K.L.N. COLLEGE OF ENGINEERING

Pottapalayam – 630 612, Sivagangai District

(An Autonomous Institution, Affiliated to Anna University, Chennai)

Estd: 1994

FINAL YEAR

CURRICULUM AND SYLLABUS

REGULATIONS 2020

For Under Graduate Program

B. TECH – INFORMATION TECHNOLOGY

CHOICE BASED CREDIT SYSTEM

(For the students admitted from the academic year 2021-2022 onwards)

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 Entrepreneurshipand to nurture their character with social concern and to pursue their career in the areas ofResearch and Industry.

VISION OF THE DEPARTMENT

To emerge as a center of excellence through innovative technical education and research in information technology

MISSION OF THE DEPARTMENT

To produce competent Information Technology professionals to face the industrial and societal challenges by imparting quality education with ethical values.

PROGRAM SPECIFIC OUTCOMES (PSOs)

PSO 1: To create better learning environment in line with technological updation and research progress.

PSO 2: To give industry exposure through research and consultancy in Information and Communication Technologies

PROGRAM EDUCATIONAL OBJECTIVES (PEOs)

PEO 1: To excel in industrial or graduate work in Information Technology and multi-Disciplinary Environments.

PEO 2: To adapt to ever changing technologies by applying Engineering Principles.

PEO 3: To practice professionalism conforming to ethical values, team work and Leadership.

PROGRAM OUTCOMES (POs)

PO1: Engineering Knowledge

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

PO2: Problem Analysis

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

PO3: Design/Development of Solutions

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

PO4: Conduct Investigations of Complex Problems

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

PO5: Modern Tool Usage

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

PO6: The Engineer and Society

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

PO7: Environment and Sustainability

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

PO8: Ethics

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

PO9: Individual and Team Work

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

PO10: Communication

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

PO11: Project Management and Finance

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

PO12: Life-Long Learning

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

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REGULATIONS 2020

For Under Graduate Program

B. TECH – INFORMATION TECHNOLOGY

CHOICE BASED CREDIT SYSTEM

CATEGORY OF COURSES

i. **Humanities and Social Sciences (HS) Courses** include Technical English, Environmental Science and Engineering, Engineering Ethics and human values, Communication Skills and Management courses.

ii. **Basic Sciences (BS**) **Courses** include Mathematics, Physics, and Chemistry.

iii. **Engineering Sciences (ES) Courses** include Engineering Practices, Engineering Graphics, Basics of Electrical / Electronics / Mechanical / Computer Engineering / Instrumentation etc.

iv. **Professional Core (PC) Courses** include the core courses relevant to the chosen programme of study.

v. **Professional Elective (PE) Courses** include the elective courses relevant to the chosen programme of study.

vi. **Open Elective (OE) Courses** include courses from other departments which a student can choose from the list specified in the curriculum of the students B.E. / B.Tech. Programmes.

vii. **Employability Enhancement Courses (EEC)** include Project Work and/or Internship, Seminar, Professional Practices, Case Study and Industrial/Practical Training.

viii. **Mandatory Courses (MC)** include Personality and Character development and the courses recommended by the regulatory bodies such as AICTE, UGC, etc

SEMESTER VII

S. NO	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
THEORY								
1		Professional Elective - IV	PE	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
THEORY CUM PRACTICAL								
6	20IT701	Cryptography Concepts and Techniques	PC	5	3	0	2	4
PRACTICAL								
7	20IT7L1	Mini Project-II	EEC	4	0	0	4	2
TOTAL				**24**	**18**	**0**	**6**	**21**

* Common to B.E CSE Programme

SEMESTER VIII

S. NO.	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
PRACTICAL								
1	20IT8L1	Project work	EEC	20	0	0	20	10
TOTAL				**20**	**0**	**0**	**20**	**10**

PROFESSIONAL ELECTIVE COURSES: VERTICALS

Cloud Computing and Data Center Technologies	Cyber Security and Data Privacy	Full Stack Development for IT	Innovative Computing Technologies	Artificial Intelligence & Machine Learning
Cloud Computing Techniques	Social Network Analysis	Principles of Programming Languages	Robotic Process Automation	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 Network and Deep Learning	Neural Network and Deep Learning
Software Defined Networks	Cryptocurrency and Block chain Technologies	Software Testing and Automation	Cryptocurrency and Block chain Technologies	Robotic Process and 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

Registration of Professional Elective Courses from Verticals:

Professional Elective Courses will be registered in Semesters V to VII. These courses are listed in groups called verticals that represent a particular area of specialisation / diversified group. Students are permitted to choose all the Professional Electives from a particular vertical or from different verticals.

Enrolment for B.E. / B. Tech. Minor degree (Optional)

A student can also optionally register for additional courses (18 credits) and become eligible for the award of B.E./B.Tech (Honors) or B.E./B.Tech Minor degree. For minor degree, a student shall register for the additional courses (18 credits) from semester V onwards. All these courses have to be in a particular vertical from any one of the other programmes. For more details on B.E./B.Tech (Honours) or Minor degree refer to the Regulations 2020 (Amendments), Clause 4 & Clause 16.

PROFESSIONAL ELECTIVE COURSES: VERTICALS

Vertical 1: Cloud Computing and Data Centre Technologies

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

Vertical 2: Cyber Security and Data Privacy

Sl. No.	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
1	20CSV12	Social Network Analysis	PE	3	3	0	0	3
2	20ITV22	Cyber Physical Systems	PE	3	3	0	0	3
3	20SCV32	Digital and Mobile Forensics	PE	4	2	0	2	3
4	20ITV42	Cryptocurrency and 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 3: Full Stack Development for IT

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

Vertical 4: Innovative Computing Technologies

Sl. No.	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
1	20ADV14	Robotic Process Automation	PE	3	3	0	0	3
2	20ITV24	Quantum Computing	PE	3	3	0	0	3
3	20ADV34	Neural Networks and Deep Learning	PE	4	2	0	2	3
4	20ITV42	Cryptocurrency and 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 5: Artificial Intelligence and Machine Learning

Sl. 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 Networks 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 COURSES OFFERED TO OTHER DEPARTMENTS

S.No	Course Code	Course Title	Category	Contact Periods	L	T	P	C
THEORY								
1.	20OE505	Information Security Essentials	OE	3	3	0	0	3
2.	20OE506	Principles of Cyber Physical Systems	OE	3	3	0	0	3
3.	20OE507	Concepts of Ethical Hacking	OE	3	3	0	0	3
4.	20OE508	Introduction to User Interface	OE	3	3	0	0	3

OPEN ELECTIVE II (OE II)

S.No.	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
1.	20OE105	Solar Photovoltaic Fundamentals and Applications	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.	20OE307	Fundamentals of Digital Signal Processing	OE	3	3	0	0	3
6.	20OE406	Java Script Programming	OE	3	3	0	0	3
7.	20OE407	Computer Graphics	OE	3	3	0	0	3
8.	20OE606	Modern Vehicle Technology	OE	3	3	0	0	3
9.	20OE705	Logic and Distributed Control System	OE	3	3	0	0	3
10.	20OE706	Industrial Computer Networks	OE	3	3	0	0	3

20IT701 CRYPTOGRAPHY CONCEPTS AND TECHNIQUES

L	T	P	C
3	0	2	4

OBJECTIVES:

- To understand about encryption and key generation techniques.
- To understand Cryptography Theories, Algorithms and Systems.
- To learn about Authentication and security measures.
- To understand various attacks present over encryption and authentications techniques.
- To understand necessary Approaches and Techniques to build protection mechanisms in order to secure computer networks.
- To study security system Practice and Techniques.

PRE-REQUISITE:

Course Code:20CS501

Course Name: Computer Networks

UNIT I INTRODUCTION **9**

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

LAB COMPONENT **6**

1. Perform encryption, decryption using the following substitution techniques
   (i) Ceaser cipher, (ii) playfair cipher iii) Hill Cipher iv) Vigenere cipher
2. Perform encryption and decryption using following transposition techniques
   i) Rail fence ii) row & Column Transformation

UNIT II SYMMETRIC CRYPTOGRAPHY **9**

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

LAB COMPONENT **6**

1. Apply DES algorithm for practical applications.
2. Apply AES algorithm for practical applications.

UNIT III PUBLIC KEY CRYPTOGRAPHY **9**

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

LAB COMPONENT **6**

1. Implement RSA Algorithm using HTML and JavaScript
2. Implement the Diffie-Hellman Key Exchange algorithm for a given problem.

UNIT IV MESSAGE AUTHENTICATION AND INTEGRITY **9**

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

LAB COMPONENT **6**

1. Calculate the message digest of a text using the SHA-1 algorithm.
2. Implement the Signature Scheme – Digital Signature Standard.

UNIT V SECURITY PRACTICE AND SYSTEM SECURITY TECHNIQUES 9

Electronic Mail security – PGP, S/MIME – IP security – Web Security - *System Security Techniques:* Intruders-Intrusion Detection–Password Management– Malicious software – viruses – Firewalls-Firewall Design Principles-Trusted Systems.

LAB COMPONENT 6

1. Demonstrate intrusion detection system (ids) using any tool eg. Snort or any other s/w.
2. Automated Attack and Penetration Tools Exploring N-Stalker, a Vulnerability Assessment Tool
3. Defeating Malwarei) Building Trojans ii) Rootkit Hunter

TOTAL: 75 PERIODS

TEXT BOOKS

1. William Stallings, Cryptography and Network Security: Principles and Practice, Pearson India Education, Seventh Edition, 2017.
2. Behrouz A Forouzan & Debdeep Mukhopadhyay , Cryptography and Network Security, Tata McGraw Hill, 3rd Edition,2007.

REFERENCES:

1. C K Shyamala, N Harini and Dr. T R Padmanabhan: Cryptography and Network Security, Wiley India Pvt.Ltd.,2011
2. Charlie Kaufman, Radia Perlman, and Mike Speciner, Network Security: Private Communication in a Public World, Prentice Hall(Pearson education), Third Edition, 2022

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS:

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

OUTCOMES

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

Course Name : CRYPTOGRAPHY CONCEPTS AND TECHNIQUES		**Course Code : 20IT701**			
CO	**Course Outcomes**	**Unit**	**K-CO**	**POs**	**PSOs**
C401.1	Understand the fundamentals of networks security, security architecture, threats and vulnerabilities.	1	K2	1, 2, 8, 9	1
C401.2	Apply the different cryptographic operations of symmetric cryptographic algorithms	2	K2	1, 2,3, 8, 9, 10	1
C401.3	Apply the different cryptographic operations of public key cryptography	3	K2	1, 2, 3, 8,9, 10	1
C401.4	Apply the various Authentication schemes to simulate different applications.	4	K3	1,2,,8, 9,12	1
C401.5	Understand various Security practices and System security standards	4	K3	1, 2, 3,8,9,12	1
C401.6	Build cryptosystems by applying symmetric and public key encryption algorithms.	5	K2	1,2,3,5, 8, 9, 12	1,2
C401.7	Demonstrate the network security system using open source tools	5	K2	1, 2, 3, 5,8, 9,12	1.2

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	-
C401.2	3	2	1		-	-	-	1	1	1	-	-	1	-
C401.3	3	2	1		-	-	-	1	1	1	-	-	1	-
C401.4	2	1			-	-	-	1	1	-	-	1	1	-
C401.5	2	1			-	-	-	1	1	1	-	1	1	-
C401.6	3	2	1		1	-	-	1	1	-	-	1	1	2
C401.7	3	2	1		1	-	-	1	1	-	-	1	1	1

20IT7L1 **MINI PROJECT-II** **L T P C**

0 0 4 2

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 thee 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:

Course Name : Mini Project		**Course Code : 20IT7L1**		
CO	**Course Outcomes**	**K-CO**	**POs**	**PSOs**
C402.1	Identify a problem and its applicability along with suitable domain.	K3	1-12	1,2
C402.2	Analyze and formulate project modules and identified constraints based on environmental and societal impact.	K4	1-12	1,2
C402.3	Select efficient tools and methods for designing and implementing project modules.	K4	1-12	1,2
C402.4	Propose an effective solution for the problem identified with the help of developed methodology and tools	K6	1-12	1,2
C402.5	Summarize all the modules through effective integration and testing.	K5	1-12	1,2
C402.6	Illustrate the completed task and compile the project report.	K4	1-12	1,2

CO-PO Mapping

COs ↓	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
C402.1	3	2	1	-	-	3	3	3	3	3	2	2	3	3
C402.2	3	3	2	1	2	3	3	2	2	2	3	2	3	3
C402.3	3	3	2	1	3	2	2	2	2	2	3	2	3	3
C402.4	3	3	3	3	3	3	3	2	2	2	3	2	3	3
C402.5	3	3	3	2	3	3	3	2	2	2	3	2	3	3
C402.6	3	3	2	1	1	1	1	3	3	3	2	2	3	3

20IT8L1	PROJECT WORK	L	T	P	C
		0	0	20	10

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 : 20CS8L1		
CO	**Course Outcomes**	**K-CO**	**POs**	**PSOs**
C403.1	Identify a domain and problem by applying required domain knowledge.	K3	1,2,3,6,7,8,9,10, 11,12	1,2
C403.2	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
C403.3	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
C403.4	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
C403.5	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
C403.6	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

COs ↓	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
C410.1	3	2	1	-	-	3	3	3	3	3	2	2	3	3
C410.2	3	3	2	1	2	3	3	2	2	2	3	2	3	3
C410.3	3	3	2	1	3	2	2	2	2	2	3	2	3	3
C410.4	3	3	3	3	3	3	3	2	2	2	3	2	3	3
C410.5	3	3	3	2	3	3	3	2	2	2	3	2	3	3
C410.6	3	3	2	1	1	1	1	3	3	3	2	2	3	3

20CSV11	CLOUD COMPUTING TECHNIQUES	L	T	P	C
		2	0	2	3

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 Techniques		**Course Code : 20CSV11**			
CO	**Course Outcomes**	**Unit**	**K-CO**	**POs**	**PSOs**
CO1	Describe the cloud architecture, cloud deployment & service models and challenges of cloud design	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

20CSV21	DATA WAREHOUSING AND DATA MINING	L	T	P	C
		3	0	0	3

OBJECTIVES:

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

PRE-REQUISITE:

Course Code : 20CS402
Course Name : Database Management Systems

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

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

UNIT - II DATA MINING - INTRODUCTION 9

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

UNIT - III FREQUENT PATTERN ANALYSIS 9

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

UNIT - IV CLASSIFICATION AND CLUSTERING 9

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

UNIT - V DATA MINING TOOLS 9

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

TOTAL: 45 PERIODS

TEXT BOOKS:

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

REFERENCES:

3. James E. Smith, Ravi Nair, "Virtual Machines: Versatile Platforms for Systems and Processes", Elsevier/Morgan Kaufmann, 2005.
4. 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 : DATA WAREHOUSING AND DATA MINING		**Course Code : 20CSV21**			
CO	**Course Outcomes**	**Unit**	**K-CO**	**POs**	**PSOs**
CO1	Discuss data warehouse system and business analysis with OLAP tools	1	K2	1,2	1,2
CO2	Describe various pre-processing and visualization techniques for data analysis	2	K2	1,2,8,9	1,2
CO3	Apply frequent pattern and association rule mining techniques	3	K3	1,2,3,8,9	1,2
CO4	Select and apply an appropriate classification algorithm for labeled data	4	K3	1,2,3,8,9,12	1,2
CO5	Apply various clustering techniques for unlabeled data	4	K3	1,2,3,8,9,12	1,2
CO6	Apply learning and clustering algorithms using data mining tools	5	K3	1,2,3,8,9,12	1,2

CO-PO Mapping														
COs ↓	**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	1
CO3	3	2	1	-	-	-	-	2	2	-	-	-	2	1
CO4	3	2	1	-	-	-	-	2	2	-	-	1	2	1
CO5	3	2	1	-	-	-	-	2	2	-	-	1	2	1
CO6	3	2	1	-	-	-	-	2	2	-	-	1	2	1

20CSV31	CLOUD SERVICE MANAGEMENT	L	T	P	C
		3	0	0	3

OBJECTIVES:

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

PRE-REQUISITE: NIL

UNIT - I CLOUD SERVICE MANAGEMENT FUNDAMENTALS 9

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

UNIT - II CLOUD SERVICES STRATEGY 9

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

UNIT - III CLOUD SERVICE MANAGEMENT 9

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

UNIT - IV CLOUD SERVICE ECONOMICS 9

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

UNIT - V CLOUD SERVICE GOVERNANCE & VALUE 9

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

TOTAL: 45 PERIODS

TEXT BOOKS:

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

REFERENCES:

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

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

Course Name : CLOUD SERVICE MANAGEMENT											**Course Code : 20CSV31**			
CO	**Course Outcomes**										**Unit**	**K-CO**	**POs**	**PSOs**
CO1	Discuss the fundamentals of cloud service management										1	K2	1,2	2
CO2	Describe the cloud service strategies like cloud policy, risk management and change management etc.,										2	K2	1,2,8,9	2
CO3	Explain the life cycle and benchmarks of cloud services										3	K2	1,2,8,9	2
CO4	Illustrate deployment and migration of cloud services										3	K2	1,2,8,9	2
CO5	Discuss the economic based cloud services										4	K2	1,2,8,9,10	2
CO6	Explain the strong theoretical foundation leading to cloud service governance & measuring the value of cloud-based services										5	K2	1,2,8,9,10	2
CO-PO Mapping														
CO ↓	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	2	1	-	-	-	-	-	-	-	-	-	-	-	2
CO2	2	1	-	-	-	-	-	1	1	-	-	-	-	2
CO3	2	1	-	-	-	-	-	1	1	-	-	-	-	2
CO4	2	1	-	-	-	-	-	1	1	-	-	-	-	2
CO5	2	1	-	-	-	-	-	1	1	1	-	-	-	2
CO6	2	1	-	-	-	-	-	1	1	1	-	-	-	2

		L	T	P	C
20CSV41	SOFTWARE DEFINED NETWORKS	3	0	0	3

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 Comprehens 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 Beginnersll, 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 openflow 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	-

20ADV51	STORAGE TECHNOLOGIES	L	T	P	C
		3	0	0	3

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 VIRTUALIZATION 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 SAN connectivity, Converged Enhanced Ethernet, FCoE architecture.

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

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

REFERENCE:

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

OUTCOMES:

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

Course Name : STORAGE TECHNOLOGIES				**Course Code : 20ADV51**	
CO	**Course Outcomes**	**Unit**	**K-CO**	**POs**	**PSOs**
CO1	Demonstrate the fundamentals of information storage management and various models of Cloud infrastructure services and deployment	1	K2	1,2,9,10,12	-
CO2	Illustrate the usage of advanced intelligent storage systems and RAID	2	K3	1,2,3,9,10,12	-
CO3	Identify various storage networking architectures - SAN	3	K3	1,2,3,9,10,12	-
CO4	Apply storage subsystems and Virtualization	3	K3	1,2,3,9,10,12	-
CO5	Examine the different role in providing disaster recovery and remote replication technologies	4	K3	1,2,3,9,10,12	-
CO6	Infer the security needs and security measures to be employed in information storage Management	5	K2	1,2,9,10,12	-

CO-PO Mapping

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

20ITV63	INFORMATION RETRIEVAL TECHNIQUES	L	T	P	C
		3	0	0	3

OBJECTIVES:

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

PRE-REQUISITE : NIL

UNIT - I INTRODUCTION **9**

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

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

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

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

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

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

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

UNIT - V RECOMMENDER SYSTEM **9**

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

TOTAL: 45 PERIODS

TEXT BOOKS:

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

REFERENCES:

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

OUTCOMES:

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

Course Name : INFORMATION RETRIEVAL TECHNIQUES													**Course Code : 20ITV63**	
CO	**Course Outcomes**												**Unit**	**K-CO**	**POs**	**PSOs**
CO1	Explain the IR components and Web Search Engine Framework												1	K2	1, 2, 8, 9	1,2
CO2	Discuss various information retrieval models												2	K2	1, 2,8,9	1,2
CO3	Apply appropriate method of classification or clustering												3	K3	1, 2, 3, 8,9	1,2
CO4	Explain the Web Search Engine architecture and ranking functions												4	K2	1, 2,8,9	1,2
CO5	Discuss Web Link Analysis algorithms and advanced search												4	K2	1, 2,8,9	1,2
CO6	Illustrate recommendation techniques and develop content-based Recommender Systems												5	K3	1, 2, 3,5, 8,9	1,2
CO-PO Mapping																
COs ↓	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**		
CO1	2	1	-	-	-	-	-	1	1	-	-	2	2	2		
CO2	2	1	-	-	-	-	-	1	1	-	-	2	2	2		
CO3	3	2	1	-	-	-	-	1	1	-	-	2	2	2		
CO4	2	1	-	-	-	-	-	1	1	-	-	2	2	2		
CO5	2	1	-	-	-	-	-	1	1	-	-	2	2	2		
CO6	3	2	1	-	1	-	-	1	1	-	-	2	2	2		

20SCV71 **SECURITY AND PRIVACY IN CLOUD**

L	T	P	C
3	0	0	3

OBJECTIVES:

- To Introduce Cloud Computing terminology, definition & concepts
- To understand the security design and architectural considerations for Cloud
- To understand the Identity, Access control in Cloud
- To follow best practices for Cloud security using various design patterns
- To be able to monitor and audit cloud applications for security

PRE-REQUISITE : NIL

UNIT - I FUNDAMENTALS OF CLOUD SECURITY CONCEPTS 9

Overview of cloud security- Security Services - Confidentiality, Integrity, Authentication, Non repudiation, Access Control - Basic of cryptography - Conventional and public-key cryptography, hash functions, authentication, and digital signatures.

UNIT - II SECURITY DESIGN AND ARCHITECTURE FOR CLOUD 9

Security design principles for Cloud Computing - Comprehensive data protection - End-to-end access control - Common attack vectors and threats - Network and Storage - Secure Isolation Strategies - Virtualization strategies - Inter-tenant network segmentation strategies - Data Protection strategies: Data retention, deletion and archiving procedures for tenant data, Encryption, Data Redaction, Tokenization, Obfuscation, PKI and Key.

UNIT - III ACCESS CONTROL AND IDENTITY MANAGEMENT 9

Access control requirements for Cloud infrastructure - User Identification - Authentication and Authorization - Roles-based Access Control - Multi-factor authentication - Single Sign-on, Identity Federation - Identity providers and service consumers - Storage and network access control options - OS Hardening and minimization - Verified and measured boot - Intruder Detection and prevention.

UNIT - IV CLOUD SECURITY DESIGN PATTERNS 9

Introduction to Design Patterns, Cloud bursting, Geo-tagging, Secure Cloud Interfaces, Cloud Resource Access Control, Secure On-Premise Internet Access, Secure External Cloud.

UNIT - V MONITORING, AUDITING AND MANAGEMENT 9

Proactive activity monitoring - Incident Response, Monitoring for unauthorized access, malicious traffic, abuse of system privileges - Events and alerts - Auditing – Record generation, Reporting and Management, Tamper-proofing audit logs, Quality of Services, Secure Management, User management, Identity management, Security Information and Event Management

TOTAL: 45 PERIODS

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:

Course Name : SECURITY AND PRIVACY IN CLOUD		Course Code : 20SCV71			
CO	**Course Outcomes**	**Unit**	**K-CO**	**POs**	**PSOs**
CO1	Discuss the fundamental concepts of cloud security	1	K2	1,2,8,9	1,2
CO2	Illustrate the various cloud security design for cloud	2	K2	1,2,8,9	1,2
CO3	Apply data protection strategies for cloud	2	K3	1,2,5,8,9,10	1,2
CO4	Identify the cloud requirements, storage and network access control options	3	K2	1,2,8,9	1,2
CO5	Explain the different types of architectural and design considerations for security in the cloud.	4	K2	1,2,8,9	1,2
CO6	Explain the various risks, audit and monitoring mechanisms in the cloud.	5	K2	1,2,8,9	1,2

CO-PO Mapping

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

20ITV81	REINFORCEMENT LEARNING TECHNIQUES	L	T	P	C
		3	0	0	3

Objectives :

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

PRE-REQUISITE: NIL

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 selection - associative search

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

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

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

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

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

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

UNIT V VALUE FUNCTION APPROXIMATION **9**

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

TOTAL: 45 PERIODS

TEXT BOOKS :

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

REFERENCES:

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

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

COs ↓	**PO 1**	**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

20CSV12	SOCIAL NETWORK ANALYSIS	L	T	P	C
		3	0	0	3

Objectives :

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

PRE-REQUISITE:

Course Code **:**20CS501
Course Name :Computer Networks

UNIT I INTRODUCTION **9**

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

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

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

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

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

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

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

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

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

TOTAL: 45 PERIODS

TEXT BOOKS :

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

REFERENCES:

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

OUTCOMES:

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

Course Name : SOCIAL NETWORK ANALYSIS		**Course Code : 20CSV12**			
CO	**Course Outcomes**	**Unit**	**K-CO**	**POs**	**PSOs**
CO1	Explain the semantic web concepts and applications of social network analysis.	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

COs ↓	**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

		L	T	P	C
20ITV22	CYBER PHYSICAL SYSTEMS	3	0	0	3

OBJECTIVES:

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

PRE-REQUISITE: NIL

UNIT I INTRODUCTION 9

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

UNIT II SYNCHRONOUS AND ASYNCHRONOUS MODEL 9

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

UNIT III SAFETY AND LIVENESS REQUIREMENT 9

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

UNIT IV TIMED MODEL AND REAL-TIME SCHEDULING 9

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

UNIT V HYBRID SYSTEMS 9

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

TOTAL: 45 PERIODS

TEXT BOOKS

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

REFERENCE:

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

OUTCOMES:

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

Course Name : CYBER PHYSICAL SYSTEMS				Course Code :20ITV22		
CO	**Course Outcomes**	**Unit**	**K-CO**	**POs**	**PSOs**	
CO1	Ability to understand knowledge, opportunities, challenges and Logical Foundations of Cyber Physical Systems.	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

COs ↓	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	2	1			-	-	-	1	1		-	-	1	1
CO2	2	1			-	-	-	1	1	1	-	-	1	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

20SCV32	DIGITAL AND MOBILE FORENSICS	L	T	P	C
		2	0	2	3

Objectives :

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

PRE-REQUISITE: Nil

UNIT I INTRODUCTION TO DIGITAL FORENSICS **6**

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

Lab Component: **6**

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

UNIT II DIGITAL CRIME AND INVESTIGATION **6**

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

Lab Component: **6**

1. Data extraction from call logs using Sleuth Kit.

UNIT III DIGITAL FORENSIC READINESS **6**

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

Lab Component: **6**

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

UNIT IV iOS FORENSICS **6**

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

Lab Component: **6**

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

UNIT V ANDROID FORENSICS **6**

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

Lab Component: **6**

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

TOTAL: 60 PERIODS

TEXT BOOKS :

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

REFERENCE:

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

OUTCOMES:

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

Course Name : DIGITAL AND MOBILE FORENSICS		**Course Code : 20SCV32**			
CO	**Course Outcomes**	**Unit**	**K-CO**	**POs**	**PSOs**
CO1	Explain various digital forensics process	1	K2	1,2	1,2
CO2	Discuss various digital crime and investigation methods.	2	K2	1,2,8,9	1,2
CO3	Illustrate the digital forensic readiness and challenges in digital forensic	3	K2	1,2,8,9	1,2
CO4	Identify and extract digital evidence from iOS devices.	4	K2	1,2,8,9	1,2
CO5	Discuss the basics of Android forensics	5	K2	1,2,8,9	1,2
CO6	Apply needed tools in Android devices	5	K3	1,2,3,5,8,9, 10	1,2

CO-PO Mapping

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

20ITV42 CRYPTOCURRENCY AND BLOCKCHAIN TECHNOLOGIES

L	T	P	C
3	0	0	3

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 Cryptocurrencies”, O’Reilly, 2014.

REFERENCES:

1. Daniel Drescher, “Blockchain Basics”, First Edition, Apress, 2017
2. Arvind Narayanan, Joseph Bonneau, Edward Felten, Andrew Miller, and Steven Goldfeder. Bitcoin and cryptocurrency technologies: a comprehensive introduction. Princeton University Press, 2016
3. Melanie Swan, “Blockchain: Blueprint for a New Economy”, O’Reilly, 2015

4.Ritesh Modi, “Solidity Programming Essentials: A Beginner’s Guide to Build Smart Contracts for Ethereum and Blockchain”, Packt Publishing

5. Handbook of Research on Blockchain Technology, published by Elsevier Inc. ISBN: 9780128198162, 2020.

OUTCOMES:

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

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

CO-PO Mapping

COs ↓	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
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

20SCV52 **WEB APPLICATION SECURITY**

L	T	P	C
3	0	0	3

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, SessionManagement-Input Validation

UNIT - II SECURE DEVELOPMENT AND DEPLOYMENT 9

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

UNIT - III SECURE API DEVELOPMENT 9

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

UNIT - IV VULNERABILITY ASSESSMENT AND PENETRATION TESTING 9

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

UNIT - V HACKING TECHNIQUES AND TOOLS 9

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

TOTAL: 45 PERIODS

TEXT BOOKS:

1. Andrew Hoffman, Web Application Security: Exploitation and Countermeasures for ModernWeb Applications, First Edition, 2020, O'Reilly Media, Inc.
2. Bryan Sullivan, Vincent Liu, Web Application Security: A Beginners Guide, 2012, TheMcGraw-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 TerronWilliams 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

		L	T	P	C
20CSV62	ENGINEERING SECURE SOFTWARE SYSTEMS	3	0	0	3

OBJECTIVES:

- Know the importance and need for software security.
- Know about various attacks.
- Learn about secure software design.
- Understand risk management in secure software development.
- Know the working of tools related to software security.

PRE-REQUISITE:NIL

UNIT - I NEED OF SOFTWARE SECURITY AND LOW-LEVEL ATTACKS 9

Software Assurance and Software Security - Threats to software security - Sources of software insecurity - Benefits of Detecting Software Security - Properties of Secure Software – Memory Based Attacks: Low-Level Attacks Against Heap and Stack - Defense Against Memory-Based Attacks.

UNIT - II SECURE SOFTWARE DESIGN 9

Requirements Engineering for secure software - SQUARE process Model - Requirements elicitation and prioritization- Isolating The Effects of Untrusted Executable Content - Stack Inspection – Policy Specification Languages – Vulnerability Trends – Buffer Overflow – Code Injection - Session Hijacking. Secure Design - Threat Modeling and Security Design Principles.

UNIT - III SECURITY RISK MANAGEMENT 9

Risk Management Life Cycle – Risk Profiling – Risk Exposure Factors – Risk Evaluation and Mitigation – Risk Assessment Techniques – Threat and Vulnerability Management.

UNIT - IV SECURITY TESTING 9

Traditional Software Testing – Comparison - Secure Software Development Life Cycle - Risk Based Security Testing – Prioritizing Security Testing With Threat Modeling – Penetration Testing – Planning and Scoping - Enumeration – Remote Exploitation – Web Application Exploitation - Exploits and Client Side Attacks – Post Exploitation – Bypassing Firewalls and Avoiding Detection - Tools for Penetration Testing.

UNIT - V SECURE PROJECT MANAGEMENT 9

Governance and security - Adopting an enterprise software security framework - Security and project management - Maturity of Practice.

TOTAL: 45 PERIODS

TEXT BOOKS:

1. Julia H. Allen, “Software Security Engineering”, Pearson Education, 2008
2. Evan Wheeler, “Security Risk Management: Building an Information Security Risk Management Program from the Ground Up”, First edition, Syngress Publishing, 2011
3. Chris Wysopal, Lucas Nelson, Dino Dai Zovi, and Elfriede Dustin, “The Art of Software Security Testing: Identifying Software Security Flaws (Symantec Press)”, Addison-Wesley Professional, 2006.

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

COs ↓	**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	-

20SCV82	MALWARE ANALYSIS	L	T	P	C
		2	0	2	3

OBJECTIVES:

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

PRE-REQUISITE:NIL

UNIT - I INTRODUCTION AND BASIC ANALYSIS 6

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

Lab Component: 6

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

UNIT - II ADVANCED STATIC ANALYSIS 6

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

Lab Component: 6

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

UNIT - III ADVANCED DYNAMIC ANALYSIS 6

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

Lab Component: 6

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

UNIT - IV MALWARE FUNCTIONALITY 6

Down loaders and Launchers, Backdoors, Credential Stealers, Persistence Mechanisms, Handles, Mutexes, Privilege Escalation, Covert malware launching- Launchers, Process

Injection, Process Replacement, Hook Injection, Detours, APC injection.

Lab Component: **6**

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

UNIT - V ANDROID MALWARE ANALYSIS **6**

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

Lab Component: **6**

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

TOTAL: 60 PERIODS

TEXT BOOKS:

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

REFERENCES:

1. Jamie Butler and Greg Hoglund, “Rootkits: Subverting the Windows Kernel” by 2005, Addison-Wesley Professional.
2. Bruce Dang, Alexandre Gazet, Elias Bachaalany, SébastienJosse, "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

COs ↓	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

20ITV13	PRINCIPLES OF PROGRAMMING LANGUAGES	L	T	P	C
		3	0	0	3

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 SYNTAXANDSEMANTICS **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,DATATYPES, ANDBASICSTATEMENTS **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 assignments – control structures –selection–iterations –branching–guarded statements.

UNIT III UBPROGRAMSANDIMPLEMENTATIONS **9**

Subprograms – design issues – local referencing – parameter passing – overloaded methods – generic methods – design issues for functions – semantics of call and return – implementing simplesubprograms–stackanddynamiclocalvariables–nestedsubprograms–blocks–dynamicscoping

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 FUNCTIONALANDLOGICPROGRAMMINGLANGUAGES **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,“ProgrammingLanguagePragmatics”,FourthEdition,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.Clocksin and C.S.Mellish, "Programming in Prolog: Using the ISO Standard" Fifth Edition, Springer,2003.

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

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

CO-PO Mapping

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

20CSV23	UI AND UX DESIGN	L	T	P	C
		2	0	2	3

Objectives :

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

PRE-REQUISITE: NIL

UNIT I FOUNDATIONS OF DESIGN **6**

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

Lab Component: **6**

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

UNIT II FOUNDATIONS OF UI DESIGN **6**

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

Lab Component: **6**

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

UNIT III FOUNDATIONS OF UX DESIGN **6**

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

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 - CreatingPersonas - 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
2. Sketch, design with popular tool and build a prototype and perform usability testing and identify improvements

TOTAL: 60 PERIODS

TEXT BOOKS :

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

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

COs ↓	**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

20CSV31	CLOUD SERVICE MANAGEMENT	L	T	P	C
		3	0	0	3

OBJECTIVES:

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

PRE-REQUISITE: NIL

UNIT - I CLOUD SERVICE MANAGEMENT FUNDAMENTALS 9

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

UNIT - II CLOUD SERVICES STRATEGY 9

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

UNIT - III CLOUD SERVICE MANAGEMENT 9

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

UNIT - IV CLOUD SERVICE ECONOMICS 9

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

UNIT - V CLOUD SERVICE GOVERNANCE & VALUE 9

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

TOTAL: 45 PERIODS

TEXT BOOKS:

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

REFERENCES:

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

OUTCOMES:

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

Course Name : CLOUD SERVICE MANAGEMENT		Course Code : 20CSV31			
CO	**Course Outcomes**	**Unit**	**K-CO**	**POs**	**PSOs**
CO1	Discuss the fundamentals of cloud service management	1	K2	1,2	2
CO2	Describe the cloud service strategies like cloud policy, risk management and change management etc.,	2	K2	1,2,8,9	2
CO3	Explain the life cycle and benchmarks of cloud services	3	K2	1,2,8,9	2
CO4	Illustrate deployment and migration of cloud services	3	K2	1,2,8,9	2
CO5	Discuss the economic based cloud services	4	K2	1,2,8,9,10	2
CO6	Explain the strong theoretical foundation leading to cloud service governance & measuring the value of cloud-based services	5	K2	1,2,8,9,10	2

CO-PO Mapping

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

20ITV43	SOFTWARE TESTING AND AUTOMATION	L	T	P	C
		3	0	0	3

Objectives :

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

PRE-REQUISITE: NIL

UNIT I FOUNDATIONS OF SOFTWARE TESTING 9

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

UNIT II TEST PLANNING 9

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

UNIT III TEST DESIGN AND EXECUTION 9

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

UNIT IV ADVANCED TESTING CONCEPTS 9

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

20CSV61	COMPUTER VISION	L	T	P	C
		3	0	0	3

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 flow - Layered motion.

UNIT IV 3D RECONSTRUCTION 9

Shape from X - Active rangefinding - Surface representations - Point-based representations Volumetric representations - Model-based reconstruction - Recovering texture maps and albedosos

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 recognition - Context and scene understanding- Recognition databases and test sets.

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

20ITV73	DEVOPS	L	T	P	C
		2	0	2	4

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/ ContinuousDeployment)
- To understand Configuration management using Ansible
- Illustrate the benefits and drive the adoption of cloud-based Devops tools to solve realworld problems

PRE-REQUISITE: Nil

UNIT I INTRODUCTION TO DEVOPS **6**

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

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 Gradle, Understand build using Gradle.

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 Jenkins Build and Jenkins workspace

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

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.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

2.Jeff Geerling, “Ansible for DevOps: Server and configuration management for humans”,

3.David Johnson, “Ansible for DevOps: Everything You Need to Know to Use Ansible for DevOps”, Second Edition, 2016.

4. Mariot Tsitoara, “Ansible Beginning Git and GitHub: A Comprehensive Guide to Version Control, Project Management, and Teamwork for the New Developer”, Second Edition, 2019

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
C	2	1	1		1			1		1			1	1

20ADV45 **ROBOTIC PROCESS AUTOMATION**

L	T	P	C
3	0	0	3

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 fromAutomation - Benefits of RPA - Application areas of RPA, Components of RPA, RPA Platforms.Robotic Process Automation Tools - Templates, User Interface, Domains in Activities, WorkflowFiles

UNIT - II AUTOMATION PROCESS ACTIVITIES 9

Sequence, Flowchart & Control Flow: Sequencing the Workflow, Activities, Flowchart, Control Flowfor Decision making. Data Manipulation: Variables, Collection, Arguments, Data Table, Clipboardmanagement, 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 andkeyboard actions to perform operation, Scraping data from website and writing to CSV.Process Mining

UNI - IV EXCEPTION HANDLING AND CODE MANAGEMENT 9

Exception handling, Common exceptions, Logging- Debugging techniques, Collecting crashdumps, Error reporting. Code management and maintenance: Project organization, Nestingworkflows, 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

OUTCOMES:

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

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

TEXT BOOKS

1. Learning Robotic Process Automation: Create Software robots and automate business processes with the leading RPA tool - UiPath by Alok Mani Tripathi, PacktPublishing, 2018.

2. Tom Taulli , “The Robotic Process Automation Handbook: A Guide to Implementing RPA Systems”, Apress publications, 2020.

REFERENCES:

1. Frank Casale (Author), Rebecca Dilla (Author), Heidi Jaynes (Author), Lauren Livingston(Author), Introduction to Robotic Process Automation: a Primer, Institute of Robotic Process Automation, Amazon Asia-Pacific Holdings Private Limited, 2018

2. Richard Murdoch, Robotic Process Automation: Guide To Building Software Robots,Automate Repetitive Tasks & Become An RPA Consultant, Amazon Asia-Pacific Holdings Private Limited, 2018

3. A Gerardus Blokdyk, “Robotic Process Automation Rpa A Complete Guide “, 2020

20ITV24	QUANTUM COMPUTING	L	T	P	C
		3	0	0	3

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 - Ekart 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:

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

20ADV34	NEURAL NETWORKS AND DEEP LEARNING	L	T	P	C
		2	0	2	3

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

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

COs ↓	**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

20ITV65	FUZZY LOGIC AND APPLICATIONS	L	T	P	C
		3	0	0	3

OBJECTIVES :

- To impact 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 reasonance theory – introduction – ART 1 – ART2 –Applications – neural networks based on competition – kohenen 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

REFERENCES:

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

OUTCOMES:

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

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

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

20SCV54	CYBER SECURITY	L	T	P	C
		3	0	0	3

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 : 20SCV55**			
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

C-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

20ITV64	3D PRINTING AND DESIGN	L	T	P	C
		3	0	0	3

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 – Continous jet, Mulitjet; 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 Barnatt, 3D Printing: The Next Industrial Revolution, CreateSpace Independent Publishing Platform, 2013.

2. Ian M. Hutchings, Graham D. Martin, Inkjet Technology for Digital Fabrication, John Wiley & Sons, 2013.

REFERENCES:

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

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 categorise the concepts and working principles of 3D printing using inkjet technique	3	K2	1,2,8,10	
CO4	Explain and categorise 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

20CSV74	AGILE METHODOLOGIES	L	T	P	C
		3	0	0	3

OBJECTIVES:

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

PRE-REQUISITE: NIL

UNIT - I FUNDAMENTALS OF AGILE **9**

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

UNIT - II AGILE SCRUM FRAMEWORK **9**

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

UNIT - III AGILE REQUIREMENTS ENGINEERING ANDTESTING **9**

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

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

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

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

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

TOTAL: 45 PERIODS

TEXT BOOKS:

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

REFERENCES:

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

20CSV84	VIRTUAL REALITY AND AUGMENTED REALITY	L	T	P	C
		3	0	0	3

OBJECTIVES:

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

PRE-REQUISITE:NIL

UNIT - I INTRODUCTION TO VIRTUAL REALITY 9

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

UNIT - II AUGMENTED REALITY 9

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

UNIT - III COMPUTER GRAPHICS AND GEOMETRIC MODELING 9

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

UNIT - IV DEVELOPMENT TOOLS AND FRAMEWORK 9

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

UNIT - V AUGMENTED AND VIRTUAL REALITY APPLICATION 9

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

TOTAL: 45 PERIODS

TEXT BOOKS:

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

REFERENCES:

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

OUTCOMES:

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

Course Name : VIRTUAL REALITY AND AUGMENTED REALITY		Course Code : 20CSV84			
CO	**Course Outcomes**	**Unit**	**K-CO**	**POs**	**PSOs**
CO1	Explain the Virtual Reality and Environment, Virtual Reality Requirements and benefits	1	K2	1,2,8,9	1,2
CO2	Illustrate the visualization techniques for augmented reality	2	K2	1,2,8,9, 10	1,2
CO3	Discuss the concept of Computer Graphics And Geometric Modeling	3	K2	1,2,8,9	1,2
CO4	Use various types of Hardware and software in virtual Reality systems	4	K3	1,2,3,8,9, 12	1,2
CO5	Apply Development Tools And Framework for Virtual Reality	4	K3	1,2,3, 5,6,8,9, 12	1,2
CO6	Analyze and Design a system or process to meet given specifications with Realistic Engineering Constraints	5	K4	1,2,3,4, 5,6,8,9, 10, 12	1,2

CO-PO Mapping

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

20ADV15	BUSINESS INTELLIGENCE SYETEM	L	T	P	C
		3	0	0	3

OBJECTIVES:

1. To understand the Analytics Life Cycle.
2. To comprehend the process of acquiring Business Intelligence
3. To understand various types of analytics for Business Forecasting
4. To model the supply chain management for analytics.
5. 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:45PERIODS

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:

On Completion of the course, the students should 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

COs ↓	**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

20ADV25	DATA COMMUNICATION AND COMPUTER NETWORKS	L	T	P	C
		3	0	0	3

OBJECTIVES:

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

UNIT-I DATA COMMUNICATIONS 9

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

UNIT- II DATA LINK LAYER 9

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

UNIT- III NETWORK LAYER 9

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

UNI-IV TRANSPORT LAYER 9

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

UNIT-V APPLICATION LAYER 9

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

TOTAL:45PERIODS

TEXTBOOKS

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

REFERENCES

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

OUTCOMES:

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

Course Name: DATA COMMUNICATION AND COMPUTER NETWORKS		CourseCode:20ADV25			
CO	**Course Outcomes**	**Unit**	**K-CO**	**POs**	**PSOs**
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	-

CO-PO Mapping

COs ↓	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
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	-	-	-

		L	T	P	C
20ADV55	**TEXT AND SPEECH ANALYSIS**	**3**	**0**	**0**	**3**

OBJECTIVES:

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

UNIT-I NATURAL LANGUAGE BASICS 9

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

UNIT- II TEXT CLASSIFICATION 9

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

UNIT- III QUESTION ANSWERING AND DIALOGUE SYSTEMS 9

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

UNI-IV TEXT-TO-SPEECH SYNTHESIS 9

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

UNIT-V AUTOMATIC SPEECH RECOGNITION 9

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

TOTAL: 45 PERIODS

TEXTBOOK

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

REFERENCES:

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

OUTCOMES:

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

Course Name: TEXT AND SPEECH ANALYSIS		CourseCode:20ADV55			
CO	**Course Outcomes**	**Unit**	**K-CO**	**POs**	**PSOs**
CO1	Explain existing and emerging deep learning architectures for text and speech processing	I	K2	1,2,9,10,12	1
CO2	Apply deep learning techniques for NLP tasks	II	K3	1,2,3,9,10,12	1
CO3	Understand the language modeling and machine translation	III	K2	1,2,9,10,12	1
CO4	Build question-answering systems, chatbots and dialogue systems	III	K2	1,2,9,10,12	1
CO5	Explain coreference and coherence for text processing	IV	K2	1,2,9,10,12	1
CO6	Apply deep learning models for building speech recognition and text-to-speech systems	V	K3	1,2,3,9,10,12	1

CO-PO Mapping

COs ↓	**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	-	2	1	-
CO3	2	1	-	-	-	-	-	-	2	2	-	2	1	-
CO4	2	1	-	-	-	-	-	-	2	2	-	2	1	-
CO5	2	1	-	-	-	-	-	-	2	2	-	2	1	-
CO6	3	2	1	-	-	-	-	-	2	2	-	2	1	-

		L	T	P	C
20ADV14	DATA AND INFORMATION SECURITY	3	0	0	3

COURSE OBJECTIVES:

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

UNIT-I INTRODUCTION **9**

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

UNIT- II SECURITY INVESTIGATION **9**

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

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

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

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

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

UNIT-V WEB SECURITY **9**

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

TOTAL:45 PERIODS

TEXTBOOKS

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

REFERENCES:

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

		L	T	P	C
20ADV75	**ETHICS AND AI**	**3**	**0**	**0**	**3**

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**

DefinitionofmoralityandethicsinAI-Impactonsociety-Impactonhumanpsychology-Impactonthelegalsystem-Impactontheenvironmentand the planet-Impact on trust

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

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

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

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

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

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

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

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

TOTAL: 45 PERIODS

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

OUTCOMES:

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

Course Name: ETHICS AND AI		**Course Code:20ADV75**			
CO	**Course Outcomes**	**Unit**	**K-CO**	**POs**	**PSOs**
CO1	Learn about morality and ethics in AI	I	K2	1,2,8,9,10,12	-
CO2	Acquire the knowledge of real time application ethics, issues and its challenges.	II	K2	1,2,8,9,10,12	-
CO3	Understand the ethical harms and ethical initiatives in AI	III	K2	1,2,8,9,10,12	-
CO4	Learn about AI standards and Regulations like AI Agent, Safe Design of Autonomous and Semi-Autonomous Systems	IV	K2	1,2,8,9,10,12	-
CO5	Understand the concepts of Roboethics and Morality with professional responsibilities.	IV	K2	1,2,8,9,10,12	-
CO6	Learn about the societal issues in AI with National and International Strategies on AI	V	K2	1,2,8,9,10,12	-

CO-PO Mapping														
COs ↓	**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	2	1	-	-	-	-	-	2	2	2	-	2	-	-
CO4	2	1	-	-	-	-	-	-	2	2	-	2	-	-
CO5	2	1	-	-	-	-	-	2	2	2	-	2	-	-
CO6	2	1	-	-	-	-	-	1	2	2	-	2	-	-

		L	T	P	C
20ADV85	HEALTH CARE ANALYTICS	3	0	0	3

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

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

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

UNIT-V CASE STUDIES **9**

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

TOTAL:45 PERIODS

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

COs	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	-

OPEN ELECTIVE II

20OE505	INFORMATION SECURITY ESSENTIALS	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To understand the basics of Information Security
- To know the legal, ethical and professional issues in Information Security
- To know the aspects of risk management
- To become aware of various standards in this area
- To know the technological aspects of Information Security

PRE-REQUISITE: NIL

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 SECURITY ANALYSIS **9**

Risk Management: Identifying and Assessing Risk, Assessing and Controlling Risk - Systems: Access Control Mechanisms, Information Flow and Confinement Problem

UNI - IV LOGICAL DESIGN **9**

Blueprint for Security, Information Security Policy, Standards and Practices, ISO 17799/BS 7799, NIST Models, VISA International Security Model, Design of Security Architecture, Planning for Continuity.

UNIT - V PHYSICAL DESIGN **9**

Security Technology, IDS, Scanning and Analysis Tools, Cryptography, Access Control Devices, Physical Security, Security and Personnel

TOTAL: 45 PERIODS

TEXT BOOKS

1. Michael E Whitman and Herbert J Mattord, —Principles of Information Security‖, Vikas

Publishing House, New Delhi, 2014

2. Micki Krause, Harold F. Tipton, — Handbook of Information Security Management‖, Vol 1-3 CRCPress LLC, 2007

REFERENCES:

1.Stuart McClure, Joel Scrambray, George Kurtz, —Hacking Exposedǁ, Tata McGraw- Hill, 2003

2. Matt Bishop, — Computer Security Art and Scienceǁ, Pearson/PHI, 2002.

OUTCOMES:

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

Course Name : INFORMATION SECURITY ESSENTIALS		**Course Code : 20OE505**			
CO	**Course Outcomes**	**Unit**	**K-CO**	**POs**	**PSOs**
OE5.5.1	Discuss the basics of information security	1	K2	1,2,8,9,10,12	
OE5.5.2	Illustrate the legal, ethical and professional issues in information security	2	K2	1,2,8,9,10,12	
OE5.5.3	Demonstrate the aspects of risk management.	3	K2	1,2,8,9,10,12	
OE5.5.4	Aware of various standards in the Information Security System	4	K2	1,2,8,9,10,12	1, 2
OE5.5.5	Describe the design and implementation of Security Techniques.	5	K2	1,2,8,9,10,12	1, 2
OE5.5.6	Identify the technological aspects of Information Security	5	K2	1,2,8,9,10,12	1, 2

CO-PO Mapping

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
OE5.5.1	2	1						2	2	2		2		
OE5.5.2	2	1						2	2	2		2		
OE5.5.3	2	1						2	2	2		2		
OE5.5.4	2	1						2	2	2		2	1	1
OE5.5.5	2	1						2	2	2		2	1	1
OE5.5.6	2	1						2	2	2		2	1	1

20OE506	PRINCIPLES OF CYBER PHYSICAL SYSTEMS	L	T	P	C
		3	0	0	3

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: actor models-properties of systems-feedback control-Discrete dynamics: Discrete systems- Finite state machines

UNIT II SYNCHRONOUS AND ASYNCHRONOUS MODEL 9

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

UNIT III SAFETY AND LIVENESS REQUIREMENT 9

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

UNIT IV TIMED MODEL AND REAL-TIME SCHEDULING 9

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

UNIT V HYBRID SYSTEMS 9

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

TOTAL: 45 PERIODS

TEXT BOOKS

1. Rajeev Alur, Principles of cyber-physical systems, The MIT press, 2015.
2. E. A. Lee and S. A. Seshia, Introduction to Embedded Systems - A Cyber-Physical Systems Approach, Lulu.com, First Edition, Jan 2013.

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 : PRINCIPLES OF CYBER PHYSICAL SYSTEMS			Course Code :20OE506		
CO	**Course Outcomes**	**Unit**	**K-CO**	**POs**	**PSOs**
OE5.6.1	Ability to understand knowledge, opportunities, challenges and Logical Foundations of Cyber Physical Systems.	1	K2	1, 2, 8, 9	1,2
OE5.6.2	Ability to develop model for synchronous, asynchronous, continuous and discrete systems.	2	K2	1, 2, 8,9,10	1,2
OE5.6.3	Ability to identify safety specifications and critical properties of Cyber Physical Systems.	3	K2	1, 2, 5, 8, 9	1,2
OE5.6.4	Ability to design and analyze the stability of hybrid systems.	4	K2	1, 2, 5, 8, 9,10	1,2
OE5.6.5	Ability to apply automata for timed systems.	5	K2	1, 2, 5, 8, 9	1.2
OE5.6.6	Ability to understand Zeno Behaviors	5	K2	1, 2, 5, 8, 9	1,2

CO-PO Mapping

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
OE5.6.1	2	1			-	-	-	1	1		-	-	1	1
OE5.6.2	2	1			-	-	-	1	1	1	-	-	1	1
OE5.6.3	2	1			1	-	-	1	1	-	-	1	1	1
OE5.6.4	2	1			1	-	-	1	1	1	-	1	1	1
OE5.6.5	2	1			1	-	-	1	1	-	-	1	1	1
OE5.6.6	2	1			1			1	1				1	1

20OE507	CONCEPTS OF ETHICAL HACKING	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To understand and analyze security threats & countermeasures related to Ethical Hacking.
- To learn different Scanning and Enumeration methodologies and tools.
- To understand various hacking techniques and attacks at a system level.
- To be exposed to the different hacking methods for web services and session hijacking.
- To understand the hacking mechanisms on how a wireless network is hacked.

PRE-REQUISITE: NIL

UNIT - I EHICAL HACKING OVERVIEW & VULNERABILITIES 9

Introduction to Hacking – Understanding the Importance of Security – Concept of Ethical Hacking and Essential Terminologies - Phases involved in Hacking – Types of Hacker Attacks – Vulnerability Research - Exploit- Penetration Testing – Penetration Testing Methodologies – Social Engineering

UNIT - II FOOTPRINTING & PORT SCANNING 9

Introduction to Footprinting – Information Gathering Methodology– Footprinting Tools – Introduction to Scanning – Scanning Methodology – Tools – Port Scanning – Introduction to Enumeration – Enumeration Techniques – Enumeration Procedure – Tools - Google Hacking

UNIT- III SYSTEM HACKING 9

Introduction – Various methods of Password cracking – Password Cracking Websites – Password Guessing – Role of Eavesdropping - Password Cracking Tools – Password Cracking Countermeasures – Escalating Privileges – Executing Applications – Keystroke Loggers and Spyware - Understanding Sniffers ,Comprehending Active and Passive Sniffing, ARP Spoofing and Redirection, DNS and IP Sniffing, HTTPS Sniffing.

UNIT-IV HACKING WEB SERVICES & SESSION HIJACKING 9

Web application vulnerabilities - Application coding errors - SQL injection into Back-end Databases - Cross-site scripting - Cross-site request forging - Authentication bypass - Web services and related flaws - Protective http headers - Understanding Session Hijacking - Phases involved in Session Hijacking - Types of Session Hijacking - Session Hijacking Tools

UNIT - V HACKING WIRELESS NETWORKS AND MOBILE SECURITY 9

Wireless Security : Introducing Aircrack - Role of WEP, Cracking WEP Keys, Sniffing Traffic, Wireless DOS attacks, WLAN Scanners, WLAN Sniffers, Hacking Tools, Securing Wireless Network -

Mobile Security : Android vsiOS security model, Threat Models, Information Tracking – Rootkits – Threats in Mobile Applications – Analyzer for Mobile Apps to Discover Security Vulnerabilities.

TOTAL: 45 PERIODS

TEXT BOOKS

1. EC-Council, “Ethical Hacking and Countermeasures: Attack Phases”, Cengage Learning, 2010.
2. RafayBoloch, “Ethical Hacking and Penetration Testing Guide”, CRC Press, 2017.

REFERENCES:

1. Matthew Hickey, Jennifer Arcuri, “Hands on Hacking: Become an Expert at Next Gen Penetration Testing and Purple Teaming”, 1st Edition, Wiley, 2020.
2. Kevin Beaver, “Ethical Hacking for Dummies”, Sixth Edition, Wiley, 2018.
3. Michael T. Simpson, Kent Backman, James E. Corley, “Hands-On Ethical Hacking and Network Defense”, Cengage Learning, 2013.
4. Patrick Engebretson, “The Basics of Hacking and Penetration Testing – Ethical Hacking and Penetration Testing Made Easy”, Second Edition, Elsevier, 2013.
5. Jon Erickson, “Hacking, 2nd Edition: The Art of Exploitation”, No Starch Press Inc., 2008.

OUTCOMES:

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

Course Name : CONCEPTS OF ETHICAL HACKING		**Course Code : 20OE507**			
CO	**Course Outcomes**	**Unit**	**K-CO**	**POs**	**PSOs**
OE5.7.1	Identify security threats, vulnerabilities, countermeasures related to ethical hacking.	1	K2	1, 2, 8, 9	1,2
OE5.7.2	Protect data assets and exposed to Scanning and Enumeration methodologies and tools.	2	K2	1, 2, 3, 8, 9	1.2
OE5.7.3	Defend a computer against a variety of security attacks using sniffers at different layers.	3	K2	1,2,3,8,9,12	1,2
OE5.7.4	Practice and use safe techniques on the World Wide Web.	4	K2	1,2,3,8,10,9,12	1,2
OE5.7.5	Identify the hacking mechanisms on how a wireless network is hacked.	5	K2	1,2,3,8,9,12	1,2
OE5.7.6	Describe the hacking mechanism to secure the mobile applications	5	K2	1,2,8,9,10	1,2

CO-PO Mapping

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
OE5.7.1	2	1			-	-	-	1	1		-	-	1	1
OE5.7.2	2	1			-	-	-	1	1		-	-	1	1
OE5.7.3	2	1			-	-	-	1	1	-	-	1	1	1
OE5.7.4	2	1			-	-	-	1	1	1	-	1	1	1
OE5.7.5	2	1			-	-	-	1	1	-	-	1	1	1
OE5.7.6	2	1						1	1	1			1	1

20OE508	INTRODUCTION TO USER INTERFACE	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To learn the basics of User interface.
- To learn the foundations of Human Computer Interaction.
- To be familiar with the web design components such as windows.
- To be aware of Multimedia and Windows layout.

PRE-REQUISITE: NIL

UNIT I INTRODUCTION **9**

Human–Computer Interface – Characteristics Of Graphics Interface –Direct Manipulation Graphical System – Web User Interface –Popularity –Characteristic & Principles.

UNIT II HUMAN COMPUTER INTERACTION **9**

User Interface Design Process – Obstacles –Usability –Human Characteristics In Design – Human Interaction Speed –Business Functions –Requirement Analysis – Direct – Indirect Methods – Basic Business Functions – Design Standards – System Timings – Human Consideration In Screen Design – Structures Of Menus – Functions Of Menus– Contents Of Menu– Formatting – Phrasing The Menu – Selecting Menu Choice– Navigating Menus– Graphical Menus.

UNIT III WINDOWS **9**

Characteristics– Components– Presentation Styles– Types– Managements– Organizations– Operations– Web Systems– Device– Based Controls Characteristics– Screen – Based Controls – Operate Control – Text Boxes– Selection Control– Combination Control– Custom Control– Presentation Control.

UNIT IV MULTIMEDIA **9**

Text For Web Pages – Effective Feedback– Guidance & Assistance–Internationalization– Accesssibility – Icons– Image– Multimedia – Coloring.

UNIT V WINDOWS LAYOUT– TEST **9**

Prototypes – Kinds Of Tests – Retest – Information Search – Visualization – Hypermedia – WWW– Software Tools.

TOTAL: 45 PERIODS

TEXT BOOKS

1. Wilbent. O. Galitz, “The Essential Guide To User Interface Design”, John Wiley&Sons, 2002.
2. Ben Sheiderman, “Design The User Interface”, Pearson Education, 2021.

REFERENCES:

1.Alan Cooper, "The Essential Of User Interface Design", Wiley – Dream Tech Ltd., 2002.

OUTCOMES:

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

Course Name : INTRODUCTION TO USER INTERFACE											**Course Code :20OE508**			
CO	**Course Outcomes**									**Unit**	**K-CO**	**POs**		**PSOs**
OE5.8.1	Design effective dialog using HCI.									1	K2	1, 2, 8, 9		1,2
OE5.8.2	Design effective HCI for individuals.									2	K2	1, 2, 8, 9,10		1,2
OE5.8.3	Explain the structures and functions of Menus.									3	K2	1, 2, 8, 9,12		1,2
OE5.8.4	Explain the various controls in Windows.									4	K2	1, 2, 8, 9,10,12		1,2
OE5.8.5	Assess the importance of user feedback and multimedia applications..									5	K2	1, 2, 8, 9,12		1.2
OE5.8.6	Explain the HCI implications for designing hypermedia, and learn about World Wide Web and software tools.									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**
OE5.8.1	2	1			-	-	-	1	1		-	-	1	2
OE5.8.2	2	1			-	-	-	1	1	1	-	-	1	2
OE5.8.3	2	1			-	-	-	1	1	-	-	1	1	2
OE5.8.4	2	1			-	-	-	1	1	1	-	1	1	2
OE5.8.5	2	1			-	-	-	1	1	-	-	1	1	2
OE5.8.6	2	1			-			1	1				1	2

MANAGEMENT ELECTIVE COURSES

20HS7A2 TOTAL QUALITY MANAGEMENT L T P C 3 0 0 3

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. Besterfiled, et at., "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	6,8,9,10,11,12	
CO2	Explain the TQM Principles, understand the importance of employee involvement and supplier partnership	2	K2	6,8,9,10,11,12	
CO3	Explain the basics of Six Sigma, Traditional tools, New tools ,	3	K2	6,8,9,10,11,12	
CO4	Explain the process of Benchmarking and FMEA.	3	K2	6,8,9,10,11,12	
CO5	Explain process capability, QFD, TPM, Taguchi quality loss function and performance measures	4	K2	6,8,9,10,11,12	
CO6	Explain the Quality system ISO 9000, ISO 14000, Audit, Certification process and implementation of TQM in manufacturing and service sectors	5	K2	6,7,8,9,10,11,12	

CO-PO Mapping

COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1					1	2		2	2	2	2	1			
CO2					2	2		2	2	2	2	1			
CO3					2	2		2	2	2	2	1			
CO4					2	2		2	2	2	2	1			
CO5					2	2		2	2	2	2	1			
CO6					-	2	2	2	2	2	2	1			

20HS6A1	INTELLECTUAL PROPERTY RIGHTS	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To get an adequate knowledge on patent and copyright for their innovative research works.
- To use in their career, information in patent documents provide useful insight on novelty of their idea from state-of-the art search. This provide further way for developing their idea or innovations.
- To pave the way to catch up Intellectual Property (IP) as an career option.
    - R & D IP Counsel
    - Government Jobs – Patent Examiner
    - Private Jobs
    - Patent agent and Trademark agent
    - Entrepreneur

PRE-REQUISITE: NIL

UNIT - I OVERVIEW OF INTELLECTUAL PROPERTY 9

Introduction and the need for intellectual property right (IPR) - Kinds of Intellectual Property Rights: Patent, Copyright, Trade Mark, Design, Geographical Indication, Plant Varieties and Layout Design - Genetic Resources and Traditional Knowledge - Trade Secret - IPR in India: Genesis and development - IPR in abroad - Major International Instruments concerning Intellectual Property Rights: Paris Convention - 1883, the Berne Convention - 1886, the Universal Copyright Convention - 1952, the WIPO Convention - 1967, the Patent Co-operation Treaty - 1970, the TRIPS Agreement - 1994.

UNIT - II PATENTS 9

Patents - Elements of Patentability: Novelty, Non Obviousness (Inventive Steps), Industrial Application - Non-Patentable Subject Matter - Registration Procedure - Rights and Duties of Patentee - Assignment and license - Restoration of lapsed Patents - Surrender and Revocation of Patents - Infringement - Remedies & Penalties - Patent office and Appellate Board.

UNIT - III COPYRIGHTS 9

Nature of Copyright - Subject matter of copyright: original literary, dramatic, musical, artistic works - cinematograph films and sound recordings - Registration Procedure - Term of protection - Ownership of copyright - Assignment and license of copyright - Infringement - Remedies & Penalties - Related Rights - Distinction between related rights and copyrights.

UNIT - IV TRADEMARKS 9

Concept of Trademarks - Different kinds of marks (brand names, logos, signatures, symbols, well known marks, certification marks and service marks) - Non Registrable Trademarks - Registration of Trademarks - Rights of holder and assignment and licensing of marks - Infringement, Remedies & Penalties - Trademarks registry and appellate board.

UNIT - V OTHER FORMS OF IP & REGISTRATION PROCESS 9

Design: meaning and concept of novel and original - Procedure for registration, effect of registration and term of protection.Geographical Indication (GI): meaning, and difference between GI and trademarks - Procedure for registration, effect of registration and term of protection. IPR registration process through government website-modalities and publications. Plant Variety Protection: meaning and benefit sharing and farmers' rights – Procedure for registration, effect of registration and term of protection. Layout Design Protection: meaning – Procedure for registration, effect of registration and term of protection.

TOTAL: 45 PERIODS

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/)

OUTCOMES:

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

Course Name : Intellectual Property Rights		**Course Code :**20HS6A1			
CO	**Course Outcomes**	**Unit**	**K-CO**	**POs**	**PSOs**
C320.1	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	
C320.2	Describe the patents, patent regime in India and abroad and registration aspects.	2	K2	6,7,8,10,11,12	
C320.3	Describe the copyrights and its related rights and registration aspects.	3	K2	6,7,8,10,11,12	
C320.4	Explain the trademarks and registration aspects.	4	K2	6,7,8,10,11,12	
C320.5	Explain the Design, Geographical Indication (GI), Plant Variety and Layout Design Protection and their registration aspects.	5	K2	6,7,8,10,11,12	
C320.6	Analyze the current trends in IPR and Government steps in fostering IPR.	5	K2	6,7,8,10,11,12	

CO-PO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
C320.1						1	1	1		1	1	1			
C320.2						1	1	1		1	1	1			
C320.3						1	1	1		1	1	1			
C320.4						1	1	1		1	1	1			
C320.5						1	1	1		1	1	1			
C320.6						1	1	1		1	1	1			

20HS6B1	PROJECT MANAGEMENT AND ENTREPRENEURSHIP	L	T	P	C
		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 Clellend'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:

Course Name : Project Management and Entrepreneurship		**Course Code :**20HS6B1			
CO	**Course Outcomes**	**Unit**	**K-CO**	**POs**	**PSOs**
C327.1	Conclude the project characteristics and various stages of a project.	1	K6	8,9,10,11	
C327.2	Compile the conceptual clarity about project organization and feasibility.	2	K5	8,9,10,11	
C327.3	Apply the risk management plan and analyze the role of stakeholders.	3	K3	8,9,10,11	
C327.4	Analyze the social responsibility for an entrepreneurship.	4	K4	7,8,9,10,11	
C327.5	Interpret the gain knowledge to overcome the factors affecting small-scale business.	4	K3	8,9,10,11	
C327.6	Formulate a new small-scale business.	5	K6	7,8,9,10,11	

CO-PO Mapping

Course Outcomes	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO 1**	**PSO 2**	**PSO 3**
C327.1								2	2	2	3				
C327.2								2	2	2	3				
C327.3								2	2	2	3				
C327.4							3	2	2	2	3				
C327.5								2	2	2	3				
C327.6							3	2	2	2	3				

20HS8A1	HUMAN RELATIONS AT WORK	L	T	P	C
		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.
3. 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**
C403E4.1	Implement the elements of Emotional Intelligence and create a plan for continual improvement.	1	K3	6,8,9,10	
C403E4.2	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	
C403E4.3	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	
C403E4.4	Identify various Yoga Postures.	3	K3	6,8,9,10	
C403E4.5	Develop an action plan to increase personal motivation in a personal and or workplace situation.	4	K3	6,8,9,10	
C403E4.6	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**	**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**	**PSO3**
C403E4.1	3	3	3	3	-	-	-	-	-	-	-	-	-	-	-
C403E4.2	3	3	3	3	-	-	-	-	-	-	-	-	-	-	-
C403E4.3	3	3	3	3	-	-	-	-	-	-	-	-	-	-	-
C403E4.4	3	3	3	3	-	-	-	-	-	-	-	-	-	-	-
C403E4.5	3	3	3	3	-	-	-	-	-	-	-	-	-	-	-
C403E4.6	3	3	3	3	-	-	-	-	-	-	-	-	-	-	-

20HS8B2	ECONOMICS FOR ENGINEERS	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To understand the fundamental economic concepts
- To understand cost estimation concepts
- To understand value engineering
- To understand project appraisal and methods of anlaysis
- 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 cash flow 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 BOOKS:

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

REFERENCES:

1. ChanS.Park,“ContemporaryEngineeringEconomics”, 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:EngineeringEconomy,"EngineeringEconomy", 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**
C403E5.1	Describe the concept of engineering economics	1	K2	1,2,8	1,2
C403E5.2	Comprehend macroeconomic principles	2	K2	1,2,8	1,2
C403E5.3	Decision making in diverse business set up	3	K2	1,2,8	1,2
C403E5.4	Explain the Inflation & Price Change	3	K2	1,2,8	1,2
C403E5.5	Explain Present Worth Analysis	4	K2	1,2,8	1,2
C403E5.6	Apply the principles of economics through various case studies	5	K3	1,2,3,8	1,2

CO-PO mapping

CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
C403E5.1	2	1	-	-	-	1	1	2	2	2	-	-	1	1
C403E5.2	2	1	-	-	-	1	1	2	2	2	-	-	1	1
C403E5.3	2	1	-	-	-	1	1	2	2	2	-	-	1	1
C403E5.4	2	1	-	-	-	1	1	2	2	2	-	-	1	1
C403E5.5	2	1	-	-	-	1	1	2	2	2	-	-	1	1
C403E5.6	2	1	-	-	-	1	1	2	2	2	2	-	1	1

20HS5A1	MANAGEMENT CONCEPTS & ORGANIZATIONAL BEHAVIOR	L	T	P	C
		3	0	0	3

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 - Defintion 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 Communication - Measures to overcome communication barriers

UNIT - IV INDIVIDUAL 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

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, AshishBajpai, Principles of Management, Tata McGraw Hill,

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.

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
- To understand the techniques of Pricing and Sales Force Planning

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