K.L.N.COLLEGEOFENGINEERING

Pottapalayam–630612, Sivagangai District

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

Estd:1994

FINAL YEAR

CURRICULUMANDSYLLABUS

REGULATIONS 2020

For Under Graduate Program

B.TECH. ARTIFICIAL INTELLIGENCE AND DATA SCIENCE

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 Entrepreneurship and to nurture their character with social concern and to pursue their career in the areas of Research and Industry.

VISION OF THE DEPARTMENT

To become a centre of Excellence in producing competent and futuristic professionals in Artificial Intelligence and Data Science through quality Education and Research to the Society and Industry.

MISSIONOFTHEDEPARTMENT

To produce intellectual, innovative and ethical professionals by imparting technical and industry oriented skills with ethical values in Artificial Intelligence and allied areas to pursue their career in Industry and Research.

K.L.N. COLLEGE OF ENGINEERING, POTTAPALAYAM

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

PROGRAM SPECIFIC OUTCOMES (PSOs)

PSO 1:Ability to apply major key algorithms, techniques and theoretical findings in the field of Artificial Intelligence, Machine Learning and Deep Learning.

PSO 2: Ability to incorporate data science theories an methodologies into new research in data management, data visualization, and statistical analysis of data.

PROGRAM EDUCATIONAL OBJECTIVES (PEOs)

PEO 1:To excel in professional career and pursue higher education in the field of artificial intelligence and data science.

PEO 2: To apply their knowledge and skills to develop innovative solutions for real world problem through lifelong learning.

PEO 3: To excel as socially committed engineers or entrepreneurs with good communication and team work skills with high regard to ethical and moral values.

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 multi disciplinary 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 multi disciplinary environments.

PO12:Life-LongLearning

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

REGULATIONS2020

For Under Graduate Program

B. TECH - ARTIFICIAL INTELLIGENCE AND DATA SCIENCE

CHOICE BASED CREDIT SYSTEM

CATEGORYOFCOURSES

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

K.L.N. COLLEGE OF ENGINEERING, POTTAPALAYAM

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B.TECH- ARTIFICIAL INTELLIGENCE AND DATA SCIENCE
REGULATIONS – 2020

CHOICE BASED CREDIT SYSTEM

SEMESTER VII

Sl. No.	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
1	20CS701	Data Analytics	PC*	3	3	0	0	3
2	20AD701	Artificial Intelligence for Robotics	PC	3	3	0	0	3
3	20AD702	Cloud Computing	PC	3	3	0	0	3
4		Professional Elective-V	PE	3	3	0	0	3
5		Professional Elective–VI	PE	3	3	0	0	3
6		Open Elective–II	OE	3	3	0	0	3
PRACTICAL								
7	20AD7L1	Data Exploration Laboratory	PC	4	0	0	4	2
8	20AD7L2	Cloud Computing Laboratory	PC	4	0	0	4	2
9	20AD7L3	Mini Project	EEC	4	0	0	4	2
	TOTAL			**30**	**18**	**0**	**12**	**24**

*** Common to B.E CSEProgramme**

SEMESTER VIII

S. No	COURSE CODE	COURSE TITLE	Category	Contact Periods	L	T	P	C
PRACTICAL								
1	20AD8L1	Project work	EEC	20	0	0	20	10
TOTAL				**20**	**0**	**0**	**20**	**10**

PROFESSIONALELECTIVECOURSES:VERTICALS

Cloud Computing and Data Center Technologies	Cyber Security and Data Privacy	Full Stack Development for IT	Innovative Computing Technologies	Expert Systems
Virtualization	Social Network Analysis	Principles of Programming Languages	Data and Information Security	Business Intelligence System
Data Warehousing and Data Mining	Cyber Physical Systems	UI and UX Design	Quantum Computing	Data Communication and Computer Networks
Cloud Services Management	Digital and Mobile Forensics	Cloud Services Management	Neural Networks and Deep Learning	Neural Networks and Deep Learning
Software Defined Networks	Cryptocurrency and Block chain Technologies	Software Testing and Automation	Cryptocurrency and Block chain Technologies	Robotic Process andAutomation
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	Sensors and Devices
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	20ADV11	Virtualization	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	Data and Information Security	PE	3	3	0	0	3
2	20ITV24	Quantum Computing	PE	3	3	0	0	3
3	20ADV34	Neural Networks and Deep Learning	PE	4	2	0	2	3
4	20ITV42	Cryptocurrency and 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: EXPERT SYSTEMS

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	3	2	0	2	3
4	20ADV45	Robotic Processand Automation	PE	3	3	0	0	3
5	20ADV55	Text and Speech Analysis	PE	3	3	0	0	3
6	20ADV65	Sensors and Devices	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 COURSE OFFERED TO OTHER DEPARTMENTS

VI SEMESTER

Sl. No.	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
1	20OE901	Data Science using Python	OE	3	3	0	0	3
2	20OE902	Introduction of Artificial Intelligence and Data Science	OE	3	3	0	0	3
3	20OE903	Mobile app development and its applications	OE	4	2	0	2	3
4	20OE904	Foundation of Robotics	OE	3	3	0	0	3

VII SEMESTER

Sl. No.	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
1	20OE905	Artificial Neural Network and applications	OE	3	3	0	0	3
2	20OE906	AI and Robotics	OE	3	3	0	0	3
3	20OE907	Fundamentals of Blockchain Technologies	OE	4	2	0	2	3
4	20OE908	Introduction to Web Application Security	OE	3	3	0	0	3

20CS701	DATA ANALYTICS	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To understand the basic concepts of Data Analytic.
- To Handle missing data in the real world datasets by choosing appropriate methods
- To Learn data analysis methods
- To learn stream computing
- To Understand and apply Data Analysis Techniques
- To gain knowledge on Hadoop related tool

PRE-REQUISITE: 20CS604 - Machine Learning

UNIT I INTRODUCTION 9

Knowledge domains of Data Analysis, Understanding structured and unstructured data, data analytic tools, applications of data analytics, various phases of data analytics lifecycle—discovery, data preparation, model planning, model building, communicating results, operationalization.

UNIT II DATA PREPROCESSING 9

Data Preprocessing: Data Cleaning–Data Integration-Data Reduction— Data Transformation Handling Missing Data: Introduction to Missing data, Traditional methods for dealing with missing data, Maximum Likelihood Estimation — Basics, Missing data handling, improving the accuracy of analysis

UNIT III CLASSIFICATION AND CLUSTERING 9

Statistical Methods: Regression modelling, Multivariate Analysis- Classification: SVM&Kernel Methods-Rule Mining-Cluster Analysis, Types of Data in Cluster Analysis, Partitioning Methods, Hierarchical Methods, Density Based Methods, Grid Based Methods, Model Based Clustering Methods, Clustering High Dimensional Data-Predictive Analytics.

UNIT IV MINING DATA STREAMS 9

Streams: Concepts — Stream Data Model and Architecture - Sampling data in a stream -Mining Data Streams and Mining Time-series data- Real Time Analytics Platform (RTAP)Applications. CaseStudy: Text,Web and Social Media Analytics, Real Time Sentiment Analysis, Stock Market Predictions

UNIT V HADOOP FRAMEWORKS 9

HADOOP – HDFS concepts, Algorithms using Map Reduce, Introduction to NoSQL, Cassandra, Pig, Hive.

TOTAL: 45 PERIODS

TEXT BOOKS

1. John Wiley & Sons, Data Science and Big Data Analytics: Discovering, Analyzing, Visualizing and Presenting Data, EMC Education Services (Editor),2015
2. Craig K. Enders, “Applied Missing Data Analysis”, The Guilford Press, 2010.
3. Michael Berthold, David J. Hand, —Intelligent Data Analysis, Springer, Second Edition, 2007.

REFERENCES:

1. Bill Franks, Taming the Big Data Tidal Wave: Finding Opportunities in Huge Data Streams with Advanced Analytics, Wiley, 2012
2. Michael Minelli, Michelle Chambers, and AmbigaDhiraj, "Big Data, Big Analytics: Emerging Business Intelligence and Analytic Trends for Today's Businesses", Wiley, 2013.
3. P. J. Sadalage and M. Fowler, "NoSQL Distilled: A Brief Guide to the Emerging World of
4. Polyglot Persistence", Addison-Wesley Professional, 2012.

Course Name: DATA ANALYTICS		Course Code : 20CS701			
CO	**Course Outcomes**	**Unit**	**K-CO**	**POs**	**PSOs**
C401.1	Explain the basic concepts of Data Analytics	1	K2	1, 2, 8, 9,10	1
C401.2	Describe the Data Analysis preprocessing Techniques.	2	K2	1, 2, 8,9, 10	1
C401.3	Explain about how missing data will be handled during preprocessing	2	K2	1, 2, 8,9, 10	1
C401.4	Apply the Classification and Clustering algorithms for real time applications	3	K3	1,2,3,6,8, 9,10,12	1
C401.5	Apply intelligent analytics techniques like neural networks, fuzzy and genetic algorithms for real time analytics applications	4	K3	1, 2, 3,5,8,9, 10,12	1
C401.6	Explain the Hadoop related tools such as Pig and Hive for big data analytics	5	K2	1,2,5, 8,9,10, 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	-	-	1	-
C401.2	2	1	-	-	-	-	-	1	1	1	-	-	1	-
C401.3	2	1	-	-	-	-	-	1	1	1	-	-	1	-
C401.4	3	2	1	-	-	1	-	1	1	1	-	2	1	-
C401.5	3	2	1	-	2	-	-	1	1	1	-	2	1	-
C401.6	2	1	-	-	2	-	-	1	1	1	-	2	1	2

20AD701	ARTIFICIAL INTELLIGENCE FOR ROBOTICS	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To learn concepts of robot locomotion.
- To understand the kinematics models of Robots.
- To learn the sensors used in mobile robots
- To learn thestrategies for extracting information from the sensors.

PRE-REQUISITE:NIL

UNIT I ROBOT LOCOMOTION 9

Introduction to AI and Robotics – Legged Mobile Robots- Leg configurations and stability-Examples of legged robot locomotion-Wheeled Mobile Robots-Wheeled locomotion: the design space

UNIT II MOBILE ROBOT KINEMATICS 9

Kinematic models and constraints – mobile robot maneuverability – mobile robot workspace –Beyond Basic Kinematics– motion control-Open loop control.

UNIT III ROBOT PERCEPTION 9

Sensors for mobile robots – representing uncertainty: statistical representation – error propagation –Feature extraction: Feature extraction based on range data-Visual appearance based feature extraction

UNIT IV MOBILE ROBOT LOCALIZATION 9

Introduction to localization-The Challenge of Localization: Noise and Aliasing: noise and aliasing – localization-based navigation – belief representation– map representation – probabilistic map-based localization – Localization Systems-autonomous map building.

UNIT V ROBOT PLANNING AND NAVIGATION 9

Planning and reacting: Path planning- obstacle avoidance – navigation architectures: Modularity for code reuse and sharing-Control localization-Techniques for decomposition

TOTAL: 45 PERIODS

TEXT BOOKS:

1. R. Siegwart, I. R. Nourbaksh, and D. Scarramuzza, “Introduction to Autonomous Mobile Robots”, Second Edition, MIT Press, 2011.

REFERENCES

1. Stuart Russel and Peter Norvig, “Artificial Intelligence: A Modern Approach”, Fourth Edition, Pearson Education, 2020.
2. Bhaumik and Arkapravo “From AI to Robotics: Mobile, Social, and Sentient Robots” by CRC Press Taylor & Francis 2017.

Course Name: ARTIFICIAL INTELLIGENCE FOR ROBOTICS				CourseCode:20AD701	
CO	**Course Outcomes**	**Unit**	**K-CO**	**POs**	**PSOs**
C402.1	Discuss the concepts of robot locomotion.	I	K2	1,2,9,10,12	1
C402.2	Demonstrate the kinematics models of Robots.	II	K2	1,2,9,10,12	1
C402.3	Interpolate the sensors used in mobile robots	III	K2	1,2,9,10,12	1
C402.4	Demonstrate strategies for extracting information from the sensors.	III	K2	1,2,9,10,12	1
C402.5	Construct the localization algorithms to locate a robot with respect to its environment.	IV	K3	1,2,3,9,10,12	1
C402.6	Interpret the path planning methods for navigation	V	K2	1,2,9,10,12	1

CO-PO Mapping

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

20AD702	CLOUD COMPUTING	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To understand the concept of cloud computing.
- To appreciate the evolution of cloud from the existing technologies.
- To have knowledge on the various issues in cloud computing.
- To be familiar with the lead players in cloud.
- To appreciate the emergence of cloud as the next generation computing paradigm.

PRE-REQUISITE:NIL

UNIT I INTRODUCTION 9

Introduction to Cloud Computing – Definition of Cloud – Evolution of Cloud Computing – Underlying Principles of Parallel and Distributed Computing – Cloud Characteristics – Elasticity in Cloud – On-demand Provisioning.

UNIT II CLOUD ENABLING TECHNOLOGIES 9

Service Oriented Architecture – REST and Systems of Systems – Web Services – PublishSubscribe Model – Basics of Virtualization – Types of Virtualization – Implementation Levels of Virtualization – Virtualization Structures – Tools and Mechanisms – Virtualization of CPU – Memory – I/O Devices – Virtualization Support and Disaster Recovery.

UNIT III CLOUD ARCHITECTURE, SERVICES AND STORAGE 9

Layered Cloud Architecture Design – NIST Cloud Computing Reference Architecture – Public, Private and Hybrid Clouds - IaaS – PaaS – SaaS – Architectural Design Challenges – Cloud Storage – Storage-as-a-Service – Advantages of Cloud Storage – Cloud Storage Providers – S3.

UNIT IV RESOURCE MANAGEMENT AND SECURITY IN CLOUD 9

Inter Cloud Resource Management – Resource Provisioning and Resource Provisioning Methods – Global Exchange of Cloud Resources – Security Overview – Cloud Security Challenges – Software-as-a-Service Security – Security Governance – Virtual Machine Security – IAM – Security Standards.

UNIT V CLOUD TECHNOLOGIES AND ADVANCEMENTS 9

Virtual Box -- Google App Engine – Programming Environment for Google App Engine –– Open Stack – Federation in the Cloud – Four Levels of Federation – Federated Services and Applications – Future of Federation.

TOTAL: 45 PERIODS

TEXT BOOKS

1. Kai Hwang, Geoffrey C. Fox, Jack G. Dongarra, "Distributed and Cloud Computing, FromParallel Processing to the Internet of Things", Morgan Kaufmann Publishers, 2012.
2. Rittinghouse, John W., and James F. Ransome, —Cloud Computing: Implementation,Management and Security‖, CRC Press, 2017.

REFERENCES:

1. RajkumarBuyya, Christian Vecchiola, S. ThamaraiSelvi, —Mastering Cloud Computing‖, TataMcgraw Hill, 2013.
2. Toby Velte, Anthony Velte, Robert Elsenpeter, "Cloud Computing - A Practical Approach‖, TataMcgraw Hill, 2009.
3. George Reese, "Cloud Application Architectures: Building Applications and Infrastructure in theCloud: Transactional Systems for EC2 and Beyond (Theory in Practice)‖, O'Reilly, 2009.

OUTCOMES:

ATTHEENDOFTHECOURSE,LEARNERSWILLBEABLETO:

CourseName:CloudComputing		CourseCode:20AD702			
CO	**CourseOutcomes**	**Unit**	**K-CO**	**POs**	**PSOs**
C403.1	Describethemainconcepts,keytechnologies,strengths andlimitationsofcloudcomputing.	1	K2	1,2,8,9	1,2
C403.2	Explainthekeyandenablingtechnologiesthathelpinthe developmentofcloud.	2	K2	1,2,8,9	1,2
C403.3	Discuss theusage ofarchitecture of computeandstoragecloud, service anddeliverymodels.	3	K2	1,2,8,9	1,2
C403.4	Explainthecoreissuesofcloudcomputingsuchasresour cemanagementandsecurity.	4	K2	1,2,8,9	1,2
C403.5	Illustrate thesecurity featuresto be adopted incloud.	4	K2	1,2,8,9	1,2
C403.6	Infertheappropriate technologies, algorithms Andapproachesforimplementationanduseofcloud	5	K3	1,2,3,8,9	1,2

CO-POMapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
C403.1	2	1	-	-	-	-	-	1	**1**	1	-	-	2	2
C403.2	2	1	-	-	-	-	-	1	1	1	-	-	2	2
C403.3	2	1	-	-	-	-	-	1	1	1	-	-	2	2
C403.4	2	1	-	-	-	-	-	1	1	1	-	-	2	2
C403.5	2	1	-	-	-	-	-	1	1	1	-	-	2	2
C403.6	3	2	1	-	-	-	-	1	1	1	-	-	2	2

20AD7L1	DATA EXPLORATION LABORATORY	L	T	P	C
		0	0	4	2

OBJECTIVES:

- Understand various methods of Data Preparation and Manipulation
- Learn the data analysis basics with Python
- To understand various types of Tools for Analytics
- To perform DAX calculation for data model
- To design report and dashboard for Visualization

PRE-REQUISITE:NIL

LISTOFEXPERIMENTS

1. Perform data pre-processing operations using python
2. Perform Z-test
3. Perform T-test
4. Perform ANOVA
5. Install the data Analysis and Visualization tool:Python/TableauPublic/ PowerBI Desktop.
6. Prepare & Load data
7. Develop the data model
8. Perform DAX calculations
9. Design a report
10. Create a dashboard and perform data analysis

TOTAL:60PERIODS

OUTCOMES:

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

- Apply the various analysis methods in python.
- Install and use data Analysis and Visualization tool.
- Prepare & load data to develop the data model
- Apply DAX calculation for analytics
- Construct the report for given dataset using Visualization tool.
- Design a dashboard and perform data analysis

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LISTOFSOFTWAREFORABATCHOF30STUDENTS:

Tool:Python/TableauPublic/ PowerBI Desktop

Course Name: DATA EXPLORATION LABORATORY		Course Code: 20AD7L1			
CO	**Course Outcomes**	**EXP**	**K-CO**	**POs**	**PSOs**
C407.1	Apply the various analysis methods in python.	1,2,3,4	K3	1,2,3,4,5,9,10,12	2
C407.2	Install and use data Analysis and Visualization tool.	5	K3	1,2,3,5,9,10,12	2
C407.3	Prepare & load data to develop the data model	6,7	K3	1,2,3,5,9,10,12	2
C407.4	Apply DAX calculation for analytics	8	K3	1,2,3,4,5,9,10,12	2
C407.5	Construct the report for given dataset using Visualization tool.	9	K3	1,2,3,5,9,10,12	2
C407.6	Design a dashboard and perform data analysis	10	K3	1,2,3,4,5,9,10,12	2

CO-PO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
C407.1	3	2	1	2	3	-	-	-	2	2	-	3	-	3
C407.2	3	2	1	-	3	-	-	-	2	2	-	3	-	3
C407.3	3	2	1	-	3	-	-	-	2	2	-	3	-	3
C407.4	3	2	1	2	3	-	-	-	2	2	-	3	-	3
C407.5	3	2	1	-	3	-	-	-	2	2	-	3	-	3
C407.6	3	3	3	2	3	-	-	-	2	2	-	3	-	3

20AD7L2	CLOUD COMPUTING LABORATORY	L	T	P	C
		0	0	4	2

OBJECTIVES:

- To learn and develop applications using gcc and make
- To learn and use version control systems
- To develop web applications in cloud
- To learn the design and development process involved in creating a cloud based application
- To learn to implement and use parallel programming using Hadoop

PRE-REQUISITE:NIL

LISTOFEXPERIMENTS

1. Install Virtualbox/VMware Workstation with different flavours of linux or windows OS on topof windows7 or 8.
2. Install a C compiler in the virtual machine created using virtual box and execute SimplePrograms
3. Install Google App Engine. Create hello world app and other simple web applications usingpython/java.
5. Use GAE launcher to launch the web applications.
4. Simulate a cloud scenario using CloudSim and run a scheduling algorithm that is notpresent in CloudSim.
5. Find a procedure to transfer the files from one virtual machine to another virtual machine.
6. Install Hadoop single node cluster and run simple applications like wordcount..

TOTAL:60PERIODS

Course Name: Cloud Computing Laboratory		**Course Code: 20AD7L2**			
CO	**Course Outcomes**	**EXP**	**K-CO**	**POs**	**PSOs**
C408.1	Configure various virtualization tools such as Virtual Box, VMware workstation.	1,2	K3	1,2,3,4,5,9,10,12	
C408.2	Design and deploy a web application in a PaaS environment.	3,4	K3	1,2,3,5,9,10,12	
C408.3	Learn how to simulate a cloud environment to implement new schedulers.	5	K3	1,2,3,5,9,10,12	
C408.4	Install and use a generic cloud environment that can be used as a private cloud.	6	K3	1,2,3,4,5,9,10,12	
C408.5	Install Hadoop single node cluster and run simple applications.	7	K3	1,2,3,5,9,10,12	

CO-PO Mapping

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

20AD8L1	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 student 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

Course Name :Project Work		Course Code :20AD8L1		
CO	**Course Outcomes**	**K-CO**	**POs**	**PSOs**
C410.1	Identify a domain and problem by applying required domain knowledge.	K3	1,2,3,6,7,8,9, 10, 11,12	1,2
C410.2	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
C410.3	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
C410.4	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
C410.5	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
C410.6	Elaborate the completed task and compile the project report.	K4	1,2,3,4,5,6,7, 8,9,10,11,12	1,2

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

20ADV11	VIRTUALIZATION	L	T	P	C
		2	0	2	3

OBJECTIVES:

- To Learn the basics and types of Virtualization
- To understand the Hypervisors and its types
- To Explore the Virtualization Solutions
- To discover various virtualization platforms

PRE-REQUISITE:NIL

UNIT-I INTRODUCTION TO VIRTUALIZATION 6

Virtualization and cloud computing - Need of virtualization – cost, administration, fast deployment, reduce infrastructure cost – limitations- Types of hardware virtualization: Full virtualization - partial virtualization - Paravirtualization-Types of Hypervisors

UNIT- II SERVER AND DESKTOP VIRTUALIZATION 6

Virtual machine basics- Types of virtual machines- Understanding Server Virtualization- types of server virtualization- Business Cases for Server Virtualization – Uses of Virtual Server Consolidation – Selecting Server Virtualization Platform-Desktop Virtualization-Types of Desktop Virtualization

UNIT- III NETWORK VIRTUALIZATION 6

introduction to Network Virtualization-Advantages- Functions-Tools for Network VirtualizationVLAN-WAN Architecture-WAN

UNIT-IV STORAGE VIRTUALIZATION 6

Memory Virtualization-Types of Storage Virtualization-Block, File-Address space Remapping-Risks of Storage Virtualization-SAN-NAS-RAID

UNIT-V VIRTUALIZATION TOOLS 6

VMWare-Amazon AWS-Microsoft HyperV- Oracle VM Virtual Box - IBM PowerVM- Google Virtualization- Case study.

30+30 PERIODS

PRACTICALEXERCISES:

1.Create type 2 virtualization in VMWARE or any equivalent Open Source Tool. Allocate memoryandstoragespaceasperrequirement.InstallGuestOSonthatVMWARE.

2.a.Shrinkandextend virtualdisk

b. Create,Manage, Configureandschedule snapshots

c. CreateSpanned, MirroredandStripedvolume

d. Create RAID 5volume

3.a.DesktopVirtualizationusingVNC

b.DesktopVirtualizationusingChromeRemoteDesktop

4.Create type 2 virtualization on ESXI 6.5 server

5.CreateaVLAN inCISCOpackettracer

6.InstallKVMinLinux

7.CreateNestedVirtual Machine(VMunderanotherVM)

TEXTBOOK

1. Cloud computing a practical approach - Anthony T.Velte , Toby J. Velte Robert Elsenpeter, TATA McGraw- Hill , New Delhi – 2010
2. Cloud Computing (Principles and Paradigms), Edited by RajkumarBuyya, James Broberg, AndrzejGoscinski, John Wiley & Sons, Inc. 2011
3. David Marshall, Wade A. Reynolds, Advanced Server Virtualization: VMware and Microsoft Platform in the Virtual Data Center, Auerbach

References

1. Chris Wolf, Erick M. Halter, “Virtualization: From the Desktop to the Enterprise”, APress, 2005.
2. James E. Smith, Ravi Nair, “Virtual Machines: Versatile Platforms for Systems and Processes”, Elsevier/Morgan Kaufmann, 2005.
3. David Marshall, Wade A. Reynolds, “Advanced Server Virtualization: VMware and Microsoft Platform in the Virtual Data Center”, Auerbach Publications, 2006

Course Name: VIRTUALIZATION		**CourseCode:20ADV11**			
CO	**Course Outcomes**	**Unit**	**K-CO**	**POs**	**PSOs**
CO1	Understand the virtualization concepts and Hypervisor	I	K2	1,2,9,10,12	-
CO2	Install &Configure the different VM platforms for an application	Lab	K3	1,2,3,5,9,10,12	-
CO3	Construct server and desktop virtualization	II	K2	1,2,9,10,12	-
CO4	Demonstrate network virtualization and Architecture	III	K2	1,2,9,10,12	-
CO5	Demonstrate memory and storage virtualization	IV	K2	1,2,9,10,12	-
CO6	Apply various virtualization tools	V, Lab	K3	1,2,3,5,9,10,12	-

CO-PO Mapping

CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	2	1	-	-	-	-	-	-	2	2	-	2	-	-
CO2	3	2	1	-	3	-	-	-	2	2	-	2	-	-
CO3	2	1	-	-	-	-	-	-	2	2	-	2	-	-
CO4	2	1	-	-	-	-	-	-	3	2	-	2	-	-
CO5	2	1	-	-	-	-	-	-	3	2	-	2	-	-
CO6	3	2	1	-	3	-	-	-	3	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 ofPatterns.Introduction to Data Mining Systems – Knowledge Discovery Process – Data Mining Techniques – Issues – applications- Data Objects and attribute types, Statistical description of data, Data Preprocessing – Cleaning, Integration, Reduction, Transformation and discretization, Data Visualization, Data similarity and dissimilarity measures.

UNIT - III FREQUENT PATTERN ANALYSIS **9**

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

UNIT - IV CLASSIFICATION AND CLUSTERING **9**

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

UNIT - V DATA MINING TOOLS **9**

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

TOTAL: 45 PERIODS

TEXT BOOKS:

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

REFERENCES:

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

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, CapexvsOpex 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 EnamulHaque, 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 RajkumarBuyya, Christian Vechhiola, S. ThamaraiSelvi.

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

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

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

OBJECTIVES:

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

PRE-REQUISITE: NIL

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 HypervisorBased Overlays – SDN via Opening up the Device – SDN Controllers – General Concepts.

UNIT - III DATA CENTERS 9

Multitenant and Virtualized Multitenant Data Center – SDN Solutions for the Data Center Network – VLANs – EVPN – VxLAN – NVGRE

UNIT - IV SDN PROGRAMMING 9

Programming SDNs: Northbound Application Programming Interface, Current Languages and Tools, Composition of SDNs – Network Functions Virtualization (NFV) and Software Defined Networks: Concepts, Implementation and Applications

UNIT - V SDN FRAMEWORK 9

Juniper SDN Framework – IETF SDN Framework – Open Daylight Controller – Floodlight Controller – Bandwidth Calendaring – Data Center Orchestration

TOTAL: 45 PERIODS

TEXT BOOKS:

1. Paul Goransson and Chuck Black, Software Defined Networks: A Comprehensive Approach,F 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. VivekTiwari, SDN and Open Flow for Beginnersǁ, Amazon Digital Services, Inc., 2013.
3. Fei Hu, Editor, Network Innovation through Open Flow and SDN: Principles and Design, CRC Press, 2014.

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 mobilecomputing, 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 scaleoutstorageArchitecture.

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, ShanmuganathanKumaravel and Libor Miklas, Introduction to Storage Area Networks, Ninth Edition, IBM - Redbooks, December 2017

REFERENCES:

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

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												I	K2	1,2,9,10,12	-
CO2	Illustrate the usage of advanced intelligent storage systems and RAID												II	K3	1,2,3,9,10,12	-
CO3	Identify various storage networking architectures - SAN												III	K3	1,2,3,9,10,12	-
CO4	Apply storage subsystems and Virtualization												III	K3	1,2,3,9,10,12	-
CO5	Examine the different role in providing disaster recovery and remote replication technologies												IV	K3	1,2,3,9,10,12	-
CO6	Infer the security needs and security measures to be employed in information storage Management												V	K2	1,2,9,10,12	-

CO-PO Mapping

CO	**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 BerthierRibeiroNeto, 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.

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															
CO	**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, Nonrepudiation, 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 RajkumarBuyya, Christian Vechhiola, S. ThamaraiSelvi

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

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

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

UNITI INTRODUCTION **9**

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

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

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

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

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

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

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

UNITV VALUE FUNCTION APPROXIMATION **9**

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

TOTAL:45PERIODS

TEXTBOOKS:

1. Richard S. Sutton and Andrew G. Barto, Reinforcement Learning: An introduction, 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.

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. BorkoFurht, 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.

Course Name : SOCIAL NETWORK ANALYSIS		**Course Code : 20CSV12**			
CO	**Course Outcomes**	**Unit**	**K-CO**	**POs**	**PSOs**
CO1	Explain the semantic web concepts and applications of social network analysis.	1	K2	1, 2, 8,9	2
CO2	Discuss about modeling and knowledge representation using ontology of social network.	2	K2	1, 2, 8,9	2
CO3	Illustrate the extraction and mining communities in web social networks.	3	K2	1, 2, 8,9	2
CO4	Illustrate the various methods for predicting human behaviour in social communities.	4	K2	1, 2, 8,9	2
CO5	Describe the privacy issues in trust network analysis.	4	K2	1, 2, 8,9	2
CO6	Make use of visualization techniques for social network applications	5	K3	1, 2, 3, 8,9	2

CO-PO Mapping

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

20ITV22	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: 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

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

CO-PO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO 7	PO 8	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.

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

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

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

UNITI INTRODUCTION TO BLOCKCHAIN **9**

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

UNITII BITCOIN AND CRYPTOCURRENCY **9**

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

UNITIII BITCOIN CONSENSUS **9**

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

UNITIV HYPERLEDGER FABRIC & ETHEREUM **9**

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

UNITV BLOCKCHAIN APPLICATIONS **9**

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

TOTAL:45PERIODS

TEXTBOOKS:

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

REFERENCES:

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

20SCV52	WEBAPPLICATIONSECURITY	L	T	P	C
		3	0	0	3

OBJECTIVES:

- Tounderstandthefundamentalsofwebapplicationsecurity
- Tofocusonwideaspectsofsecuredevelopmentanddeploymentofwebapplications
- TolearnhowtobuildsecureAPIs
- Tolearn thebasicsofvulnerabilityassessmentandpenetrationtesting
- Togetaninsight aboutHackingtechniquesandTools

PRE-REQUISITE:NIL

UNIT - I FUNDAMENTALSOFWEB APPLICATION SECURITY **9**

The history of Software Security-Recognizing Web Application Security Threats, Web ApplicationSecurity, Authentication and Authorization, Secure Socket layer,Transport layer Security, SessionManagement-InputValidation

UNIT - II SECURE DEVELOPMENTAND DEPLOYMENT **9**

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

UNIT - III SECUREAPIDEVELOPMENT **9**

API Security- Session Cookies,Token Based Authentication, Securing Natter APIs: Addressingthreats with Security Controls, Rate Limiting for Availability, Encryption, Audit logging, Securingservice-to-service APIs: API Keys , OAuth2, Securing Microservice APIs: Service Mesh, LockingDownNetworkConnections,SecuringIncomingRequests.

UNIT - IV VULNERABILITYASSESSMENTANDPENETRATIONTESTING **9**

VulnerabilityAssessmentLifecycle,VulnerabilityAssessmentTools:Cloud-basedvulnerabilityscanners, Host-based vulnerability scanners, Network-based vulnerability scanners, Database-basedvulnerabilityscanners,TypesofPenetrationTests:ExternalTesting,WebApplicationTesting ,InternalPenetrationTesting, SSIDorWirelessTesting,MobileApplicationTesting.

UNIT – V HACKINGTECHNIQUESANDTOOLS **9**

SocialEngineering,Injection,Cross-SiteScripting(XSS),BrokenAuthenticationandSessionManagement,Cross-SiteRequestForgery,SecurityMisconfiguration,InsecureCryptographicStorage, Failure to Restrict URL Access, Tools: Comodo, OpenVAS, Nexpose, Nikto, Burp Suite,etc.

TOTAL: 45 PERIODS

TEXT BOOKS:

1. AndrewHoffman,WebApplicationSecurity:ExploitationandCountermeasuresforModernWebApplications,FirstEdition,2020,O'ReillyMedia,Inc.
2. BryanSullivan,VincentLiu,WebApplicationSecurity:ABeginnersGuide,2012,TheMcGraw-HillCompanies.
3. Neil Madden,API SecurityinAction,2020,ManningPublicationsCo., NY,USA.

REFERENCES:

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

20CSV62 ENGINEERING SECURE SOFTWARE SYSTEMS

L	T	P	C
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”

Course Name :**ENGINEERING SECURE SOFTWARE SYSTEMS**													**Course Code :20CSV62**	
CO	**Course Outcomes**												**Unit**	**K-CO**	**POs**	**PSOs**
CO1	Identifyvariousvulnerabilitiesrelatedtomemoryattacks and low level attacks.												1	2	1,2	1
CO2	Applysecurityprinciplesinsoftwaredevelopment and secure design.												2	3	1,2,3,8,9	1
CO3	Discusstheriskfactorsinsoftwaresystems and risk assessment techniques.												3	2	1,2,8,9	1
CO4	Applyvarioustestingtechniquesrelatedtosoftwaresecurityinthetestingphaseofsoftwaredevelopment												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	Illustratesecureprojectmanagementand its framework.												5	3	1,2,3,8,9, 10	1
CO-PO Mapping																
CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**		
CO1	2	1		-	-	-	-	2	2	1	-	-	2	-		
CO2	3	2	1	-	-	-	-	2	2	1	-	-	2	-		
CO3	2	1		-	-	-	-	2	2	1	-	-	2	-		
CO4	3	2	1	-	-	-	-	2	2	1	-	-	2	-		
CO5	2	1		-	-	-	-	2	2	1	-	-	2	-		
CO6	3	2	1	-	-	-	-	2	2	1	-	-	2	-		

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, AlexandreGazet, 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.

Course Name :MALWARE ANALYSIS		**Course Code :20SCV82**			
CO	**Course Outcomes**	**Unit**	**K-CO**	**POs**	**PSOs**
CO1	Discuss the various concepts of malware analysis and their technologies used.	1	K2	1,2,8,9	1,2
CO2	Apply the skills necessary to carry out independent analysis of modern malware samples using static analysis techniques	2	K3	1,2,3,5,8,9	1,2
CO3	Apply the knowledge to carry out malware analysis of using dynamic analysis techniques	3	K3	1,2,3,5,8,9	1,2
CO4	Implement experimentation on Malware behaviour analysis	3	K3	1,2,3,5,8,9, 10	1,2
CO5	Explain the methods and techniques used by professional malware analysts	4	K2	1,2,8,9	1,2
CO6	Illustrate the concept of Android malware analysis their architecture, and App development	5	K3	1,2,3,5,8,9, 10	1,2

CO-PO Mapping

CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**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

UNITI SYNTAXANDSEMANTICS **9**

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

UNITII 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.

UNITIII 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

UNITIV OBJECT-ORIENTATION,CONCURRENCY,ANDEVENTHANDLING **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.

UNITV 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.

Course Name :PRINCIPLES OFPROGRAMMING 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

CO	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 DESIGN6

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 DESIGN6

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 TESTING6

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 ARCHITECTURE6

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” O’Reilly 2021

REFERENCES:

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

Course Name : UI AND UX DESIGN		Course Code : 20CSV23			
CO	**Course Outcomes**	**Unit**	**K-CO**	**POs**	**PSOs**
CO1	Differentiate divergent and convergent thinking and explain brainstorming and game storming	1	K2	1,2	2
CO2	Discuss the fundamental needs of UI design	2	K2	1,2,8,9	2
CO3	Illustrate methods and tools to the process of UX design for research	3	K2	1,2,8,9	2
CO4	Explain the sketching principles, responsive design and wire framing	4	K2	1,2,8,9	2
CO5	Discuss the design of UI and UX prototyping and testing with suitable tools	4	K2	1,2,8,9	2
CO6	Identifying and writing problem statements, appropriate research methods and creating scenarios	5	K2	1,2,8,9	2

CO-PO Mapping

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

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

Objectives:

- Tounderstandthebasicsof softwaretesting
- Tolearnhowtodothetestingandplanningeffectively
- Tobuildtestcasesandexecutethem
- Tofocusonwideaspects oftestingandunderstandingmultiplefacet software testing
- Togetaninsightabouttestautomationandthetools usedfortestautomation

PRE-REQUISITE:NIL

UNITI 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

UNITII 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.

UNITIII 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.

UNITIV 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.

UNITV 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:45PERIODS

TEXTBOOKS:

1. Yogesh Singh, “Software Testing”, Cambridge University Press, 2012
2. UnmeshGundecha, SatyaAvasarala, "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. SatyaAvasarala, Selenium WebDriver Practical Guide, 2014, Packt Publishing.
7. VarunMenon, TestNg Beginner's Guide, 2013, Packt Publishing.

Course Name :SOFTWARE TESTING AND AUTOMATION				**Course Code : 20ITV43**			
CO	**Course Outcomes**	**Unit**	**K-CO**	**POs**	**PSOs**		
CO1	Discussthebasic concepts ofsoftwaretestingandtheneedforsoftwaretesting	1	K2	1,2,8,9	2		
CO2	Explaintestplanninganddifferentactivitiesinvolved intestplanning	2	K2	1,2,8,9	2		
CO3	Identify the test objectivesand apply different method of test strategies	3	K3	1,2,3,5,8,9, 10	2		
CO4	Apply advanced testing concepts like Fail-Over testing, usability testing, security testing etc.	4	K3	1,2,3,5,8,9, 10	2		
CO5	Describe the Testing methods for web and mobile applications	4	K2	1,2,8,9,10	2		
CO6	Use automatic software testing tools like Selenium web driver for automating web-based application testing	5	K3	1,2,3,5,8,9, 10	2		

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

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

UNITI 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

UNITII 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.

UNITIII 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.

UNITIV 3D RECONSTRUCTION **9**

Shape from X - Active rangefinding - Surface representations - Point-based representationsVolumetric representations - Model-based reconstruction - Recovering texture

UNITV 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:45PERIODS

TEXTBOOKS:

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.

20ITV73	DEVOPS	L	T	P	C
		2	0	2	4

Objectives:

- TointroduceDevOpsterminology,definition&concepts
- TounderstandthedifferentVersioncontroltoolslikeGit,Mercurial
- To understand the concepts of Continuous Integration/ Continuous Testing/ Continuous Deployment
- TounderstandConfigurationmanagementusingAnsible
- Illustrate the benefits and drive the adoption of cloud-based Devops tools to solve realworld problems

PRE-REQUISITE:NIL

UNITI INTRODUCTION TO DEVOPS **6**

Devops Essentials - Introduction To AWS, GCP, Azure - Version control systems: Git and Github. **6**

Lab Component:

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

UNITII 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

UNITIII 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

UNITIV 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

UNITV BUILDING DEVOPS PIPELINES USING AZURE **6**

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

Lab Component: **6**

1.Create Maven Build pipeline in Azure

2.Run regression tests using Maven Build pipeline in Azure

TOTAL:60 PERIODS

TEXTBOOKS:

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

REFERENCES:

1. Hands-On Azure Devops: Cicd Implementation For Mobile, Hybrid, And Web ApplicationsUsingAzureDevopsAndMicrosoftAzure:CICDImplementationfor...DevOpsa ndMicrosoftAzure(EnglishEdition)Paperback–1 January2020 byMiteshSoni
2. JeffGeerling, “Ansible for DevOps: Server and configuration management for
3. David Johnson, “Ansible for DevOps: Everything You Need to Know to Use Ansible for DevOps”,SecondEdition,2016.
4. MariotTsitoara, “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

COs ↓	**PO1**	**PO2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO10**	**PO11**	**PO12**	**PSO 1**	**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

20ADV14	DATA AND INFORMATION SECURITY	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 equip the students' knowledge on digital signature, email security and web 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 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

TEXT BOOKS

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

REFERENCES:

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

Course Name :DATA AND INFORMATION SECURITY		Course Code :20ADV14			
CO	**Course Outcomes**	**Unit**	**K-CO**	**POs**	**PSOs**
CO1	Explain the basics of data and information security	1	K2	1,2,8,9	2
CO2	Discuss the legal, ethical and professional issues in information security	2	K2	1,2,8,9	2
CO3	Illustrate the availability security policies in information security	2	K2	1,2,3,8,9,10	2
CO4	Identify the various authentication schemes to simulate different applications.	3	K3	1,2,8,9,10	2
CO5	Explain various security practices and system security standards	4	K2	1,2,8,9	2
CO6	Make use of Web security protocols for E-Commerce applications	5	K3	1,2,3,8,9	2

CO – PO Mapping

CO	**PO 1**	**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	2	1	-	-	-	-	-	2	2	2	-	-	-	2
CO4	3	2	1	-	-	-	-	2	2	2	-	-	-	2
CO5	2	1	-	-	-	-	-	2	2	-	-	-	-	2
CO6	3	2	1	-	-	-	-	2	2	-	-	-	-	2

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

UNITI QUANTUM COMPUTING BASIC CONCEPTS 9

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

UNITII QUANTUM GATES AND CIRCUITS 9

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

UNITIII QUANTUM ALGORITHMS 9

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

UNITIV QUANTUM INFORMATION THEORY 9

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

UNITV QUANTUM CRYPTOGRAPHY 9

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

TOTAL:45PERIODS

TEXTBOOKS:

1. Parag K Lala, McGraw 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.

NEURAL NETWORKS AND DEEP LEARNING

L	T	P
2	0	2

standthebasics indeepneuralnetworks

standthebasics of associativememoryandunsupervisedlearningnetworks

CNNarchitectures ofdeepneuralnetworks

ze the key computations underlying deep learning, then use them to build and traindeepneural networksforvarious tasks.

generativemodelsforsuitable applications.

INTRODUCTION

s-Application Scope of Neural Networks-Artificial Neural Network: An Introduction-Evolution of Neural Networks-Basic Models

ant Terminologies ofANNs-SupervisedLearning Network

t:

tsimplevectoradditioninTensorFlow.

taregressionmodelinKeras.

ASSOCIATIVEMEMORY ANDUNSUPERVISEDLEARNING NETWORKS

thms for Pattern Association-Auto associative Memory Network-Hetero associativeMemoryNetwork-BidirectionalAssociativ

ssociativeMemoryNetworks-FixedWeightCompetitive Nets(MAXNET, Hamming Network)-Kohonen Self-Organizing Feature

nt:

taperceptroninTensorFlow/KerasEnvironment.

taFeed-ForwardNetworkinTensorFlow/Keras.

THIRD-GENERATION NEURAL NETWORKS

Neural Networks-Deep Learning Neural Networks-ExtremeLearning Machine Model-Convolutional Neural Networks:

otivation –Pooling – Variants of the basic Convolution Function – EfficientConvolution Algorithms

t:

mageClassifierusingCNNinTensorFlow/Keras

DEEP FEED FORWARDNETWORKS

Theory of Deep Learning- Gradient Learning – Chain Ruleand Backpropagation Regularization: Dataset Augmentation – N

g,BaggingandDropout.

nt:

haracter and Digit Recognition using ANN

RECURRENTNEURALNETWORKS

ral Networks: Introduction – Recursive Neural Networks – Bidirectional RNNs – DeepRecurrent Networks – Applications: In
ssion, Natural LanguageProcessing.

nt:

rmSentiment AnalysisusingRNN

mmendationsystemfromsalesdatausingDeepLearning

TO

ow,YoshuaBengio,AaronCourville,"DeepLearning",MITPress,2016.

ollet, "Deep Learning with Python", Second Edition, Manning Publications,2021.

ion to Neural Networks Using Matlab 6.0 - S. N. Sivanandam, S. N Deepa

enGéron,"Hands-OnMachineLearningwithScikit-LearnandTensorFlow", Oreilly,2018.

erson,AdamGibson,"DeepLearning:APractitioner'sApproach",O'ReillyMedia,2017.

Aggarwal,"NeuralNetworksandDeepLearning:ATextbook",SpringerInternationalPublishing,1stEdition,2018.

rasforDeepNeuralNetworks,JojoMoolayil,Apress,2018

rning ProjectsUsingTensorFlow2, VinitaSilaparasetty, Apress,2020

rningwithPython,FRANÇOISCHOLLET,MANNINGSHELTERISLAND,2017.SRajasekaran,GAVijayalakshmiPai,"NeuralNetworks,Fuzzy
n,Synthesis andApplications",PHILearning,2017.

LearningwithTensorFlow, SantanuPattanayak,Apress,2017

Freeman,DavidMSKapura,"NeuralNetworksAlgorithms,Applications,andProgrammingTechniques",AddisonWesley,2003

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	K3	1,2,8,9,10	1,2
CO3	Apply conventional neural network model and its algorithms	III	K3	1,2,3,5,8,9,10,12	1,2
CO4	Use deep learning components to build and train deep neural networks for various tasks	IV	K3	1,2,3,5,8,9,10,12	1,2
CO5	Apply Recurrent Neural Network and its variants for text analysis	V	K3	1,2,3,5,8,9,10,12	1,2
CO6	Utilize the applications of neural networks and deep learning for image compression and Natural Language Processing	V	K3	1,2,3,5,8,9,10,12	1,2

CO-PO Mapping

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

20SCV54	CYBERSECURITY	L	T	P	C
		3	0	0	3

OBJECTIVES:

- Tounderstand various types of cyber-attacks andcyber-crimes
- Tolearnthreatsandriskswithincontextofthecyber security
- Tohaveanoverviewofthecyber laws &concepts of cyberforensics
- Tostudythedefensivetechniquesagainsttheseattacks

PRE-REQUISITE:NIL

UNIT-I INTRODUCTION 9

Basic Cyber Security Concepts, layers of security, Vulnerability, threat, Harmful acts, InternetGovernance–ChallengesandConstraints,ComputerCriminals,CIATriad,AssetsandThreat,motiveofattackers, activeattacks,passiveattacks,Softwareattacks,hardwareattacks,CyberThreats-CyberWarfare, CyberCrime,Cyberterrorism,CyberEspionage,etc.

UNIT- II CYBERFORENSICS 9

HistoricalbackgroundofCyberforensics,DigitalForensicsScience,TheNeedforComputer Forensics,CyberForensicsandDigitalevidence,ForensicsAnalysisofEmail,DigitalForensics Lifecycle, ForensicsInvestigation,ChallengesinComputerForensics

UNIT-III CYBERCRIME:MOBILEANDWIRELESSDEVICES 9

Introduction, Proliferation of Mobile and Wireless Devices, Trends in Mobility, Credit cardFrauds in Mobile and Wireless Computing Era, Security Challenges Posed by Mobile Devices,RegistrySettingsforMobileDevices,AuthenticationserviceSecurity,AttacksonMobile/CellPhones

UNIT-IV PRIVACYISSUES 9

PrivacyIssues:BasicDataPrivacyConcepts:FundamentalConcepts,DataPrivacyAttacks, Datalinkingandprofiling,privacypoliciesandtheirspecifications,privacypolicylanguages,privacyin differentdomains-medical,financial,etc

UNIT-V CYBERCRIME 9

Cybercrime:ExamplesandMini-CasesExamples:OfficialWebsiteofMaharashtraGovernment Hacked, Indian Banks Lose Millions of Rupees, Parliament Attack, Pune CityPoliceBustNigerianRacket,e-mailspoofing instances. Mini-Cases:TheIndianCaseof onlineGambling,AnIndianCaseofIntellectualPropertyCrime,FinancialFraudsinCyberDomain.

TOTAL:45PERIODS

TEXTBOOKS:

1. Nina Godbole and SunitBelpure, Cyber Security Understanding Cyber Crimes,ComputerForensicsandLegalPerspectives,Wiley,2013
2. B.B.Gupta,D.P.Agrawal,HaoxiangWang,ComputerandCyberSecurity:Principles,Algorithm,Applications,and Perspectives,CRCPress,2018.

REFERENCES:

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

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

CO-PO Mapping

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

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

UNITI INTRODUCTION **9**

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

UNITII 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;

UNITIII 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.

UNITIV 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;

UNITV INDUSTRIAL APPLICATIONS **9**

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

TOTAL: 45PERIODS

TEXTBOOKS:

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

REFERENCES:

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

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

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			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. JernejBarbic-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.

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

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

		L	T	P	C
20ADV15	**BUSINESS INTELLIGENCE SYETEM**	**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, SeemaAcharya, 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.

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

CO-PO Mapping

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

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.

CourseName: DATA COMMUNICATION AND COMPUTER NETWORKS		CourseCode:20ADV25			
CO	**CourseOutcomes**	**Unit**	**K-CO**	**POs**	**PSOs**
CO1	Demonstrate thebasiclayersanditsfunctionsincomputernetworks	I	K3	1,2,3,10,11	-
CO2	Evaluatetheperformanceofanetwork	II	K3	1,2,3,10,11	-
CO3	Conceptsofthebasicsofhowdataflowsfromonenodetoanother	II	K2	1,2,10,11	-
CO4	Analyzeanddesignroutingalgorithms	III	K3	1,2,3,10,11	-
CO5	Designprotocols for various functions inthenetwork	IV	K3	1,2,3,10,11	-
CO6	Knowabouttheworkingofvariousapplicationlayer protocols	V	K2	1,2,10,11	-

CO-PO Mapping

CO	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	-	-	-

20ADV45	ROBOTIC PROCESSAUTOMATION	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, ControlFlowfor 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, Collectingcrashdumps, 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

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 ProcessAutomation, 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 HoldingsPrivate Limited, 2018
3. A GerardusBlokdyk, “Robotic Process Automation RpaA Complete Guide “, 2020

Course Name :ROBOTIC PROCESS AUTOMATION		Course Code :20ADV45			
CO	**Course Outcomes**	**Unit**	**K-CO**	**POs**	**PSOs**
CO1	Understand the robotic process automation and its applications	I	K2	1,2,9,10,12	1
CO2	Illustratecontrol flows and work flows for the target process	II	K2	1,2,9,10,12	1
CO3	Demonstrate recording, web scraping andprocess mining by automation	III	K3	1,2,3,9,10, 12	1
CO4	Determineexception handling in automation processes	IV	K3	1,2,3,9,10, 12	1
CO5	Understand Code management and maintenancein automation	IV	K2	1,2,9,10,12	1
CO6	Understandthe Orchestrator forcontrolling of automated bots.	V	K2	1,2,9,10,12	1

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	3	2	1	-	-	-	-	-	1	1	-	2	2	-
CO4	3	2	1	-	-	-	-	-	1	1	-	2	2	-
CO5	2	1	-	-	-	-	-	-	1	1	-	1	2	-
CO6	2	1	-	-	-	-	-	-	1	1	-	1	2	-

20ADV55	TEXT AND SPEECH ANALYSIS	L	T	P	C
		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

TEXTBOOKS

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

REFERENCES:

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

20ADV65 SENSORSANDDEVICES

L	T	P	C
3	0	0	3

OBJECTIVES:

- Tounderstanddifferenttypesofsensorsandactuatorsfordifferentenvironments.
- Tofindthedifferentmeasurementsmethodsusingsensors
- Todesign suitable sensorsandactuatorsforengineeringapplications

PRE-REQUISITE: NIL

UNIT-I CLASSIFICATIONANDCHARACTERISTICSOFSENSORS **9**

Classification of Sensors and Transducers - Units and Measures–Transfer function-Impedancematching - Range, Span, Resolution, Accuracy, Errors, Repeatability, Sensitivity and Sensitivityanalysis - Hysteresis , Nonlinearity and saturation - Frequency response, response time andbandwidth -Calibration-Excitation– Dead band-Reliability.

UNIT-II SENSORSANDACTUATORS **9**

Temperature Sensors: Thermistors, Thermocouple, RTD. Motion sensor - Accelerometers – Gyroscopes-proximity sensors. Optical and Acoustical Sensors Bio sensors-EEG-ECG-EMG,imagesensor-CCD–CMOS.Actuators-PiezoelectricandPiezoresistiveactuators,micropumps andmicroactuators.

UNIT-III INTRODUCTIONTOARDUINO **9**

ArduinoUnoArchitecture-SetuptheIDE,WritingArduinoSoftware-ArduinoLibraries- Basics of Embedded C programming for Arduino - Interfacing LED - push button andbuzzerwith Arduino.

UNIT-IV INTERFACING OFSENSORS **9**

Sensors- Definition, Types. Interfacing arduino to different sensors- light sensor, temperaturesensor,humiditysensor,pressuresensorsoundsensor,distancerangingsensor,water/detectorsensor,smoke,gas,alcoholsensor, ultrasonic range finder

UNIT–V PROGRAMMINGESP8266MODULE **9**

Wired and wireless communication, Communication protocols, interfacing communicationmoduleswitharduino.InterfacingtheHardware:Arduino,ESP8266WiFiModule,andDHT-22Sensor,CheckingYourDataviaThingSpeak,ConnectingYourArduinoSet-uptoBlynkviaWiFi

TOTAL:45PERIODS

TEXTBOOKS:

1. NathanIda,“Sensors,ActuatorsandtheirInterfaces”,InstitutionofEngineeringand Technology,2020.
2. PatranabisD,“SensorandActuators”,PrenticeHallofIndia(Pvt)Ltd.2003.
3. Renganathan.S,“TransducerEngineering”,AlliedPublishers(P)Ltd.,2003.
4. BeginningArduino”,MichalMcRoberts,SecondEdition
5. Michal McRoberts“BeginningArduino”SecondEdition,TechnologyinAction

References
1. Clarence W. de Silva, "Sensors and Actuators: EngineeringSystemInstrumentation",2nd Edition,CRCPress,2015
2. ErnestO.Doeblin,"Measurementsystem,Applicationanddesign",TataMcGrawHillPublishing CompanyLtd.,Fifth Edition,2004
3. Bradley D.A., Dawson D, Burd N C, Loader A J," Mechatronics: Electronics in products andprocesses",CRCPress, 2018
4. MassimoBanzi, "Getting started with Arduino " 2nd Edition, Orelly 2011

Extensive Reading:

- www.endnote.com/downloads/style/sensors-and-actuators
- www.iav.com/en/engineering/.../sensor-and-actuator-systems
- www.biophysics.org/2015naiwat
- https://www.postscapes.com/iot-sensors-actuators/
- https://swayam.gov.in/nd1_noc19_ee41

OUTCOMES:
ATTHEENDOFTHECOURSE,LEARNERSWILLBEABLETO:

CourseName: SENSORS AND ACTUATORS		Course code: 20ADV65			
CO	**CourseOutcomes**	**Unit**	**K-CO**	**POs**	**PSOs**
CO1	Explain the classification of sensors and transducers and discuss the characteristics of Sensors	I	K2	1,2	-
CO2	Explain the construction and operation of various types of sensors and Actuators	II	K2	1,2,12	-
CO3	Discuss the general requirements for interfacing of sensors and algorithm for various types of sensors	III	K2	1,2	-
CO4	Develop a signal conditioning circuits for thermistor and RTD	IV	K3	1,2,3,12	-
CO5	Develop V/I and I/V converters for various sensors and discuss DAC and ADC	IV	K3	1,2,3,12	-
CO6	Discuss the appropriate sensor for real time applications	V	K2	1,2,5,9,12	-

CO-PO Mapping

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

20ADV75	ETHICS AND AI	L	T	P	C
		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

CourseName: ETHICS AND AI		CourseCode:20ADV75			
CO	**CourseOutcomes**	**Unit**	**K-CO**	**POs**	**PSOs**
CO1	Describe about morality and ethics in AI	I	K2	1,2,8,9,12	1
CO2	Express the knowledge of real time application ethics, issues and its challenges.	II	K2	1,2,4,8,9,12	1
CO3	Understand the ethical harms and ethical initiatives in AI	III	K2	1,2,8,9,12	1
CO4	Discuss about AI standards and Regulations like AI Agent, Safe Design of Autonomous and Semi-Autonomous Systems	IV	K2	1,2,4,8,9,12	1
CO5	Understand the concepts of Roboethics and Morality with professional responsibilities.	IV	K2	1,2,8,9,12	1
CO6	Explain the societal issues in AI with National and International Strategies on AI	V	K2	1,2,8,9,12	1

CO-PO Mapping

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

20ADV85	HEALTH CARE ANALYTICS	L	T	P	C
		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 INTRODUCTION TO HEALTHCARE ANALYSIS **9**

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

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

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

UNIT- III HEALTH CARE MANAGEMENT **9**

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

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

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

UNIT-V CASE STUDIES **9**

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

TOTAL:45 PERIODS

REFERENCES:

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

CourseName: HEALTH CARE ANALYTICS		CourseCode:20ADV85			
CO	**CourseOutcomes**	**Unit**	**K-CO**	**POs**	**PSOs**
CO1	Explain the machine learning and deep learning algorithms for health data analysis	1	K2	1,2,9,12	1,2
CO2	Evaluate the need of healthcare data analysis in e-healthcare, telemedicine and other critical care applications	2	K3	1,2,3,5,12	1,2
CO3	Discuss the data management techniques for healthcare data	3	K2	1,2,9,12	2
CO4	Apply health data analytics for real time applications	4	K3	1,2,9,12	2
CO5	Understand emergency care system using health data analysis	4	K2	1,2,9,12	1
CO6	Apply health care analytics in Healthcare and Emerging Technologies	5	K3	1,2,3,9,12	1

CO-PO Mapping

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

Open Elective
Semester - VI

20OE901	DATA SCIENCE USING PYTHON	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To understand the basic concepts of python porgramming.
- To Handle the file and exception
- To Learn Numpy
- To learn data manipulation with pandas
- To Understand Data cleaning Techniques
- To gain knowledge on data preparation

PRE-REQUISITE: NIL

UNIT I **INTRODUCTION TO DATA SCIENCE AND PYTHON PROGRAMMING** **9**

Introduction to Data Science - Why Python? - Essential Python libraries - Python Introduction- Features, Identifiers, Reserved words, Indentation, Comments, Built-in Data types and their Methods: Strings, List, Tuples, Dictionary, Set - Type Conversion- Operators.Decision Making- Looping- Loop Control statement- Math and Random number functions. User defined functions - function arguments & its types

UNIT II **FILE, EXCEPTION HANDLING AND OOP** **9**

User defined Modules and Packages in Python- Files: File manipulations, File and Directory related methods - Python Exception Handling.OOPs Concepts -Class and Objects, Constructors – Data hiding- Data Abstraction- Inheritance.

UNIT III **INTRODUCTION TO NUMPY** **9**

NumPy Basics: Arrays and Vectorized Computation- The NumPyndarray- Creating ndarrays- Data Types for ndarrays- Arithmetic with NumPy Arrays- Basic Indexing and Slicing - Boolean Indexing-Transposing Arrays and Swapping Axes.Universal Functions: Fast Element-Wise Array Functions- Mathematical and Statistical Methods-SortingUnique and Other Set Logic.

UNIT IV **DATA MANIPULATION WITH PANDAS** **9**

Introduction to pandas Data Structures: Series, DataFrame, Essential Functionality: Dropping EntriesIndexing, Selection, and Filtering- Function Application and Mapping- Sorting and Ranking.Summarizing and Computing Descriptive Statistics- Unique Values, Value Counts, and Membership.Reading and Writing Data in Text Format.

UNIT V **DATA CLEANING, PREPARATION AND VISUALIZATION** **9**

Data Cleaning and Preparation: Handling Missing Data - Data Transformation: Removing Duplicates, Transforming Data Using a Function or Mapping, Replacing Values, Detecting and Filtering Outliers- String Manipulation: Vectorized String Functions in pandas. Plotting with pandas: Line Plots, Bar Plots, Histograms and Density Plots, Scatter or Point Plots.

TOTAL: 45 PERIODS

TEXT BOOKS

1. Y. Daniel Liang, “Introduction to Programming using Python”, Pearson,2012.
2. Wes McKinney, “Python for Data Analysis: Data Wrangling with Pandas, NumPy, and IPython”, O’Reilly, 2nd Edition,2018.
3. Jake VanderPlas, “Python Data Science Handbook: Essential Tools for Working with Data”, O’Reilly, 2017

REFERENCES:

1. Wesley J. Chun, “Core Python Programming”, Prentice Hall,2006.
2. Mark Lutz, “Learning Python”, O’Reilly, 4th Edition, 2009.

CourseName: DATA SCIENCE USING PYTHON		**CourseCode:20OE901**			
CO	**CourseOutcomes**	**Unit**	**K-CO**	**POs**	**PSOs**
CO1	Explain the basic problems using Python built-in data types and their methods	I	K2	1,2,8,12	1
CO2	Describe the user-defined modules and packages using OOP concept	II	K2	1,2,8,12	1
CO3	Explain about data operations using NumPy arrays	III	K2	1,2,5,12	1
CO4	Apply the concepts of Pandasdata Series andDataFrameto display datas	IV	K3	1,2,3,5,12	1
CO5	Explain the data preprocessing modules using Pandas	V	K2	1,2,5,12	1
CO6	Describe the data visualization methods using Pandas	V	K2	1,2,5,8,12	1

CO-PO Mapping

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

20OE902	INTRODUCTION TO AIRTIFICIAL INTELLIGENCE AND DATA SCIENCE	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To explore the need of Artificial Intelligence.
- To provide knowledge of AI systems and its variants.
- To Investigate the role of data science.
- To Work with data pre-processing methods
- To Work with data analytics methods

PRE-REQUISITE: NIL

UNIT - I INTRODUCTION TO AI **9**

Introduction–Definition - Future of Artificial Intelligence – Characteristics of Intelligent Agents– Typical Intelligent Agents – Problem Solving Approach to Typical AI problems

UNIT - II KNOWLEDGE REPRESENTATION **9**

Problem solving Methods - Search Strategies- Uninformed - Informed - Heuristics - Local Search Algorithms and Optimization Problems - Searching with Partial Observations – Constraint Satisfaction Problems

UNIT- III INTRODUCTION TO DATA SCIENCE **9**

Introduction– Evolution of Data Science – Data Science Roles – Stages in a Data Science Project – Applications of Data Science in various fields – Data Security Issues

UNI T- IV DATA COLLECTION AND DATA PRE-PROCESSING **9**

Data Collection Strategies – Data Pre-Processing Overview – Data Cleaning – Data Integration and Transformation – Data Reduction – Data Discretization.

UNIT - V EXPLORATORY DATA ANALYTICS **9**

Descriptive Statistics – Mean, Standard Deviation, Skewness and Kurtosis – Box Plots – Pivot Table – Heat Map – Correlation Statistics – ANOVA

TOTAL: 45 PERIODS

TEXT BOOKS

1. S. Russell and P. Norvig, "Artificial Intelligence: A Modern Approachǁ, Prentice Hall, Fourth Edition, 2021.
2. Bratko, —Prolog: Programming for Artificial Intelligenceǁ, Fourth edition, Addison-Wesley Educational Publishers Inc., 2011.
3. JojoMoolayil, “Smarter Decisions : The Intersection of IoT and Data Science”, PACKT, 2016
4. Cathy O’Neil and Rachel Schutt , “Doing Data Science”, O'Reilly, 2015

REFERENCES:

1. Husain, Amir. The sentient machine: The coming age of artificial intelligence. Simon and Schuster, 2017
2. Kaplan, Jerry. Artificial intelligence: What everyone needs to know. Oxford University Press, 2016
3. David Dietrich, Barry Heller, Beibei Yang, “Data Science and Big data Analytics”, EMC 2013
4. Raj, Pethuru, “Handbook of Research on Cloud Infrastructures for Big Data Analytics”, IGI Global

Course Name: INTRODUCTION TO AIRTIFICIAL INTELLIGENCE AND DATA SCIENCE		Course Code:20OE902			
CO	**Course Outcomes**	**Unit**	**K-CO**	**POs**	**PSOs**
CO1	Understand the characteristics of intelligent agents	I	K2	1,2,9,10,12	1
CO2	Classify searching algorithm in AI	II	K3	1,2,3,9,10,12	1
CO3	Describe various knowledge representation methods	II	K2	1,2,4,9,10,12	1
CO4	Examine the basics of data science	III	K3	1,2,3,9,10,12	2
CO5	Apply the concepts of Data Collection and Data Pre-Processing	IV	K3	1,2,3,9,10,12	2
CO6	Demonstrate exploratory data analytics	V	K3	1,2,3,9,10,12	2

CO-PO Mapping

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

20OE903	MOBILEAPPDEVELOPMENT AND ITS APPLICATION	L	T	P	C
		3	0	0	3

OBJECTIVES:

- Understandsystemrequirementsformobileapplications
- Generatesuitabledesign using specific mobile developmentframeworks
- Generatemobileapplicationdesign
- Implementthedesignusingspecificmobiledevelopmentframeworks
- Deploythemobileapplicationsinmarketplacefordistribution

PRE-REQUISITE:NIL

UNIT-I **INTRODUCTIONTOMOBILEAPPLICATIONS** **9**

WebVsmobileApp–CostofDevelopment–Myths-MobileApplications–Marketing-MobileUserInterfaceDesign-EffectiveUseofScreen–MobileUsers-MobileInformationDesign-MobilePlatforms -Tools ofMobileInterface Design

UNIT- II **ANDROIDUSERINTERFACEDESIGN** **9**

AndroidArchitecture–AndroidSDKTools – ApplicationComponents-Intents –Contentproviders-Broadcastreceivers–Services- UserInterfaceDesign -Views –ViewGroups–Layouts-EventHandling–Listeners–Adapters–Menus- ActionBars–Notifications-AndroidLocalization

UNIT- III **ANDROIDDATASTORAGE** **9**

ContentProviders–Uri –CRUDaccess–Browser–CallLog–Contacts–MediaStore-DataAccessand Storage-SharedPreferences–StorageExternal-NetworkConnection-SQLiteDatabases

UNIT-IV **ANDROIDNATIVECAPABILITIES** **9**

Camera–Audio-SensorsandBluetooth-Playingaudio/video-Mediarecording-Sensors-Listeningto sensor readings – Bluetooth - Android Communications – GPS - Working with Location Manager,Working with Google Maps extensions - Maps via intent - Map Activity - Location based Services –LocationUpdates-LocationProviders-SelectingaLocationProvider-Finding Location

UNIT-V **IOSDESIGN** **9**

iPhoneCraze–iOSFeatures–iOSTools-iOSProject–ObjectiveCBasics–BuildingiOSApp–ActionsandOutlets–Delegates-UserInterfaceElements–Accelerometer–LocationHandling-SQLiteDatabase

TOTAL:45PERIODS

TEXTBOOK

1.JeffMcWherterandScottGowell,"ProfessionalMobileApplicationDevelopment",Wrox,2012.

REFERENCES

1. RetoMeier,“ProfessionalAndroid for Development”,JohnWileyandSons,2012.
2. DavidMark,JackNutting,JeffLaMarcheandFredericOlsson,“BeginningiOS6Development:Exploringtheir OSSDK”,Apress,2013.

Course Name: MOBILEAPPDEVELOPMENTAND ITS APPLICATION		Course Code:20OE903			
CO	**Course Outcomes**	**Unit**	**K-CO**	**POs**	**PSOs**
CO1	Understand the requirements for mobile applications	I	K2	1,2,9,10,12	-
CO2	Describe user interface for mobile applications	II	K3	1,2,3,9,10,12	-
CO3	Store mobile data of android applications	III	K2	1,2,9,10,12	-
CO4	Native capabilities of android applications	IV	K2	1,2,9,10,12	-
CO5	Describe iOS applications with tools	V	K3	1,2,3,9,10,12	-
CO6	Classify Mobile App using android and ios platforms	V	K3	1,2,3,9,10,12	-

CO-PO Mapping

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

20OE904	FOUNDATION OF ROBOTICS	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To study the kinematics, drive systems and programming of robots.
- To study the basics of robot laws and transmission systems.
- To familiarize students with the concepts and techniques of robot manipulator, its kinematics.
- To familiarize students with the various Programming and Machine Visionapplication in robots.
- To build confidence among students to evaluate, choose and incorporate robots inngineering systems

PRE-REQUISITE: NIL

UNIT - I FUNDAMENTALS OF ROBOT 9

Robot – Definition – Robot Anatomy – Co-ordinate systems, Work Envelope, types and classification – specifications – Pitch, yaw, Roll, Joint Notations, Speed of Motion, Pay Load – Robot Parts and their functions – Need for Robots – Different Applications

UNIT - II ROBOT KINEMATICS 9

Forward kinematics, inverse kinematics and the difference: forward kinematics and inverse Kinematics of Manipulators with two, three degrees of freedom (in 2 dimensional), four degrees of freedom (in 3 dimensional) – derivations and problems.

UNIT- III ROBOT DRIVE SYSTEMS AND END EFFECTORS 9

Pneumatic Drives – Hydraulic Drives – Mechanical Drives – Electrical Drives – D.C. Servo Motors, Stepper Motor, A.C. Servo Motors – Salient Features, Applications and Comparison of All These Drives. End Effectors – Grippers

UNI - IV SENSORS IN ROBOTICS 9

Force sensors, touch and tactile sensors, proximity sensors, non-contact sensors, safety considerations in robotic cell, proximity sensors, fail safe hazard sensor systems, and compliance mechanism. Machine vision system - camera, frame grabber, sensing and digitizing image data – signal conversion, image storage, lighting techniques, image processing and analysis

UNIT - V PROGRAMMING AND APPLICATIONS OF ROBOT 9

Teach pendant programming, lead through programming, robot programming languages – VAL programming – Motion Commands, Sensors commands, End-Effector Commands, and simple programs - Role of robots in inspection, assembly, material handling, underwater, space and medical fields.

TOTAL: 45 PERIODS

TEXT BOOKS

1. Ganesh.S.Hedge,"A textbook of Industrial Robotics", Lakshmi Publications, 2006.
2. Mikell.P.Groover , "Industrial Robotics – Technology, Programming and applications" McGraw Hill 2ND edition 2012.

REFERENCES:

1. Fu K.S. Gonalz R.C. and ice C.S.G."Robotics Control, Sensing, Vision and Intelligence", McGraw Hill book co. 2007.
2. YoramKoren, "Robotics for Engineers", McGraw Hill Book, Co., 2002.
3. Janakiraman P.A., "Robotics and Image Processing", Tata McGraw Hill 2005.
4. John. J.Craig, "Introduction to Robotics: Mechanics and Control" 2nd Edition, 2002.
5. Jazar, "Theory of Applied Robotics: Kinematics, Dynamics and Control", Springer India reprint, 2010.

CourseName: FOUNDATION OF ROBOTICS		Course Code:20OE904			
CO	**CourseOutcomes**	**Unit**	**K-CO**	**POs**	**PSOs**
CO1	Understand the features of robots and technology involved in the control.	I	K2	1,2,9,10,12	1
CO2	Describe the basic engineering knowledge for Robot Kinematics	II	K3	1,2,3,9,10,12	1
CO3	Apply various concepts like configurations, End effectors and grippers	III	K3	1,2,3,9,10,12	1
CO4	Classify different sensors in robots.	IV	K3	1,2,39,10,12	1
CO5	Demonstrate the image processing and image analysis techniques	IV	K3	1,2,3,9,10,12	1
CO6	Acquire knowledge of programming languages and applications of Robot	V	K3	1,2,3,9,10,12	1

CO-PO Mapping

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

Open Elective

Semester - VII

		L	T	P	C
20OE905	**ARTIFICIAL NEURAL NETWORK AND APPLICATIONS**	**3**	**0**	**0**	**3**

OBJECTIVES:

1. Study the concepts of Artificial Intelligence.
2. Learn the methods of solving problems using Artificial Intelligence.
3. Introduce the concepts of ANN.

PRE-REQUISITE:NIL

UNIT-I INTRODUCTION TO ANN **9**

Features , structure and working of Biological Neural Network , Trends inComputing Comparison of BNN and ANN

UNIT- II BASICS OF ARTIFICIAL NEURAL NETWORKS **9**

History of neural network research, characteristics of neural networksterminology, models of neuron McCulloch – Pitts model, Perceptron, Adalinemodel, Basic learning laws, Topology of neural network architecture

UNIT- III BACK PROPAGATION NETWORKS : (BPN) **9**

Architecture of feed forward network, single layer ANN, multilayerperceptron, back propagation learning, input - hidden and output layer computation, backpropagation algorithm, applications, selection of tuningparameters in BPN, Numbers of hidden nodes, learning.

UNIT-IV BASIC FUNCTIONAL UNITS OF ANN FOR PATTERN RECOGNITION TASKS **9**

Basic feedforward, Basic feedback and basic competitive learning neural network.Pattern association, pattern classification and pattern mapping tasks

UNIT-V APPLICATIONS OF ANN **9**

Pattern classification – Recognition of Olympic games symbols, Recognitionof printed Characters. Neocognitron – Recognition of handwritten characters.NET Talk: to convert English text to speech. Recognition of consonant vowel(CV) segments, texture classification and segmentation

TOTAL:45PERIODS

TEXTBOOK

1. B. Yegnanarayana - Artificial neural network PHI Publication.
2. S. Raj sekaran, VijayalakshmiPari - Neural networks, Fuzzy logic and Genetic Algorithms
3. Kevin L. Priddy, Paul E. Keller – Artificial neural networks: An Introduction - SPIE Press, 2005

REFERENCES

1. Mohammad H. Hassoun – Fundamentals of artificial neural networks - MIT Press ,1995
2. Nelson Morgan – Artificial neural network: Electronic Implementations – IEEE Press, 1990
3. Journal of Artificial neural networks, Volume 1 – Ablex Publishing corporation , 1994

CourseName: ARTIFICIAL NEURAL NETWORK AND APPLICATIONS		Course Code:20OE905			
CO	**CourseOutcomes**	**Unit**	**K-CO**	**POs**	**PSOs**
CO1	Organize synaptic connectivity as the basis of neural computation and learning	I	K3	1,2,3,9,10,12	1
CO2	Understand the ideological basics of artificial neural networks	II	K2	1,2,9,10,12	1
CO3	Apply the backpropagation algorithm in ANN	III	K3	1,2,3,9,10,12	1
CO4	Identify the different structures of artificial neural networks.	IV	K3	1,2,3,9,10,12	1
CO5	Explain functional units of ANN for pattern recognition	IV	K3	1,2,3,9,10,12	1
CO6	Describe various application of artificial neural networks	V	K3	1,2,3,9,10,12	1

CO-PO Mapping

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

		L	T	P	C
20OE906	AI and ROBOTICS	3	0	0	3

OBJECTIVES:

1. To present a problem oriented in depth knowledge of Artificial Intelligence and Robotics.
2. To address the underlying concepts, methods and application of different ArtificialIntelligence and Robotics

PRE-REQUISITE:NIL

UNIT-I Scope of AI **9**

Games theorem, natural language processing, vision and speech processing, robotics, expert systems, AI techniques- search knowledge, abstraction.

UNIT- II Problem solving **9**

State space search; Production systems, search space control: depth first, breadth-first search, heuristic search - hill climbing, best-first search, branch and bound. Problem Reduction, Constraint Satisfaction End, Means-End Analysis

UNIT- III Knowledge Representation **9**

Predicate Logic: unification, modus pones, resolution, dependency directed backtracking. Rule based Systems: forward reasoning, conflict resolution, backward reasoning, use of no backtracks. Structured Knowledge Representation: semantic net slots, exceptions and default frames, conceptualdependency, scripts.

UNIT-IV Handling uncertainty and learning **9**

Non-monotonic reasoning, probabilistic reasoning, use of certainty factors, fuzzy logic, Concept of learning, learning automation, genetic algorithm, learning by inductions, neural network.

UNIT-V Robotics **9**

Robot Classification, Robot Specification, notation Direct and Inverse Kinematics: Co-ordinates Frames, Rotations, Homogeneous Coordinates

TOTAL:45PERIODS

TEXTBOOK

1. E. Rich and K. Knight, “Artificial intelligence”, MH, 2nd ed., 1992.
2. N.J. Nilsson, “Principles of AI”, Narosa Publ. House, 2000.
3. Robin R Murphy, Introduction to AI Robotics PHI Publication, 2000

REFERENCES

1. D. W. Patterson, “Introduction to AI and Expert Systems”, PHI, 1992.
2. R. J. Schalkoff, “Artificial Intelligence - an Engineering Approach”, McGraw Hill Int. Ed., Singapore, 1992.
3. George Lugar, .AI-Structures and Strategies for and Strategies for Complex Problem solving, 4/e, 2002, Pearson Educations.

CourseName: AI FOR ROBOTICS		Course Code:20OE905			
CO	**CourseOutcomes**	**Unit**	**K-CO**	**POs**	**PSOs**
CO1	Understand natural language processing, AI techniques	I	K2	1,2,9,10,12	1
CO2	Apply the problem solving techniques	II	K3	1,2,3,9,10,12	1
CO3	Classify thePredicate Logic and Rule based Systems	III	K3	1,2,3,9,10,12	1
CO4	understand the Concept of learning	IV	K2	1,2,9,10,12	1
CO5	Explain Structured Knowledge Representation in AI	IV	K3	1,2,3,9,10,12	1
CO6	Classify Robots and discover its specification	V	K3	1,2,3,9,10,12	1

CO-PO Mapping

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

20OE907	FUNDAMENTALS OF BLOCKCHAIN TECHNOLOGY	L	T	P	C
		3	0	0	3

OBJECTIVES:

1. To understand the history, types and applications of Blockchain
2. To acquire knowledge about cryptography and consensus algorithms.
3. Deploy projects using Web3j and design blockchain based applications

PRE-REQUISITE:NIL

UNIT-I INTRODUCTION TO BLOCKCHAIN **9**

Distributed DBMS – Limitations of Distributed DBMS, Introduction to Block chain – History, Definition, Distributed Ledger, Blockchain Categories – Public, Private, Consortium, Blockchain Network and Nodes,Peer-to-Peer Network, Mining Mechanism, Generic elements of Blockchain, Features of Blockchain, andTypes of Blockchain

UNIT- II BLOCKCHAIN ARCHITECTURE **9**

Operation of BitcoinBlockchain, Blockchain Architecture – Block, Hash, Distributer P2P, Structure of Blockchain- Consensus mechanism: Proof of Work (PoW), Proof of Stake (PoS), Byzantine Fault Tolerance(BFT), Proof of Authority (PoA) and Proof of Elapsed Time (PoET)

UNIT- III BLOCKCHAIN-BASED FUTURES SYSTEM **9**

Project presentation- Futures smart contract: Blockchain oracles- Web3j: Setting up the Web3J- Installingweb3j- Wallet creation, Java client: The wrapper generator- Initializing web3j- Setting up Ethereumaccounts- Deploying the contract

UNIT-IV BLOCKCHAINS IN BUSINESS AND CREATING ICO **9**

Public versus private and permissioned versus permission less blockchains- Privacy and anonymity in Ethereum- Why are privacy and anonymity important? - The Ethereum Enterprise Alliance- Blockchainas-a-Service- Initial Coin Offering (ICO): Project setup for ICO implementation- Token contracts- Tokensalecontracts-Contract security and testing the code.

UNIT-V DISTRIBUTED STORAGE IPFS AND SWARM **9**

Ethereum Virtual Machine- Swarm and IPFS: Installing IPFS, Hosting our frontend: Serving your frontendusing IFPS, Serving your frontend using Swarm, IPFS file uploader project: Project setup the web page

TOTAL:45PERIODS

TEXTBOOK

1. Imran Bashir, “Mastering Blockchain: Distributed Ledger Technology, decentralization, and smart contracts explained”, 2ndEdition, Packt Publishing Ltd, March 2018.
2. BellajBadr, Richard Horrocks, Xun (Brian) Wu, “BlockchainBy Example: A developer's guide to creating decentralizedapplications using Bitcoin, Ethereum, and Hyperledger”, Packt Publishing Limited, 2018.

REFERENCES

1. Andreas M. Antonopoulos , “Mastering Bitcoin: Unlocking Digital Cryptocurrencies”, O’Reilly Media Inc, 2015
2. Arvind Narayanan, Joseph Bonneau, Edward Felten, Andrew Miller and Steven Goldfeder, “Bitcoin and CryptocurrencyTechnologies: A Comprehensive Introduction”, Princeton University Press, 2016

CourseName: AI FOR ROBOTICS		**Course Code:20OE905**			
CO	**CourseOutcomes**	**Unit**	**K-CO**	**POs**	**PSOs**
CO1	Understand the Mining Mechanism and Blockchain Network.	I	K2	1,2,9,10,12	-
CO2	Understand the cryptography and Consensus mechanism	II	K2	1,2,9,10,12	-
CO3	Classify Project presentation using Web3j.	III	K3	1,2,3,9,10,12	-
CO4	Implement an ICO on Ethereum	IV	K3	1,2,3,9,10,12	-
CO5	Explainblockchain based application with Swarm and IPFS	V	K3	1,2,3,9,10,12	-
CO6	DemonstrateInitial Coin Offering and Contract security	V	K3	1,2,3,9,10,12	-

CO-PO Mapping

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

20OE908	INTRODUCTION WEB APPLICATION SECURITY	L	T	P	C
		3	0	0	3

OBJECTIVES:

1. To reveal the underlying in web application.
2. To identify and aid in fixing any security vulnerabilities during the web developmentprocess.
3. To understand the security principles in developing a reliable web application

PRE-REQUISITE:NIL

UNIT-I Overview of Web Applications **9**

Introduction history of web applications interface ad structure benefits and drawbacks of web applications Web application Vs Cloud application.

UNIT- II Web Application Security Fundamentals **9**

Security Fundamentals: Input Validation - Attack Surface Reduction Rules of Thumb- Classi- fying and Prioritizing Threads

UNIT- III Browser Security Principles **9**

Origin Policy - Exceptions to the Same-Origin Policy - Cross-Site Scripting and Cross-Site Request Forgery - Reflected XSS - HTML Injection

UNIT-IV Web Application Vulnerabilities **9**

Understanding vulnerabilities in traditional client server application and web applications, client state manipulation, cookie based attacks, SQL injection, cross domain attack (XSS/XSRF/XSSI) http header injection. SSL vulnerabilities and testing - Proper encryption use in web application- Session vulnerabilities and testing - Cross-site request forgery

UNIT-V Web Application Security **9**

Http request , http response, rendering and events , html image tags, image tag security, issue, java script onerror , Javascript timing , port scanning , remote scripting , running remotecode, frame and iframe , browsersandbox, policy goals, same origin policy, library import, domain relaxationClickjacking - DNS rebinding - Flash security - Java applet security - Single-sign-on solution and security -IPv6 impact on web security

TOTAL:45PERIODS

TEXTBOOK

1. Sullivan, Bryan, and Vincent Liu. Web Application Security, A Beginner's Guide. McGraw HillProfessional, 2011.
2. Stuttard, Dafydd, and Marcus Pinto. The Web Application Hacker's Handbook: Finding andExploiting Security Flaws. John Wiley Sons, 2011

REFERENCES

1. Hacking Exposed Web Applications, 3rd edition, JOEL SCAMBRAY, VINCENT LIU,CALEB SIMA
2. The Web Application Hacker's Handbook Discovering and Exploiting Security Flaws ByDafyddStuttard, Marcus Pinto
3. Rich Bowen, Ken Coar, "Apache Cookbook", O'Reilly
4. Open Web Application Security Project. A Guide to Building Secure Web Applications andWeb Services. http://www.owasp.org/index.php/Category:OWASP_Guide_Project

CourseName: AI FOR ROBOTICS		Course Code:20OE905			
CO	**CourseOutcomes**	**Unit**	**K-CO**	**POs**	**PSOs**
CO1	Identify the vulnerabilities in the web applications.	I	K2	1,2,9,10,12	-
CO2	Explain various types of threats and mitigation measures of webapplications	II	K3	1,2,3,9,10,12	-
CO3	Understand the Browser Security Principles	III	K2	1,2,9,10,12	-
CO4	Apply the security principles in developing a reliable web application	IV	K3	1,2,3,9,10,12	-
CO5	Use industry standard tools for web application security	V	K2	1,2,9,10,12	-
CO6	Describe penetration testing to improve the security of web applications	V	K3	1,2,3,9,10,12	-

CO-PO Mapping

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

MANAGEMENT ELECTIVE COURSES

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

OBJECTIVES:

- To understand TQM concepts.
- To know about TQM principles.
- To understand Six Sigma, Traditional tools, New tools, Benchmarking and FMEA.
- To understand Taguchi's Quality Loss Function, Performance Measures and apply QFD, TPM, COQ and BPR.
- To apply QMS and EMS in any organization.

PRE-REQUISITE: 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	**CourseOutcomes**											**Unit**	**K –CO**	**POs**	**PSOs**
CO1	Explain basic concepts, TQM framework, Barriers Benefits of TQM and importance of customers											1	K2	1,5,6,8 -12	
CO2	Explain the TQM Principles, understand the importance of employee involvement and supplier partnership											2	K2	1,5, 6,8 -12	
CO3	Explain the basics of Six Sigma, Traditional tools, New tools,											3	K2	1,5,6,8 -12	
CO4	Explain the process of Benchmarking and FMEA.											3	K2	1,5,6,8 -12	
CO5	Explain process capability, QFD, TPM, Taguchi quality loss function and performance measures											4	K2	1,5,6,8 -12	
CO6	Explain the Quality system ISO 9000, ISO 14000, Audit, Certification process and implementation of TQM in manufacturing and service sectors											5	K2	1,6,7,8-12	
CO-PO Mapping															
CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**		**PSO1**	**PSO2**
CO1	1				1	2		2	2	2	2	1			
CO2	1				2	2		2	2	2	2	1			
CO3	1				2	2		2	2	2	2	1			
CO4	1				2	2		2	2	2	2	1			
CO5	1				2	2		2	2	2	2	1			
CO6	1				-	2	2	2	2	2	2	1			

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**
CO1	Explain the fundamental aspects of Intellectual property Rights which plays a major role in development and management of innovative projects in industries.	1	K2	6,7,8,10,11,12	
CO2	Describe the patents, patent regime in India and abroad and registration aspects.	2	K2	6,7,8,10,11,12	
CO3	Describe the copyrights and its related rights and registration aspects.	3	K2	6,7,8,10,11,12	
CO4	Explain the trademarks and registration aspects.	4	K2	6,7,8,10,11,12	
CO5	Explain the Design, Geographical Indication (GI), Plant Variety and Layout Design Protection and their registration aspects.	5	K2	6,7,8,10,11, 12	
CO6	Analyze the current trends in IPR and Government steps in fostering IPR.	5	K2	6,7,8,10,11,	

CO-PO Mapping

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

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 (McClellend'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**
CO1	Conclude the project characteristics and various stages of a project.	1	K6	8,9,10,11	
CO2	Compile the conceptual clarity about project organization and feasibility.	2	K5	8,9,10,11	
CO3	Apply the risk management plan and analyze the role of stakeholders.	3	K3	8,9,10,11	
CO4	Analyze the social responsibility for an entrepreneurship.	4	K4	7,8,9,10,11	
CO5	Interpret the gain knowledge to overcome the factors affecting small-scale business.	4	K3	8,9,10,11	
CO6	Formulate a new small-scale business.	5	K6	7,8,9,10,11	

CO-PO Mapping

COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	-	-	-	-	-	-	-	2	2	2	3	-	-	-	-
CO2	-	-	-	-	-	-	-	2	2	2	3	-	-	-	-
CO3	-	-	-	-	-	-	-	2	2	2	3	-	-	-	-
CO4	-	-	-	-	-	-	3	2	2	2	3	-	-	-	-
CO5	-	-	-	-	-	-	-	2	2	2	3	-	-	-	-
CO6	-	-	-	-	-	-	3	2	2	2	3	-	-	-	-

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, “Yogasanaur pranayama”, N.S. Publications, New Delhi, 2015.
3. Janardan Swami YogabhyasiMandal, “Yogic Asanas for Group Training - Part-I”, Nagpur.

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

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

CO-PO Mapping

COs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12	PSO 1	PSO 2	PSO3
CO1	3	3	3	3	-	-	-	-	-	-	-	-	-	-	-
CO2	3	3	3	3	-	-	-	-	-	-	-	-	-	-	-
CO3	3	3	3	3	-	-	-	-	-	-	-	-	-	-	-
CO4	3	3	3	3	-	-	-	-	-	-	-	-	-	-	-
CO5	3	3	3	3	-	-	-	-	-	-	-	-	-	-	-
CO6	3	3	3	3	-	-	-	-	-	-	-	-	-	-	-

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. PanneerSelvam, 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**
CO1	Describe the concept of engineering economics	1	K2	1,2,8	1,2
CO2	Comprehend macroeconomic principles	2	K2	1,2,8	1,2
CO3	Decision making in diverse business set up	3	K2	1,2,8	1,2
CO4	Explain the Inflation & Price Change	3	K2	1,2,8	1,2
CO5	Explain Present Worth Analysis	4	K2	1,2,8	1,2
CO6	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
CO1	2	1	-	-	-	1	1	2	2	2	-	-	1	1
CO2	2	1	-	-	-	1	1	2	2	2	-	-	1	1
CO3	2	1	-	-	-	1	1	2	2	2	-	-	1	1
CO4	2	1	-	-	-	1	1	2	2	2	-	-	1	1
CO5	2	1	-	-	-	1	1	2	2	2	-	-	1	1
CO6	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 DemandClassification 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 ImplementationIndustrial Marketing Strategy Components - Industrial Marketing Research for New Product DevelopmentIndustrial 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.

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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