and Self – Confidence – Self-Motivation and Goal Setting – Emotional Intelligence – Attitudes and Happiness – Values and Ethics – Problem Solving and Creativity.

**UNIT-II HUMAN RELATIONS AT WORK 9**

Dealing Effectively with People – Communication in the Workplace – Specialized Tactics for Getting Along with Others in the Workplace – Managing Conflict – Becoming an Effective Leader – Motivating Others and Developing Teamwork – Diversity and Cross-Cultural Competence.

**UNIT - III STAYING PHYSICALLY HEALTHY 9**

Yoga: Ashtanga, Yam and Niyam, Asan – Pranayam – Exercise: Aerobic and anaerobic.

**UNIT - IV STAYING PSYCHOLOGICALLY HEALTHY 9**

Managing Stress and Personal Problems – Meditation – Cognitive, behavioural and emotional well-being.

**UNIT - V DEVELOPING CAREER THRUST 9**

Getting Ahead in Your Career – Learning Strategies – Perception – Life Span Changes – Developing Good Work Habits.

**TOTAL: 45 PERIODS**

**TEXT BOOKS:**

1. Andrew DuBrin, "Human Relations for Career and Personal Success: Concepts, Applications, and Skills", Pearson Education, Eleventh Edition, 2016.
2. Swami Vivekananda, "Raja-Yoga or Conquering the Internal Nature", Vedanta Press, 1998.

**REFERENCES:**

1. Jerrold S. Greenberg, "Comprehensive Stress Management", McGraw-Hill Humanities Social, Thirteenth Edition, 2012.
- 2.Y.Udai, "Yogasan aur pranayama", N.S. Publications, New Delhi, 2015.  
Janardan Swami Yogabhyasi Mandal, "Yogic Asanas for Group Training - Part-I",Nagpur.

**OUTCOMES:**

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

Course Name : Human Relations at Work					Course Code : 20HS8A1										
CO	Course Outcomes				Unit	K-CO	POs	PSOs							
CO1	Implement the elements of Emotional Intelligence and create a plan for continual improvement.				1	K3	6,8,9,10								
CO2	Demonstrate the elements of teamwork such as team development stages, leadership skills, team dynamics, problems solving and decision making approaches, and team building.				2	K3	6,8,9,10								
CO3	Employ active listening skills including paraphrasing, questioning, empathetic listening, analytic listening, responding and communicating non-verbally while respecting individual differences.				2	K3	6,8,9,10								
CO4	Identify various Yoga Postures.				3	K3	6,8,9,10								
CO5	Develop an action plan to increase personal motivation in a personal and or workplace situation.				4	K3	6,8,9,10								
CO6	Identify different elements of organizational behavior and change including organizational climate, culture, power, ethics, and organizational development techniques to develop a change model for an aspect of their personal and or professional life.				5	K3	6,8,9,10								
CO-PO Mapping															
COs	PO 1	PO2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO1 1	PO 12	PS O1	PS O2	PSO 3
CO1	3	3	3	3											
CO2	3	3	3	3											
CO3	3	3	3	3											
CO4	3	3	3	3											
CO5	3	3	3	3											
CO6	3	3	3	3											

<b>20HS8B2</b>	<b>ECONOMICS FOR ENGINEERS</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 fundamental economic concepts
- To understand cost estimation concepts
- To understand value engineering
- To understand project appraisal and methods of analysis
- To understand the methods of depreciation

**PRE-REQUISITE: NIL**

**UNIT - I INTRODUCTION TO ECONOMICS 9**

Introduction to Economics- Flow in an economy, Law of supply and demand, Concept of Engineering Economics – Engineering efficiency, Economic efficiency, Scope of engineering economics – Element of costs, Marginal cost, Marginal Revenue, Sunk cost, Opportunity cost, Break-even analysis - V ratio, Elementary economic Analysis – Material selection for product Design selection of a product, Process planning.

**UNIT - II COST ESTIMATION AND MACRO ECONOMICS 9**

Cost and revenue concepts- Determination of equilibrium price under perfect competition - Banking – Inflation - National Income

**UNIT - III VALUE ENGINEERING 9**

Make or buy decision, Value engineering – Function, aims, Value engineering procedure: Interest formulae and their applications –Time value of money, Single payment compound amount factor, Single payment present worth factor, Equal payment series sinking fund factor, Equal payment series payment Present worth factor- equal payment series capital recovery factor - Uniform gradient series annual equivalent factor, Effective interest rate, Examples in all the methods.

**UNIT - IV PROJECT APPRAISAL AND ANALYSIS 9**

Methods of comparison of alternatives – present worth method (Revenue dominated cashflow diagram), Future worth method (Revenue dominated cash flow diagram, cost dominated cash flow diagram), Annual equivalent method (Revenue dominated cash flow diagram, cost dominated cash flow diagram),rate of return method, Examples in all the methods.

**UNIT - V DEPRECIATION 9**

Depreciation- Introduction, Straight line method of depreciation, declining balance method of depreciation-Sum of the years digits method of depreciation, sinking fund method of depreciation/ Annuity method of depreciation, service output method of depreciation-Evaluation of public alternatives- introduction, Examples, Inflation adjusted decisions – procedure to adjust inflation, Examples on comparison of alternatives and determination of economic life of asset.

**TOTAL: 45 PERIODS**

**TEXT BOOK:**

1. Panneer Selvam, R, "Engineering Economics", Prentice Hall of India Ltd, New Delhi,2001.

**REFERENCES:**

1. ChanS.Park, "Contemporary Engineering Economics", PrenticeHallofIndia,2011.
2. Donald.G. Newman, Jerome.P.Lavelle, "Engineering Economics and analysis" Engg.Press,Texas,2010.
3. Degarmo, E.P., Sullivan, W.G and Canada, J.R, "Engineering Economy", Macmillan, NewYork,2011.
4. ZahidAkhan:"Engineering Economy", DorlingKindersley,2012

**OUTCOMES:**

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

Course Name : ECONOMICS FOR ENGINEERS						Course Code : 20HS8B2								
CO	Course Outcomes					Unit	K-CO	POs	PSOs					
CO1	Describe the concept of engineering economics\					1	K2	6-10	1,2					
CO2	Comprehend macroeconomic principles					2	K2	6-10	1,2					
CO3	Decision making in diverse business set up					3	K2	6-10	1,2					
CO4	Explain the Inflation & Price Change					3	K2	6-10	1,2					
CO5	Explain Present Worth Analysis					4	K2	6-10	1,2					
CO6	Apply the principles of economics through various case studies					5	K3	6-10,11	1,2					
CO-PO mapping														
CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1						1	1	2	2	2			1	1
CO2						1	1	2	2	2			1	1
CO3						1	1	2	2	2			1	1
CO4						1	1	2	2	2			1	1
CO5						1	1	2	2	2			1	1
CO6						1	1	2	2	2	2		1	1

<b>200EA05</b>	<b>ESSENTIALS OF 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 the fundamentals of network security
- To acquire knowledge on standard algorithms used to provide confidentiality, integrity and authenticity.
- To understand the various key distribution and management schemes.
- To understand how to deploy encryption techniques to secure data in transit across datanetworks.
- To design security applications in the field of Information technology

**UNIT I INTRODUCTION 10**

Services, Mechanisms and attacks-Classical Encryption techniques (Symmetric cipher model, substitution techniques, transposition techniques). Finite fields and number theory: Groups, Rings, Euclid’s Algorithm-Finite fields- Polynomial Arithmetic –Prime numbers-Fermat’s and Euler’s Theorem-Testing for primality -The Chinese remainder theorem

**UNIT II BLOCK CIPHERS & PUBLIC KEY ENCRYPTION 10**

Data Encryption Standard-Block cipher design principles-block cipher modes of operation-Advanced Encryption Standard (AES)-Triple DES-Blowfish-RC5 algorithm. Public key encryption: Principles of public key cryptosystems-The RSA algorithm – Key Management - Diffie Hellman Key exchange.

**UNIT III HASH FUNCTIONS AND DIGITAL SIGNATURES 9**

Authentication requirement – Authentication function – MAC – Hash function – Security of hash function and MAC –MD5 - SHA - HMAC – Digital signature and authentication protocols – DSS

**UNIT IV E-MAIL, IP & WEB SECURITY 8**

E-mail Security: Pretty Good Privacy-S/MIME. IP Security: Overview of IPSec - IP security policy-Encapsulation Security Payload (ESP)- Web Security: Web Security Considerations-Secure Socket Layer (SSL)-Transport Layer Security (TLS)- -Secure Electronic Transaction (SET).

**UNIT V SYSTEM SECURITY 8**

Authentication applications – Kerberos – X.509 Authentication services - Firewalls – Types of Firewalls- Firewall design principles- Trusted System. Intruders – Intrusion detection – Virusesand related threats – Virus Countermeasures

**TOTAL: 45 PERIODS**

**REFERENCES:**

1. Behrouz A. Ferouzan, "Cryptography & Network Security", Tata McGraw Hill, 2007.
2. Bruce Schneier and Neils Ferguson, "Practical Cryptography", First Edition, Wiley Dream techIndia Pvt Ltd, 2003.
3. Charles Pfleeger, "Security in Computing", 4<sup>th</sup> Edition, Prentice Hall of India, 2006.
4. Charlie Kaufman and Radia Perlman, Mike Speciner, "Network Security", Second Edition, Private Communication in Public World, PHI 2002.
5. Douglas R Simson, "Cryptography – Theory and practice", First Edition, CRC Press, 1995.
6. Ulysess Black, "Internet Security Protocols", Pearson Education Asia, 2000.
7. William Stallings, "Cryptography and Network Security", 6<sup>th</sup> Edition, Pearson Education, March 2013.
8. Man Young Rhee, "Internet Security: Cryptographic Principles-Algorithms and Protocols", Wiley Publications, 2003.

**COURSE OUTCOMES:**

**At the end of the course, the student should be able to:**

<b>Course Name: ESSENTIALS OF NETWORK SECURITY</b>		<b>Course Code: 200EA05</b>												
<b>CO</b>	<b>Course Outcomes</b>	<b>Unit</b>	<b>K-CO</b>	<b>POs</b>	<b>PSOs</b>									
CO1	Compare various Security Techniques Design Secure Applications Inject secure coding in the developed applications	1	K2	1,2,8,9,10,12	1									
CO2	Analyze the vulnerabilities in any computing system and hence be able to design a security solution.	2	K2	1,2,8,9,10,12	1									
CO3	Analyze the possible security attacks in complex real time systems and their effective countermeasures	3	K2	1,2,8,9,10,12	1									
CO4	Identify the security issues in the network and resolve it.	4	K2	1,2,8,9,10,12	1									
CO5	Understand the various security mechanisms using rigorous approaches,	5	K2	1,2,8,9,10,12	1									
CO6	Evaluate the security mechanisms such as theoretical derivation, modeling, and simulations	5	K3	1,2,3,8,9,10,12	1									
<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>
CO1	2	1	-	-	-	-	-	1	1	1	-	1	2	-
CO2	2	1	-	-	-	-	-	1	1	1	-	1	2	-
CO3	2	1	-	-	-	-	-	1	1	1	-	1	2	-
CO4	2	1	-	-	-	-	-	1	1	1	-	1	2	-
CO5	2	1	-	-	-	-	-	1	1	1	-	1	2	-
CO6	3	2	1	-	-	-	-	1	1	1	-	1	2	-

<b>200EA06</b>	<b>ETHICAL HACKING BASICS</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 about the importance of information security
- To learn different scanning and enumeration methodologies and tools
- To understand various hacking techniques and attacks
- To be exposed to programming languages for security professionals
- To get familiarized with the different phases in penetration testing

**UNIT I INTRODUCTION TO HACKING 9**

Introduction to Hacking – Importance of Security – Elements of Security – Phases of an Attack – Types of Hacker Attacks – Hactivism – Vulnerability Research – Introduction to Footprinting – Information Gathering Methodology – Footprinting Tools – WHOIS Tools – DNS Information Tools – Locating the Network Range –Meta Search Engines.

**UNIT II SCANNING AND ENUMERATION 9**

Introduction to Scanning – Objectives – Scanning Methodology – Tools – Introduction to Enumeration– Enumeration Techniques – Enumeration Procedure – Tools.

**UNIT III SYSTEM HACKING 9**

Authentication requirement – Authentication function – MAC – Hash function – Security of hash function and MAC –MD5 - SHA - HMAC – Digital signature and authentication protocols – DSS

**UNIT IV PROGRAMMING FOR SECURITY PROFESSIONALS 9**

Programming Fundamentals – C language – HTML – Perl – Windows OS Vulnerabilities – Tools forIdentifying Vulnerabilities – Countermeasures – Linux OS Vulnerabilities – Tools for Identifying Vulnerabilities – Countermeasures.

**UNIT V PENETRATION TESTING 9**

Introduction – Security Assessments – Types of Penetration Testing- Phases of Penetration Testing –Tools – Choosing Different Types of Pen-Test Tools – Penetration Testing Tools

**TOTAL: 45 PERIODS**

**TEXT BOOKS**

1. Michael T. Simpson, Kent Backman, and James E. Corley, Hands-On Ethical Hacking and Network Defense, Course Technology, Delmar Cengage Learning, 2010.
2. The Basics of Hacking and Penetration Testing - Patrick Engebretson, SYNGRESS, Elsevier, 2013.
3. The Web Application Hacker’s Handbook: Finding and Exploiting Security Flaws,Dafy ddStuttard and Marcus Pinto, 2011.

**REFERENCES**

1. Black Hat Python: Python Programming for Hackers and Pentesters, Justin Seitz , 2014.

**COURSE OUTCOMES:**

At the end of the course, the student should be able to:

Course Name: ETHICAL HACKING BASICS		Course Code: 200EA06												
CO	Course Outcomes	Unit	K-CO	POs									PSOs	
CO1	Express knowledge on basics of computer based vulnerabilities	1	K2	1,2,8,9,10,12									1	
CO2	Understand the different foot printing, reconnaissance and scanning methods.	2	K2	1,2,8,9,10,12									1	
CO3	Demonstrate the enumeration and vulnerability analysis methods	3	K2	1,2,8,9,10,12									1	
CO4	Gain knowledge on hacking options available in Web and wireless applications.	4	K2	1,2,8,9,10,12									1	
CO5	Acquire knowledge on the options for network protection.	5	K2	1,2,8,9,10,12									1	
CO6	Use Penetration test tools for security assessment	5	K3	1,2,3									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	-	1	2	-
CO2	2	1	-	-	-	-	-	1	1	1	-	1	2	-
CO3	2	1	-	-	-	-	-	1	1	1	-	1	2	-
CO4	2	1	-	-	-	-	-	1	1	1	-	1	2	-
CO5	2	1	-	-	-	-	-	1	1	1	-	1	2	-
CO6	3	2	1											

<b>200EA07</b>	<b>FUNDAMENTAL OF CYBER FORENSICS</b>	<b>L T P C</b>
		<b>3 0 0 3</b>

**OBJECTIVES:**

- To learn cyber crime and forensics
- To become familiar with forensics tools
- To learn to analyze and validate forensics data
- To understand cyber laws and the admissibility of evidence with case studies
- To learn the vulnerabilities in network infrastructure with ethical hacking

**UNIT I INTRODUCTION TO CYBER CRIME AND FORENSICS 9**

Introduction to Traditional Computer Crime, Traditional problems associated with Computer Crime. Role of ECD and ICT in Cybercrime - Classification of Cyber Crime. The Present and future of Cybercrime - Cyber Forensics -Steps in Forensic Investigation - Forensic Examination Process - Types of CF techniques - Forensic duplication and investigation - Forensics Technology and Systems - Understanding Computer Investigation – Data Acquisition.

**UNIT II EVIDENCE COLLECTION AND FORENSICS TOOLS 9**

Processing Crime and Incident Scenes – Digital Evidence - Sources of Evidence -Working with File Systems. - Registry - Artifacts - Current Computer Forensics Tools: Software/ Hardware Tools - Forensic Suite - Acquisition and Seizure of Evidence from Computers and Mobile Devices - Chain of Custody

**UNIT III ANALYSIS AND VALIDATION 9**

Validating Forensics Data – Data Hiding Techniques – Performing Remote Acquisition – Network Forensics – Email Investigations – Cell Phone and Mobile Devices Forensics - Analysis of Digital Evidence - Admissibility of Evidence - Cyber Laws in India - Case Studies

**UNIT IV ETHICAL HACKING 9**

Introduction to Ethical Hacking - Footprinting and Reconnaissance - Scanning Networks - Enumeration - System Hacking - Malware Threats – Sniffing – Email Tracking

**UNIT V ETHICAL HACKING IN WEB 9**

Social Engineering - Denial of Service - Session Hijacking - Hacking Web servers - Hacking Web Applications – SQL Injection - Hacking Wireless Networks - Hacking Mobile Platforms.

**TOTAL: 45 PERIODS**

**TEXT BOOKS**

1. Bill Nelson, Amelia Phillips, Christopher Steuart, — Guide to Computer Forensics and InvestigationsII, Cengage Learning, India Sixth Edition, 2019.
2. CEH official Certified Ethical Hacking Review Guide, Wiley India Edition, Version 11, 2021.
3. Dejeey, S. Murugan - Cyber Forensics, Oxford University Press, India, 2018

**REFERENCES**

1. John R.Vacca, “Computer Forensics “, Cengage Learning, 2005
2. MarjieT.Britz, “Computer Forensics and Cyber Crime: An Introduction 3rd Edition, Prentice Hall, 2013.
3. AnkitFadia “ Ethical Hacking, Second Edition, Macmillan India Ltd, 2006
4. Kenneth C.Brancik “Insider Computer FraudII Auerbach Publications Taylor &Francis Group– 2008.

**COURSE OUTCOMES:**

At the end of the course, the student should be able to:

Course Name: FUNDAMENTAL OF CYBER FORENSICS		Course Code: 200EA07												
CO	Course Outcomes	Unit	K-CO	POs	PSOs									
CO1	Understand Cyber Crime and Forensics	1	K2	1,2,8,9,10,12	1									
CO2	Utilize Forensic Tools for Evidence Collection	2	K2	1,2,8,9,10,12	1									
CO3	Analyze and Validate Digital Evidence	3	K2	1,2,8,9,10,12	1									
CO4	Demonstrate Ethical Hacking Techniques	4	K2	1,2,8,9,10,12	1									
CO5	Assess Security Threats in Web	5	K2	1,2,8,9,10,12	1									
CO6	the Security Threats in Mobile Environments	5	K3	1,2,8,9,10,12	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	-	1	2	-
CO2	2	1	-	-	-	-	-	1	1	1	-	1	2	-
CO3	2	1	-	-	-	-	-	1	1	1	-	1	2	-
CO4	2	1	-	-	-	-	-	1	1	1	-	1	2	-
CO5	2	1	-	-	-	-	-	1	1	1	-	1	2	-
CO6	2	1	-	-	-	-	-	1	1	1	-	1	2	-

<b>200EA08</b>	<b>CYBER LAW AND POLICIES</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, explore, and acquire a critical understanding cyber law.
- To develop competencies for dealing with frauds and deceptions (confidence tricks, scams) and other cyber-crimes for example, child pornography etc. that are taking place via the internet.

**UNIT I INTRODUCTION TO CYBER LAW EVOLUTION OF COMPUTER TECHNOLOGY 9**

Emergence of Cyber space. Cyber Jurisprudence, Jurisprudence and law, Doctrinal approach, Consensual approach, Real Approach, Cyber Ethics, Cyber Jurisdiction, Hierarchy of courts, Civil and criminal jurisdictions, Cyberspace-Web space, Web hosting and web Development agreement, Legal and Technological Significance of domain Names, Internet as a tool for global access.

**UNIT II INFORMATION TECHNOLOGY ACT 9**

Overview of IT Act, 2000, Amendments and Limitations of IT Act, Digital Signatures, Cryptographic Algorithm, Public Cryptography, Private Cryptography, Electronic Governance, Legal Recognition of Electronic Records, Legal Recognition of Digital Signature Certifying Authorities, Cyber Crime and Offences, Network Service Providers Liability, Cyber Regulations Appellate Tribunal, Penalties and Adjudication.

**UNIT III CYBER LAW AND RELATED LEGISLATION 9**

Patent Law, Trademark Law, Copyright, Software – Copyright or Patented, Domain Names and Copyright disputes, Electronic Data Base and its Protection, IT Act and Civil Procedure Code, IT Act and Criminal Procedural Code, Relevant Sections of Indian Evidence Act, Relevant Sections of Bankers Book Evidence Act, Relevant Sections of Indian Penal Code, Relevant Sections of Reserve Bank of India Act, Law Relating To Employees And Internet, Alternative Dispute Resolution , Online Dispute Resolution (ODR).

**UNIT IV ELECTRONIC BUSINESS AND LEGAL ISSUES 9**

Evolution and development in E- commerce, paper vs paper less contracts E-Commerce models- B2B, B2C, E security. Business, taxation, electronic payments, supply chain, EDI, E-markets, Emerging Trends.

**UNIT V CASE STUDY ON CYBER CRIMES 9**

Harassment Via E-Mails, Email Spoofing (Online A Method Of Sending E-Mail Using A False Name Or E-Mail Address To Make It Appear That The E-Mail Comes From Somebody Other Than The True Sender, Cyber Pornography (Exm.MMS),Cyber-Stalking.

**TOTAL: 45 PERIODS**

**TEXT BOOKS :**

1. K.Kumar, "Cyber Laws: Intellectual property & E Commerce, Security", 1<sup>st</sup> Edition, Dominant Publisher, 2011.
2. Rodney D. Ryder, "Guide To Cyber Laws", Second Edition, Wadhwa And Company, New Delhi, 2007.
3. Information Security policy & implementation Issues, NIIT, PHI.

**REFERENCES :**

1. Vakul Sharma, "Handbook Of Cyber Laws" Macmillan India Ltd, 2<sup>nd</sup> Edition, PHI, 2003.
  2. Justice Yatindra Singh, " Cyber Laws", Universal Law Publishing, 1<sup>st</sup> Edition, New Delhi, 2003.
  3. Sharma, S.R., "Dimensions Of Cyber Crime", Annual Publications Pvt. Ltd., 1<sup>st</sup> Edition, 2004.
- Augustine, Paul T., " Cyber Crimes And Legal Issues", Crecent Publishing Corporation, 2007.

**COURSE OUTCOMES:**

**At the end of the course, the student should be able to:**

<b>Course Name: CYBER LAW AND POLICIES</b>		<b>Course Code: 200EA08</b>												
<b>CO</b>	<b>Course Outcomes</b>	<b>Unit</b>	<b>K-CO</b>	<b>POs</b>	<b>PSOs</b>									
CO1	Describe the concepts of cyber Space and Cyber Laws	1	K2	1,2,8,9	-									
CO2	Understand the Information Technology ACT	2	K2	1,2,10	-									
CO3	Describe the cyber laws and various relevant sections	3	K2	1,2,8,9	-									
CO4	Discuss the Electronic commerce and E Security	4	K2	1,2,10	1,2									
CO5	Describe the emerging trends and security	5	K2	1,2,8,9	1,2									
CO6	Discuss the various Case Studies on Real Time Crimes	5	K3	1,2,10,12	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>
CO1	2	1	-	-	-	-	-	1	1	-	-	-	-	-
CO2	2	1	-	-	-	-	-	-	-	1	-	-	-	-
CO3	2	1	-	-	-	-	-	1	1	-	-	-	-	-
CO4	2	1	-	-	-	-	-	-	-	1	-	-	1	1
CO5	2	1	-	-	-	-	-	1	1	-	-	-	1	1
CO6	2	1	-	-	-	-	-	-	-	1	-	1	1	1