K.L.N. COLLEGE OF ENGINEERING

Pottapalayam, Sivagangai District

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

Estd: 1994

FINAL YEAR CURRICULUM & SYLLABUS

CHOICE BASED CREDIT SYSTEM

REGULATIONS 2020

For Under Graduate Program

B.E. COMPUTER SCIENCE AND ENGINEERING

(For the students admitted from the academic year 2020-2021 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 evolve in the field of Computer Science & Engineering through sustainable technical education with innovative research and to foster competent professionals to serve and lead the society.

MISSION OF THE DEPARTMENT

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

PROGRAM EDUCATIONAL OBJECTIVES (PEOs)

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

PROGRAM SPECIFIC OUTCOMES (PSOs)

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

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

PROGRAM OUTCOMES

PO1. Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

PO2. Problem analysis: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

PO3. Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

PO4. Conduct investigations of complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

PO5. Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.

PO6. The engineer and society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

PO7. Environment and sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

PO8. Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

PO9. Individual and team work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

PO10. Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

PO11. Project management and finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

PO12. Life-long learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

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

REGULATIONS 2020

For Under Graduate Program

B.E. – COMPUTER SCIENCE AND ENGINEERING

CHOICE BASED CREDIT SYSTEM

CATEGORY OF COURSES

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

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

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

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

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

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

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

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

K.L.N. COLLEGE OF ENGINEERING, POTTAPALAYAM

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

REGULATIONS 2020

CHOICE BASED CREDIT SYSTEM

B.E. – COMPUTER SCIENCE AND ENGINEERING

CURRICULAM AND SYLLABUS VII & VIII SEMESTERS

SEMESTER VII

Sl. No.	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
THEORY								
1	20CS701	Data Analytics	PC*	3	3	0	0	3
2	20CS702	Artificial Intelligence	PC	3	3	0	0	3
3		Open Elective II	OE	3	3	0	0	3
4		Professional Elective II	PE	3	3	0	0	3
5		Professional Elective III	PE	3	3	0	0	3
PRACTICAL								
6	20CS7L1	Data Analytics Laboratory	PC*	4	0	0	4	2
7	20CS7L2	Mini Project	EEC	4	0	0	4	2
TOTAL				**23**	**15**	**0**	**8**	**19**

SEMESTER VIII

Sl. No.	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
THEORY								
1		Professional Elective IV	PE	3	3	0	0	3
2		Professional Elective V	PE	3	3	0	0	3
PRACTICAL								
3	20CS8L1	Project Work	EEC	20	0	0	20	10
TOTAL				**26**	**6**	**0**	**20**	**16**

***Common to B.E.CSE &B.Tech IT programmes**

PROFESSIONAL ELECTIVES (PE)

SEMESTER VII PROFESSIONAL ELECTIVE II

Sl. No.	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
1	20CS7A1	Cloud Computing	PE	3	3	0	0	3
2	20CS7A2	Agile Methodologies	PE*	3	3	0	0	3
3	20CS7A3	Java Scripting	PE	3	3	0	0	3
4	20CS7A4	Natural Language Processing	PE*	3	3	0	0	3
5	20CS7A5	Advanced Topics on Databases	PE	3	3	0	0	3
6	20IT601	Internet of Things	PE*	3	3	0	0	3
7	20HS7A2	Total Quality Management	PE	3	3	0	0	3

SEMESTER VII PROFESSIONAL ELECTIVE III

Sl. No.	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
1	20CS7B1	C# and .Net Programming	PE*	3	3	0	0	3
2	20CS7B2	Wireless Adhoc and Sensor Networks	PE*	3	3	0	0	3
3	20CS7B3	Multi-core Architectures and Programming	PE	3	3	0	0	3
4	20CS7B4	Distributed Systems	PE	3	3	0	0	3
5	20IT7B2	User Interface Design	PE*	3	3	0	0	3
6	20IT7B4	Service Oriented Architecture	PE*	3	3	0	0	3
7	20HS601	Operations Research	PE	3	3	0	0	3

SEMESTER VIII PROFESSIONAL ELECTIVE IV

Sl. No.	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
1	20CS8A1	Social Network Analysis	PE*	3	3	0	0	3
2	20CS8A2	Software Defined Networks	PE	3	3	0	0	3
3	20CS8A3	Digital Forensics and Ethical Hacking	PE*	3	3	0	0	3
4	20CS8A4	Soft Computing	PE	3	3	0	0	3
5	20IT7B1	Cyber Physical Systems	PE	3	3	0	0	3
6	20IT8A2	Information Security	PE*	3	3	0	0	3
7	20EC8A3	Robotics and Automation	PE	3	3	0	0	3

SEMESTER VIII PROFESSIONAL ELECTIVE V

Sl. No.	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
1	20CS8B1	Information Retrieval Techniques	PE*	3	3	0	0	3
2	20CS8B2	Green Computing	PE*	3	3	0	0	3
3	20CS8B3	Virtual Reality and Augmented Reality	PE*	3	3	0	0	3
4	20CS8B4	Block Chain Technology	PE*	3	3	0	0	3
5	20IT8B2	Software Project Management	PE	3	3	0	0	3
6	20HS6A1	Intellectual Property Rights	PE	3	3	0	0	3
7	20HS8B2	Economics for Engineers	PE	3	3	0	0	3

***Common to B.E.CSE &B.Tech IT programmes**

SEMESTER VII OPEN ELECTIVE II

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

OPEN ELECTIVE – II (VII SEMESTER) offered to other Department

Sl. No.	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
1	20OE405	Machine Learning Techniques	OE	3	3	0	0	3
2	20OE406	Java Script Programming	OE	3	3	0	0	3
3	20OE407	Computer Graphics	OE	3	3	0	0	3
4	20OE408	Essentials of Data Analytics	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 data sets 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 tools

PRE-REQUISITE:

Course Code: 20CS604
Course Name: 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 INTELLIGENT DATA ANALYSIS 9

Analysis of Time Series : Linear and Non Linear Systems Analysis, Neural Networks : Fundamentals – Back Propagation Neural Network – Fuzzy Logic : Basics of Fuzzy Sets and Fuzzy Logic - Genetic Algorithms

UNIT - V HADOOP FRAMEWORKS 9

HADOOP – HDFS concepts, Algorithms using MapReduce, 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 Ambiga Dhiraj, "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 Polyglot Persistence", Addison-Wesley Professional, 2012.

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

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	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	1,2,3,8, 9,12	1
C401.5	Apply intelligent analytics techniques like neural networks, fuzzy and genetic algorithms for real time analytics applications											4	K3	1, 2, 3,8,9	1
C401.6	Explain the Hadoop related tools such as HBase, Cassandra, Pig, and Hive for big data analytics											5	K2	1,2,5, 8,9, 12	1,2
CO-PO Mapping															
CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**		**PSO1**	**PSO2**
C401.1	2	1	-	-	-	-	-	1	1	-	-	-		1	-
C401.2	2	1	-	-	-	-	-	1	1	1	-	-		1	-
C401.3	2	1	-	-	-	-	-	1	1	1	-	-		1	-
C401.4	3	2	1	-	-	-	-	1	1	-	-	1		1	-
C401.5	3	2	1	-	-	-	-	1	1	-	-	1		1	-
C401.6	2	1	-	-	1	-	-	1	1	-	-	1		1	2
C	2	1	1	-	1	-	-	1	1	1	-	1		1	1

20CS702	ARTIFICIAL INTELLIGENCE	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To understand the various characteristics of Intelligentagents
- To learn the different search strategies inAI
- To learn to represent knowledge in solving AIproblems
- To understand the different ways of designing softwareagents
- To know about the various applications of AI.

PRE-REQUISITE: NIL

UNIT - I INTRODUCTION **9**

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

UNIT - II PROBLEM SOLVING METHODS **8**

Problem solving Methods - Search Strategies- Uninformed - Informed - Heuristics - Local Search Algorithms and Optimization Problems - Searching with Partial Observations - Constraint Satisfaction Problems – Constraint Propagation - Backtracking Search - Game Playing – Optimal Decisions in Games – Alpha - Beta Pruning - Stochastic Games

UNIT - III KNOWLEDGE REPRESENTATION **9**

First Order Predicate Logic – Prolog Programming – Unification – Forward Chaining-Backward Chaining – Resolution – Knowledge Representation - Ontological Engineering-Categories and Objects – Events - Mental Events and Mental Objects - Reasoning Systems for Categories - Reasoning with Default Information.

UNIT - IV SOFTWARE AGENTS **9**

Architecture for Intelligent Agents – Agent communication – Negotiation and Bargaining – Argumentation among Agents – Trust and Reputation in Multi-agent systems

UNIT - V APPLICATIONS **9**

AI applications – Language Models – Information Retrieval- Information Extraction – Natural Language Processing - Machine Translation – Speech Recognition – Robot – Hardware – Perception – Planning – Moving.

TOTAL: 45 PERIODS

TEXT BOOKS:

1. S. Russell and P. Norvig, "Artificial Intelligence: A Modern Approach, Prentice Hall, Third Edition, 2011.
2. I. Bratko, Prolog: Programming forArtificial Intelligence, Fourth edition, Addison-Wesley Educational Publishers Inc., 2011.

REFRENCES:

1. M. TimJones, ArtificialIntelligence: A Systems Approach (Computer Science), Jones and Bartlett Publishers, Inc.; First Edition, 2008
2. Nils J.Nilsson, The Quest for Artificial Intelligence, Cambridge University Press, 2009.
3. William F. Clocksin and Christopher S. Mellish,Programming in Prolog: Using the ISO Standard, Fifth Edition, Springer, 2003.
4. Gerhard Weiss, Multi Agent Systems, Second Edition, MIT Press, 2013.
5. David L. Poole and Alan K. Mackworth, Artificial Intelligence: Foundations of Computational Agents, Cambridge University Press, 2010.

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

Course Name : ARTIFICIAL INTELLIGENCE		**Course Code : 20CS702**			
CO	**Course Outcomes**	**Unit**	**K-CO**	**POs**	**PSOs**
C402.1	Explain the concept of intelligent agent and various problem solving approaches.	1	K2	1, 2, 8,9	1
C402.2	Determine the appropriate search algorithms for any AI problem	2	K2	1, 2, 8,9	1
C402.3	Discuss the suitable agent strategy to solve a given problem.	2	K2	1, 2, 8,9	1
C402.4	Illustrate first order and predicatelogic for a given problem	3	K3	1, 2, 3, 8,9	1
C402.5	Explain software agents components to solve a problem	4	K2	1, 2, 8,9	1
C402.6	Summarize the different applications that use Artificial Intelligence	5	K2	1, 2, 8,9	1

CO-PO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO11	PO12	PSO1	PSO2
C402.1	2	1	-	-	-	-	-	1	1	1	-	-	2	-
C402.2	2	1	-	-	-	-	-	1	1	1	-	-	2	-
C402.3	2	1	-	-	-	-	-	1	1	1	-	-	2	-
C402.4	3	2	1	-	-	-	-	1	1	1	-	-	2	-
C402.5	2	1	-	-	-	-	-	1	1	1	-	-	2	-
C402.6	2	1	-	-	-	-	-	1	1	1	-	-	2	-
C	2	1	1	-	-	-	-	1	1	1	-	-	2	-

20CS7L1	DATA ANALYTICS LABORATORY	L	T	P	C
		0	0	4	2

OBJECTIVES:

- To implement numerical and statistical analysis on various data sources
- To apply data pre-processing techniques
- To implement linear regression technique on numeric data for prediction
- To execute classification and clustering algorithms on different datasets
- To implement and evaluate the performance of KNN algorithm on different datasets

PRE-REQUISITE: NIL

1. Write a Program to Read and write operations on different types of Files (csv, xls, txt etc).
2. Implement a program for statistical operations such as Mean, Median, Mode and Standard deviation.
3. Implement data pre-processing operations
    a. Handling Missing data
    b. Min-Max normalization
4. Write a Program to implement Linear Regression Model on given dataset
5. Write a Program to implement logistic regression to perform classification on given dataset.
6. Write a Program to implement Simple Naïve Bayes classification algorithm on given dataset.
7. Write a Program to implement K-Means clustering operation and visualize for given dataset.
8. Write a Program to diagnose any disease using KNN classification and plot the results.
9. Create Visualization:
    a. Find the data distributions using box and scatter plot.
    b. Find the outliers using plot.
    c. Plot the histogram, bar chart and pie chart on sample data.
10. Mini Project

TOTAL: 60 PERIODS

LAB EQUIPMENT FOR A BATCH OF 30 STUDENTS:

Software Requirements: R / Python

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

OUTCOMES :

Course Name : Data Analytics Laboratory		Course Code : 20CS7L1			
CO	**Course Outcomes**	**Experiments**	**K-CO**	**POs**	**PSOs**
C406.1	Build numerical and statistical analysis on various data sources	1,2	K3	1,2,3,8,9,10, 12	1,2
C406.2	Apply data preprocessing and dimensionality reduction methods on raw data	3	K3	1,2,3,8,9,10, 12	1,2
C406.3	Apply the different regression technique on given dataset	4,5	K3	1,2,3,8,9,10, 12	1,2
C406.4	Apply the classification and clustering algorithms on different datasets	6,7,8	K3	1,2,3,8,9,10, 12	1,2
C406.5	Apply appropriate visualization techniques for presenting the data	9	K3	1,2,3,8,9,10, 12	1,2
C406.6	Solve the real world data analysis problems.	10	K4	1,2,3,4,5,6,8, 9,10,11,12	1,2

CO-PO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
C406.1	3	2	1	-	-	-	-	2	2	2	-	2	1	2
C406.2	3	2	1	-	-	-	-	2	2	2	-	2	1	2
C406.3	3	2	1	-	-	-	-	2	2	2	-	2	1	2
C406.4	3	2	1	-	-	-	-	2	2	2	-	2	1	2
C406.5	3	2	1	-	-	-	-	2	2	2	-	2	1	2
C406.6	3	3	2	1	1	1	-	2	2	2	2	2	1	2
C	3	2	1	1	1	1	-	2	2	2	1	2	1	2

20CS7L2 **MINI PROJECT** **L T P C**
0 0 4 2

OBJECTIVES:

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

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

TOTAL: 60 PERIODS

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

Course Name : Mini Project		**Course Code : 20CS7L2**			
CO	**Course Outcomes**	**Experiments**	**K-CO**	**POs**	**PSOs**
C407.1	Identify a problem and its applicability along with suitable domain.	-	K3	1,2,3,6,7,8,9, 10, 11,12	1,2
C407.2	Analyze and formulate project modules and identified constraints based on environmental and societal impact.	-	K4	1,2,3,4,5,6,7, 8,9,10,11,12	1,2
C407.3	Select efficient tools and methods for designing and implementing project modules.	-	K4	1,2,3,4,5,6,7, 8,9,10,11,12	1,2
C407.4	Propose an effective solution for the problem identified with the help of developed methodology and tools	-	K6	1,2,3,4,5,6,7, 8,9,10,11,12	1,2
C407.5	Summarize all the modules through effective integration and testing.	-	K5	1,2,3,4,5,6,7, 8,9,10,11,12	1,2
C407.6	Illustrate the completed task and compile the project report.	-	K4	1,2,3,4,5,6,7, 8,9,10,11,12	1,2

CO-PO Mapping

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

20CS8L1	PROJECT WORK	L	T	P	C
		0	0	20	0

OBJECTIVES:

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

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

TOTAL: 300 PERIODS

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

Course Name : Project Work		Course Code : 20CS8L1			
CO	**Course Outcomes**	**Experiments**	**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

CO-PO Mapping

CO	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
C410	3	3	2	2	2	3	3	3	3	3	3	2	3	3

SEMESTER VII ELECTIVE II

20CS7A1	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 10

Service Oriented Architecture – REST and Systems of Systems – Web Services – Publish-Subscribe 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 8

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 10

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 8

Hadoop – MapReduce – 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, From Parallel 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. Rajkumar Buyya, Christian Vecchiola, S. ThamaraiSelvi, Mastering Cloud Computing, Tata Mcgraw Hill, 2013.
2. Toby Velte, Anthony Velte, Robert Elsenpeter, "Cloud Computing - A Practical Approach, Tata Mcgraw Hill, 2009.
3. George Reese, "Cloud Application Architectures: Building Applications and Infrastructure in the Cloud: transactional Systems for EC2 and Beyond (Theory in Practice), O'Reilly, 2009.

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

Course Name : Cloud Computing		Course Code : 20CS7A1			
CO	**Course Outcomes**	**Unit**	**K-CO**	**POs**	**PSOs**
CE404.1	Descibe the main concepts, key technologies, strengths and limitations of cloud computing.	1	K2	1,2,8,9	1,2
CE404.2	Explain the key and enabling technologies that help in the development of cloud.	2	K2	1,2,8,9	1,2
CE404.3	Discuss the usage of architecture of compute and storage cloud, service and delivery models.	3	K2	1,2,8,9	1,2
CE404.4	Explain the core issues of cloud computing such as resource management and security.	4	K2	1,2,8,9	1,2
CE404.5	Illustrate the security features to be adopted in cloud.	4	K2	1,2,8,9	1,2
CE404.6	Infer the appropriate technologies, algorithms and approaches for implementation and use of cloud	5	K3	1,2,3, 8,9	1,2

CO-PO Mapping														
CO	**PO1**	**PO2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO10**	**PO11**	**PO12**	**PSO 1**	**PSO2**
CE404.1	2	1	-	-	-	-	-	1	**1**	1	-	-	2	2
CE404.2	2	1	-	-	-	-	-	1	1	1	-	-	2	2
CE404.3	2	1	-	-	-	-	-	1	1	1	-	-	2	2
CE404.4	2	1	-	-	-	-	-	1	1	1	-	-	2	2
CE404.5	2	1	-	-	-	-	-	1	1	1	-	-	2	2
CE404.6	3	2	1	-	-	-	-	1	1	1	-	-	2	2
C	2	1	1	-	-	-	-	1	1	1	-	-	2	2

20CS7A2	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.

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

Course Name : Agile Methodologies											**Course Code : 20CS7A2**			
CO	**Course Outcomes**										**Unit**	**K-CO**	**POs**	**PSOs**
CE404.1	Explain the fundamentals of agile and project management										1	K2	1, 2, 8,9,11	1,2
CE404.2	Discuss the components of agile scrum framework.										2	K2	1, 2, 8, 9	1,2
CE404.3	Discuss the requirements engineering process in agile.										3	K2	1, 2, 8,9	1,2
CE404.4	Describe the different types of testing in agile framework.										3	K2	1, 2,5, 8, 9	1,2
CE404.5	Explain Agile software design and development practices.										4	K2	1, 2,8,9, 11	1,2
CE404.6	Illustrate agile quality assurance framework and Industry Trends										5	K2	1, 2, 5, 8,9	1,2
CO-PO Mapping														
CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CE404.1	2	1						1	**1**	1	1		1	2
CE404.2	2	1						1	1	1	1		1	2
CE404.3	2	1						1	1	1	1		1	2
CE404.4	2	1			1			1	1	1			1	2
CE404.5	2	1						1	1	1	1		1	2
CE404.6	2	1			1			1	1	1			1	2
C	2	1			1			1	1	1	1		1	2

20CS7A3	JAVA SCRIPTING	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To understand Definition, Evolution and Nature of JavaScript
- To understand the basics of Script Writing
- To Learn Java Script Names, Objects, and Methods
- To Create Dynamic Web Pages
- To understand the method of Adding Interactivity to a Web Page.

PRE-REQUISITE: Nil

UNIT – I HTML5 **10**

Introduction to HTML5 – Working with Forms: Accessing the form element, The form object, Accessibility, Validation, Using form-based navigation, Form widgets in libraries. Errors and Exceptions, Animation, Multimedia, Debugging

UNIT – II INTRODUCTION TO JAVA SCRIPT **8**

JAVA Script Basics: An introduction to JavaScript– Advantages & Limitations of Java Script. Syntax, Variables, Variable Naming Rules and JavaScript Data Types, Expressions and Operators, Flow Control, Objects and Arrays, Functions and Methods

UNIT – III JAVASCRIPT OBJECTS **9**

JavaScript DOM Model-Date and Objects,- Regular Expressions- Exception Handling-Validation-Built-in objects-Event Handling,DHTML with JavaScript

UNIT – IV ADDING INTERACTIVITY TO A WEB PAGE **9**

Controlling Script Flow, Storing Tasks within Functions,Using Conditional Statements for Decision Making,ifStatements, if-else Conditional Statements,Using the Date Object, for Conditional Statements, while Conditional Statements, break and continue Statements, Creating Functions in JavaScript, Declaring a Function, Designing a Simple Function, Form Validation function

UNIT – V ADVANCED JAVA SCRIPT **9**

Scripted HTTP, jQuery: Basics, Handling events with jQuery, Asynchronous JavaScript and Extensible Markup Language (AJAX), Extensible Markup Language (XML) and JavaScript Object Notation (JSON)

Dynamic data using jQuery

TOTAL: 45 PERIODS

TEXT BOOKS:

1. David Flanagan JavaScript: The Definitive Guide, 6th Edition,O'Relly, 2011
2. David Sawyer McFarland JavaScript & jQuery: The Missing Manual 3rd Edition, 2014

REFERENCES:

1. Marijn Haverbeke Eloquent JavaScript 3rd Edition, No Starch Press, 2018
2. Michael Moncur Teach yourself Java Script in 24 Hours SAMS Publication 2007

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

Course Name : Java Scripting		Course Code : 20CS7A3			
CO	**Course Outcomes**	**Unit**	**K-CO**	**POs**	**PSOs**
CE404.1	Summarize about HTML and develop a script to validate input	1	K3	1, 2, 3, 8,9	1
CE404.2	Generalize the basic concepts about Java Script Programming such as variables, Data Types and Expressions	2	K2	1, 2, 8,9	1
CE404.3	Explain Java Script Document Object Model	3	K2	1, 2, 8,9	1
CE404.4	Illustrate about various Java Script statements and functions	4	K2	1, 2, 8,9	1
CE404.5	Make use of Java Script events in Client side programming	5	K3	1, 2, 3, 8,9	2
CE404.6	Discuss about Web Services and Other Markup Languages	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
CE404.1	3	2	1					1	1	1			2	
CE404.2	2	1						1	1	1			2	
CE404.3	2	1						1	1	1			2	
CE404.4	2	1						1	1	1			2	
CE404.5	3	2	1					1	1	1				2
CE404.6	2	1						1	1	1				2
C	2	1	1					1	1	1			2	2

20CS7A4 NATURAL LANGUAGE PROCESSING

L	T	P	C
3	0	0	3

OBJECTIVES:

- To learn the fundamentals of natural language processing
- To understand the use of CFG and PCFG in NLP
- To understand the role of semantics of sentences and pragmatics
- To apply the NLP techniques to IR applications

PRE-REQUISITE: NIL

UNIT – I INTRODUCTION **10**

Origins and challenges of NLP – Language Modeling: Grammar-based LM, Statistical LM - Regular Expressions, Finite-State Automata – English Morphology, Transducers for lexicon and rules, Tokenization, Detecting and Correcting Spelling Errors, Minimum Edit Distance

UNIT – II WORD LEVEL ANALYSIS **8**

Unsmoothed N-grams, Evaluating N-grams, Smoothing, Interpolation and Backoff – Word Classes, Part-of-Speech Tagging, Rule-based, Stochastic and Transformation-based tagging, Issues in PoS tagging – Hidden Markov and Maximum Entropy models.

UNIT – III SYNTACTIC ANALYSIS **9**

Context-Free Grammars, Grammar rules for English, Treebanks, Normal Forms for grammar – Dependency Grammar – Syntactic Parsing, Ambiguity, Dynamic Programming parsing – Shallow parsing – Probabilistic CFG, Probabilistic CYK, Probabilistic Lexicalized CFGs - Feature structures, Unification of feature structures.

UNIT – IV SEMANTICS AND PRAGMATICS **9**

Requirements for representation, First-Order Logic, Description Logics – Syntax-Driven Semantic analysis, Semantic attachments – Word Senses, Relations between Senses, Thematic Roles, selectional restrictions – Word Sense Disambiguation, WSD using Supervised, Dictionary & Thesaurus, Bootstrapping methods – Word Similarity using Thesaurus and Distributional methods.

UNIT – V DISCOURSE ANALYSIS AND LEXICAL RESOURCES **9**

Discourse segmentation, Coherence – Reference Phenomena, Anaphora Resolution using Hobbs and Centering Algorithm – Coreference Resolution – Resources: Porter Stemmer, Lemmatizer, Penn Treebank, Brill's Tagger, WordNet, PropBank, FrameNet, Brown Corpus, British National Corpus (BNC).

TOTAL: 45 PERIODS

TEXT BOOKS:

1. Daniel Jurafsky, James H. Martin, Speech and Language Processing: An Introduction to Natural Language Processing, Computational Linguistics and Speech, Pearson Publication, 2014.
2. Steven Bird, Ewan Klein and Edward Loper, Natural Language Processing with Python, First Edition, O_Reilly Media, 2009.

REFERENCES:

1. Breck Baldwin, Language Processing with Java and LingPipe Cookbook, Atlantic Publisher, 2015.
2. Richard M Reese, Natural Language Processing with Java, O_Reilly Media, 2015.
3. Nitin Indurkhya and Fred J. Damerau, Handbook of Natural Language Processing, Second Edition, Chapman and Hall/CRC Press, 2010.
4. Tanveer Siddiqui, U.S. Tiwary, Natural Language Processing and Information Retrievall, Oxford University Press, 2008

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

Course Name : NATURAL LANGUAGE PROCESSING		Course Code : 20CS7A4			
CO	**Course Outcomes**	**Unit**	**K-CO**	**POs**	**PSOs**
CE404.1	Explain the basic challenges of NLP and describe a given text with basic Language features	1	K2	1,2, 8&9	1,2
CE404.2	Clasify the various word class analysis involved in NLP and tokenization the given text	2	K2	1,2, 8&9	1,2
CE404.3	Discuss the rule based system to tackle morphology and syntax of a language	3	K2	1,2,8&9	1,2
CE404.4	Explain the basic knowledge of Semantic Analysis	4	K2	1,2, 8&9	1,2
CE404.5	Compute word similarity using different thesaurus and distributional methods	4	K3	1, 2, 3, 8&9	1,2
CE404.6	Generalise the use of different statistical approaches for different types of NLP applications	5	K3	1, 2, 3, 8&9	1,2

CO-PO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CE404.1	2	1						1	1	1			2	2
CE404.2	2	1						1	1	1			2	2
CE404.3	2	1						1	1	1			2	2
CE404.4	2	1						1	1	1			2	2
CE404.5	3	2	1					1	1	1			2	2
CE404.6	3	2	1		2			1	1	1			2	2
C	2	1	1		2			1	1	1			2	2

20CS7A5	ADVANCED TOPICS ON DATABASES	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To learn the modeling and design of databases.
- To acquire knowledge on parallel and distributed databases and their applications.
- To study the usage and applications of Object Oriented and Intelligent databases.
- To understand the usage of advanced data models.
- To learn web databases such as XML, Cloud and Big Data.
- To acquire inquisitive attitude towards research topics in databases

PRE-REQUISITE:

Course code: 20CS402
Course name: Database Management Systems

UNIT I PARALLEL AND DISTRIBUTED DATABASES 9

Database System Architectures: Centralized and Client-Server Architectures – Server System Architectures – Parallel Systems- Distributed Systems – Parallel Databases: I/O Parallelism – Inter and Intra Query Parallelism – Inter and Intra operation Parallelism – Design of Parallel Systems- Distributed Database Concepts - Distributed Data Storage

UNIT II OBJECT AND OBJECT RELATIONAL DATABASES 9

Concepts for Object Databases: Object Identity – Object structure – Type Constructors – Encapsulation of Operations – Methods – Persistence – Type and Class Hierarchies – Inheritance – Complex Objects – Object Database Standards, Languages and Design: ODMG Model – ODL – OQL – Object Relational and Extended – Relational Systems: Object Relational features in SQL/Oracle – Case Studies

UNIT III INTELLIGENT DATABASES 9

Active Databases: Syntax and Semantics (Starburst, Oracle, DB2)- Taxonomy-Applications-Design Principles for Active Rules- Temporal Databases: Overview of Temporal Databases- TSQL2- Deductive Databases: Logic of Query Languages – Datalog-Recursive Rules-Syntax and Semantics of Datalog Languages- Implementation of Rules and Recursion - Spatial Databases- Spatial Data Types- Spatial Relationships- Spatial Data Structures-Spatial Access Methods.

UNIT IV WEB AND CLOUD DATABASES 9

XML Databases: XML-Related Technologies-XML Schema- XML Query Languages-Storing XML in Databases-XML and SQL- Native XML Databases- Web Databases-Geographic Information Systems- Biological Data Management- Cloud Based Databases: Data Storage Systems on the Cloud- Cloud Storage Architectures-Cloud Data Models-Introduction to Big Data-Storage-Analysis.

UNIT V EMERGING TECHNOLOGIES 9

Mobile Databases: Location and Handoff Management - Effect of Mobility on Data Management - Location Dependent Data Distribution - Mobile Transaction Models - Multimedia Databases- Information Retrieval- Data Warehousing - Data Mining- Text Mining.

TOTAL: 45 PERIODS

TEXT BOOKS:

1. RamezElmasri, Shamkant B. Navathe, Fundamentals of Database Systems, Sixth Edition , Pearson, 2011.
2. Thomas Cannolly and Carolyn Begg, Database Systems, A Practical Approach to Design, Implementation and Managementll, Fourth Edition, Pearson Education, 2008.

REFERENCES:

1. Henry F Korth, Abraham Silberschatz, S. Sudharshan, Database System Concepts, Sixth Edition, McGraw Hill, 2011.
2. C.J.Date, A.Kannan, S.Swamynathan, An Introduction to Database Systems, Eighth Edition, Pearson Education, 2006.
3. Carlo Zaniolo, Stefano Ceri, Christos Faloutsos, Richard T.Snodgrass, V.S.Subrahmanian, Roberto Zicari, Advanced Database Systems, Morgan Kaufmann publishers, 2006.

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

Course Name : Advanced Topics on DBMS													**Course Code : 20BS402**	
CO	**Course Outcomes**												**Unit**	**K-CO**	**POs**	**PSOs**
CE404.1	Explain the database system Architecture and Query processing on parallel systems												1	K2	1, 2, 8,9	1
CE404.2	Illustrate object methods, structure and object relational features using SQL												2	K3	1, 2, 3, 8,9	1
CE404.3	Explain design principles of Active data bases and Spatial, temporal databases												3	K2	1, 2, 5, 8,9	1
CE404.4	Discuss XML schema, Web database and cloud database.												4	K2	1, 2, 8,9	1
CE404.5	Explain Mobile Transaction models and multimedia data management												5	K2	1, 2, 8,9	1
CE404.6	Explain feature of data storage and different mining techniques												5	K2	1, 2, 5, 8,9	1
CO-PO Mapping																
CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**		
CE404.1	2	1						1	1	1			2			
CE404.2	3	2	1					1	1	1			2			
CE404.3	2	1			1			1	1	1			2			
CE404.4	2	1						1	1	1			2			
CE404.5	2	1						1	1	1			2			
CE404.6	2	1			1			1	1	1			2			
C	2	1	1		1			1	1	1			2			

20IT601 INTERNET OF THINGS

L	T	P	C
3	0	0	3

OBJECTIVES:

- To learn Smart Objects and IOT Architectures
- To learn about various IOT-related protocols
- To build simple IOT Systems using Arduino and Raspberry Pi.
- To learn data analytics and cloud in the context of IOT
- To develop IOT infrastructure for popular applications

PRE-REQUISITE: NIL

UNIT - I FUNDAMENTALS OF IOT 9

Evolution of Internet of Things – Enabling Technologies – IOT Architectures: oneM2M, IOT World Forum (IOT WF) and Alternative IOT models – Simplified IOT Architecture and Core IOT Functional Stack –– Fog, Edge and Cloud in IOT – Functional blocks of an IOT ecosystem – Sensors, Actuators, Smart Objects and Connecting Smart Objects - Threats of IOT

UNIT - II IOT PROTOCOLS 9

IOT Access Technologies: Physical and MAC layers, topology and Security of IEEE 802.15.4, 802.15.4g, 802.15.4e, 1901.2a, 802.11ah and Lora WAN – Network Layer: IP versions, Constrained Nodes and Constrained Networks – Optimizing IP for IOT: From 6LoWPAN to 6Lo

UNIT III IOT PROTOCOLS – II AND DEVELOPMENT 9

Routing over Low Power and Lossy Networks – Application Transport Methods: Supervisory Control and Data Acquisition – Application Layer Protocols: CoAP and MQTT - IOT system building blocks – Arduino – Board details, IDE programming – Raspberry Pi – Interfaces and Raspberry Pi with Python Programming.

UNIT - IV DATA ANALYTICS AND SUPPORTING SERVICES 9

Structured Vs Unstructured Data and Data in Motion Vs Data in Rest – Role of Machine Learning – No SQL Databases – Hadoop Ecosystem – Apache Kafka, Apache Spark – Edge Streaming Analytics and Network Analytics – Xively Cloud for IOT, Python Web Application Framework – Django – AWS for IOT – System Management with NETCONF-YANG

UNIT - V CASE STUDIES/INDUSTRIAL APPLICATIONS 9

Cisco IOT system – IBM Watson IOT platform – Manufacturing – Converged Plantwide Ethernet Model (CPwE) – Power Utility Industry – GridBlocks Reference Model – Smart and Connected Cities: Layered architecture, Smart Lighting, Smart Parking Architecture and Smart Traffic Control

TOTAL: 45 PERIODS

TEXT BOOKS:

1. David Hanes, Gonzalo Salgueiro, Patrick Grossetete, Rob Barton and Jerome Henry, — IOT Fundamentals: Networking Technologies, Protocols and Use Cases for Internet of Things, Cisco Press, 2017
2. Arshdeep Bahga, Vijay Madisetti, —Internet of Things – A hands-on approach, Universities Press, 2015Pearson Education, 2007.

REFERENCES:

1. Olivier Hersent, David Boswarthick, Omar Elloumi , The Internet of Things – Key applications and Protocols, Wiley, 2012 .
2. Jan Ho¨ ller, Vlasios Tsiatsis, Catherine Mulligan, Stamatis , Karnouskos, Stefan Avesand. David Boyle, From Machine-to-Machine to the Internet of Things – Introduction to a New Age of Intelligence, Elsevier, 2014.
3. Dieter Uckelmann, Mark Harrison, Michahelles, Florian (Eds), Architecting the Internet of Things, Springer, 2011.
4. Michael Margolis, Arduino Cookbook, Recipes to Begin, Expand, and Enhance Your Projects, 2nd Edition, O'Reilly Media, 2011.

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

Course Name : INTERNET OF THINGS		Course Code : 20IT601			
CO	**Course Outcomes**	**Unit**	**K-CO**	**POs**	**PSOs**
C311.1	Understand the concept of IOT.	1	K2	1,2	
C311.2	Realize various protocols for IOT.	2	K2	1,2	
C311.3	Design a PoC of an IOT system using Raspberry Pi/Arduino	3	K3	1,2,3	1.2
C311.4	Apply data analytics and use cloud offerings related to IOT.	4	K3	1,2,3	1,2
C311.5	Understand the different IOT systems	5	K2	1,2	1,2
C311.6	Build applications of IOT in real time scenario	5	K4	1,2,3,4	1,2

CO PO MAPPING

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
C311.1	2	1								1				
C311.2	2	1										1		
C311.3	3	2	1							1			1	1
C311.4	3	2	1									1	1	1
C311.5	2	1								1			1	1
C311.6	3	3	2	1								1	1	1

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.

PREREQUISITE: NIL

UNIT - I INTRODUCTION 9

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

UNIT – II TQM PRINCIPLES 9

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

UNIT – III TQM TOOLS AND TECHNIQUES I 9

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

UNIT – IV TQM TOOLS AND TECHNIQUES II 9

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

UNIT - V QUALITY SYSTEMS 9

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

TOTAL : 45 PERIODS

TEXT BOOKS:

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

REFERENCES:

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

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

Course Name : TOTAL QUALITY MANAGEMENT		Course Code : 20HS7A2			
CO	**Course Outcomes**	**Unit**	**K-CO**	**POs**	**PSOs**
CE404.1	Explain basic concepts, TQM framework, Barriers and Benefits of TQM.	I	K3	1,2,3,11	1, 2
CE404.2	Explain the TQM Principles for application.	II	K3	1,2,3,8,11	2
CE404.3	Define the basics of Six Sigma and Traditional tools, New tools, Benchmarking and FMEA.	III	K2	1,2,3,4,5,11,12	2
CE404.4	Describe Taguchi's Quality Loss Function, Performance Measures and apply Techniques like QFD, TPM, COQ and BPR.	IV	K3	1,2,3,4,5,7,11	2
CE404.5	Illustrate and apply QMS and EMS in any organization.	V	K3	1,2,3,4,11,12	2
CE404.6	Explain the process of implementation of ISO 9000/9001-2008/14000 for given manufacturing, service sector.	V	K3	1,2,3,5,11,12	2

CO-PO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CE404.1	3	2	1	-	-	-	-	-	-	-	2	-	1	2
CE404.2	3	2	1	-	-	-	-	1	-	-	2	-	1	2
CE404.3	3	2	1	1	2	-	-	-	-	-	2	1	1	2
CE404.4	3	2	1	2	2	-	1	-	-	-	2	-	1	2
CE404.5	3	2	1	-	-	-	-	-	-	-	2	1	1	2
CE404.6	3	2	1	-	1	-	-	-	-	-	2	1	1	2
C	3	2	1	1	1		1	1			2	1	1	2

SEMESTER VII ELECTIVE III

		L	T	P	C
20CS7B1	C# AND .NET PROGRAMMING	3	0	0	3

OBJECTIVES:

- To learn basic programming in C# and the object oriented programming concepts.
- To update and enhance skills in writing Windows applications, ADO.NET and ASP .NET.
- To study the advanced concepts in data connectivity, WPF, WCF and WWF with C# and .NET 4.5.
- To implement mobile applications using .Net compact framework
- To understand the working of base class libraries, their operations and manipulation of data using XML.

PRE-REQUISITE: NIL

UNIT - I C# LANGUAGE BASICS 9

.Net Architecture – Core C# – Variables – Data Types – Flow control – Objects and Types- Classes and Structs – Inheritance- Generics – Arrays and Tuples – Operators and Casts – Indexers

UNIT - II C# ADVANCED FEATURES 9

Delegates – Lambdas – Lambda Expressions – Events – Event Publisher – Event Listener – Strings and Regular Expressions – Generics – Collections – Memory Management and Pointers – Errors and Exceptions – Reflection

UNIT - III BASE CLASS LIBRARIES AND DATA MANIPULATION 9

Diagnostics -Tasks, Threads and Synchronization – .Net Security – Localization – Manipulating XML- SAX and DOM – Manipulating files and the Registry- Transactions – ADO.NET- Peer-to-Peer Networking – PNRP – Building P2P Applications – Windows Presentation Foundation (WPF).

UNIT - IV WINDOW BASED APPLICATIONS, WCF AND WWF 9

Window based applications – Core ASP.NET- ASP.NET Web forms -Windows Communication Foundation (WCF)- Introduction to Web Services – .Net Remoting – Windows Service – Windows Workflow Foundation (WWF) – Activities – Workflows

UNIT - V .NET FRAMEWORK AND COMPACT FRAMEWORK 9

Assemblies – Shared assemblies – Custom Hosting with CLR Objects – Appdomains – Core XAML – Bubbling and Tunneling Events- Reading and Writing XAML .Net Compact Framework – Compact Edition Data Stores – Errors, Testing and Debugging – Optimizing performance – Packaging and Deployment – Networking and Mobile Devices

TOTAL: 45 PERIODS

TEXT BOOKS:

1. Christian Nagel, Bill Evjen, Jay Glynn, Karli Watson, Morgan Skinner, Professional C# 2012 and .NET 4.5, Wiley, 2012
2. Harsh Bhasin, Programming in C#, Oxford University Press, 2014.

REFERENCES:

1. Ian Gariffiths, Mathew Adams, Jesse Liberty, Programming C# 4.0, OReilly, Fourth Edition, 2010.
2. Andrew Troelsen, Pro C# 5.0 and the .NET 4.5 Framework, Apress publication, 2012.
3. Andy Wigley, Daniel Moth, Peter Foot, Mobile Development Handbook, Microsoft Press, 2011.

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

Course Name : C# and .NET Programming		**Course Code : 20CS7B1**			
CO	**Course Outcomes**	**Unit**	**K-CO**	**POs**	**PSOs**
CE405.1	Describe the core syntax and features of C#	1	K2	1, 2, 8, 9	2
CE405.2	Illustrate in detail about Lambda Expression, Event Listeners, Memory Management and Pointers	2	K3	1, 2, 3, 8, 9	2
CE405.3	Illustrate file manipulation and ADO.NET using libraries	3	K3	1, 2, 3, 5, 8, 9	2
CE405.4	Develop a simple form and events handling using ASP.NET	4	K3	1, 2, 3, 5, 8, 9	2
CE405.5	Make use of CLR for execution of a .NET application	5	K3	1, 2, 3, 5, 8, 9	2
CE405.6	Compare features of .NET framework and .NET compact framework	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**
CE405.1	2	1						1	**1**	**1**				1
CE405.2	3	2	1					1	1	1				1
CE405.3	3	2	1		2			1	1	1				1
CE405.4	3	2	1		2			1	1	1				1
CE405.5	3	2	1		2			1	1	1				1
CE405.6	2	1						1	1	1				1
C	3	2	1		1			1	1	1				1

20CS7B2 WIRELESS ADHOC AND SENSOR NETWORKS

L	T	P	C
3	0	0	3

OBJECTIVES:

- Understand the design issues in ad hoc and sensor networks.
- Learn the different types of MAC protocols.
- Be familiar with different types of adhoc routing protocols.
- Be expose to the TCP issues in adhoc networks.
- Learn the architecture and protocols of wireless sensor networks.

PRE-REQUISITE:

Course Code :20CS501

Course Name :Computer Networks

UNIT - I INTRODUCTION 9

Fundamentals of Wireless Communication Technology – The Electromagnetic Spectrum – Radio propagation Mechanisms – Characteristics of the Wireless Channel -mobile ad hoc networks (MANETs) and wireless sensor networks (WSNs):concepts and architectures. Applications of Ad Hoc and Sensor networks. Design Challenges in Ad hoc and Sensor Networks.

UNIT - II MAC PROTOCOLS FOR AD HOC WIRELESS NETWORKS 9

Issues in designing a MAC Protocol- Classification of MAC Protocols- Contention based protocols: MACAW, Floor acquisition Multiple access Protocol-Contention based protocols with Reservation Mechanisms: Distributed Packet Reservation Multiple Access Protocol, Collision Avoidance Time Allocation Protocol-Contention based protocols with Scheduling Mechanisms: Distributed Priority Scheduling and Medium access Protocol - Multi-channel MAC

UNIT - III ROUTING PROTOCOLS AND TRANSPORT LAYER IN AD HOC WIRELESS NETWORKS 9

Issues in designing a routing and Transport Layer protocol for Ad hoc networks- proactive routing: DSDV, WRP - Reactive routing: DSR, AODV - Hybrid routing: CEDAR, ZRP-Classification of Transport Layer solutions-TCP over Ad hoc wireless Networks

UNIT - IV WIRELESS SENSOR NETWORKS (WSNS) AND MAC PROTOCOLS 9

Single node architecture: hardware and software components of a sensor node - WSN Network architecture: typical network architectures-Data relaying and aggregation strategies - MAC layer protocols: self-organizing, Hybrid TDMA/FDMA and CSMA based MAC- IEEE 802.15.4.

UNIT - V WSN ROUTING, LOCALIZATION & QOS 9

Issues in WSN routing – OLSR- Localization – Indoor and Sensor Network Localization-absolute and relative localization, triangulation-QOS in WSN-Energy Efficient Design-Synchronization-Transport Layer issues.

TOTAL: 45 PERIODS

TEXT BOOKS:

1. C. Siva Ram Murthy, and B. S. Manoj, "Ad Hoc Wireless Networks: Architectures and Protocols ", Prentice Hall Professional Technical Reference, 2008.
2. Carlos De Morais Cordeiro, Dharma Prakash Agrawal “Ad Hoc & Sensor Networks: Theory and Applications”, World Scientific Publishing Company, 2006.

REFERENCES:

1. Feng Zhao and LeonidesGuibas, "Wireless Sensor Networks", Elsevier Publication - 2002.
2. Holger Karl and Andreas Willig “Protocols and Architectures for Wireless Sensor Networks”, Wiley, 2005
3. Kazem Sohraby, Daniel Minoli, &TaiebZnati, “Wireless Sensor Networks-Technology, Protocols, and Applications”, John Wiley, 2007.
4. Anna Hac, “Wireless Sensor Network Designs”, John Wiley, 2003.

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

Course Name : Wireless Adhoc And Sensor Networks		**Course Code : 20CS7B2**			
CO	**Course Outcomes**	**Unit**	**K-CO**	**POs**	**PSOs**
CE405.1	Explain the basic concepts of wireless networks and challenges of Adhoc and sensor networks.	1	K2	1, 2, 8, 9	2
CE405.2	Classify the design issues and different categories of MAC protocols.	2	K2	1, 2, 8, 9	2
CE405.3	Explain the various Adhoc routing protocols and transport layer mechanisms.	3	K2	1, 2, 8, 9	2
CE405.4	Discuss the sensor characteristics and Data relaying and aggregation strategies.	4	K2	1, 2, 8, 9	2
CE405.5	Describe the different WSN MAC layer protocols.	4	K2	1, 2, 8, 9	2
CE405.6	Illustrate the issues of routing, QoS and Localization related performance measurements in WSN	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**
CE405.1	2	1						2	2	1			2	
CE405.2	2	1						2	2	1			2	
CE405.3	2	1						2	2	1			2	
CE405.4	2	1						2	2	1			2	
CE405.5	2	1						2	2	1			2	
CE405.6	2	1						2	2	1			2	
C	2	1						2	2	1			2	

20CS7B3	MULTI-CORE ARCHITECTURES AND PROGRAMMING	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To understand the need for multi-core processors, and their architecture.
- To understand the challenges in parallel and multi-threaded programming
- To learn about the various parallel programming paradigms
- To develop multicore programs and design parallel solutions.

PRE-REQUISITE:

Course code: 20CS201

Course Name: Programming in C

UNIT - I MULTI-CORE PROCESSORS 9

Single core to Multi-core architectures – SIMD and MIMD systems – Interconnection networks - Symmetric and Distributed Shared Memory Architectures – Cache coherence - Performance Issues – Parallel program design.

UNIT - II PARALLEL PROGRAM CHALLENGES 9

Performance – Scalability – Synchronization and data sharing – Data races – Synchronization primitives (mutexes, locks, semaphores, barriers) – deadlocks and livelocks – communication between threads (condition variables, signals, message queues and pipes).

UNIT - III SHARED MEMORY PROGRAMMING WITH OpenMP 9

OpenMP Execution Model – Memory Model – OpenMP Directives – Work-sharing Constructs - Library functions – Handling Data and Functional Parallelism – Handling Loops - Performance Considerations.

UNIT - IV DISTRIBUTED MEMORY PROGRAMMING WITH MPI 9

MPI program execution – MPI constructs – libraries – MPI send and receive – Point-to-point and Collective communication – MPI derived datatypes – Performance evaluation

UNIT - V PARALLEL PROGRAM DEVELOPMENT 9

Case studies - n-Body solvers – Tree Search – OpenMP and MPI implementations and comparison.

TOTAL: 45 PERIODS

TEXT BOOKS:

1. Peter S. Pacheco, — An Introduction to Parallel Programming, Morgan-Kauffman / Elsevier, 2011.
2. Darryl Gove, — Multicore Application Programming for Windows, Linux, and Oracle Solaris, Pearson, 2011

REFERENCES:

1. Michael J Quinn, — Parallel programming in C with MPI and OpenMP, Tata McGraw Hill,2003.
2. Victor Alessandrini, Shared Memory Application Programming, 1st Edition, Concepts and Strategies in Multicore Application Programming, Morgan Kaufmann, 2015.
3. Yan Solihin, Fundamentals of Parallel Multicore Architecture, CRC Press, 2015

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

Course Name : Multicore Architectures and Programming		**Course Code : 20CS7B3**			
CO	**Course Outcomes**	**Unit**	**K-CO**	**POs**	**PSOs**
CE405.1	Describe multi core architectures and identify their characteristics and performance issues	1	K2	1, 2, 8, 9	1,2
CE405.2	Identify the issues in programming Parallel Processors	2	K2	1, 2, 8, 9	1,2
CE405.3	Illustrate shared memory programs using OpenMP	3	K3	1, 2, 3, 8, 9	1,2
CE405.4	Illustrate distributed memory programs using MPI.	4	K3	1, 2, 3, 8, 9	1,2
CE405.5	Analyze the parallel program implementation of n-Body solvers using OpenMP andMPI programs	5	K4	1, 2, 3,4, 8,9	1,2
CE405.6	Analyze the parallel program implementation of Tree Search problem using OpenMP andMPI programs	5	K4	1, 2, 3,4, 8,9	1,2

CO-PO Mapping

CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CE405.1	2	1						1	1	1			1	1
CE405.2	2	1						1	1	1			1	1
CE405.3	3	2	1					1	1	1			1	1
CE405.4	3	2	1					1	1	1			1	1
CE405.5	3	3	2	1				1	1	1			1	1
CE405.6	3	3	2	1				1	1	1			1	1
C	3	2	1	1				1	1	1			1	1

20CS7B4	DISTRIBUTED SYSTEMS	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To learn fundamentals, issues related to clock synchronization and need for global state in distributed systems.
- To learn the concepts of message ordering and snapshot recording algorithms
- To learn about distributed mutual exclusion and deadlock detection algorithms.
- To understand the significance of agreement and recovery protocols indistributed systems.
- To learn the characteristics of peer-to-peer and distributed shared memory systems.

PRE-REQUISITE:

Course Code: 20CS404, 20CS402

Course Name : Operating Systems, Database Management Systems

UNIT - I CHARACTERIZATION AND MODEL OF DISTRIBUTED COMPUTATIONS **9**

Introduction: Definition–Examples of Distributed Systems-Motivation –Message passing systems versus shared memory systems-Primitives for distributed communication – Synchronous versus asynchronous executions –Design issues and challenges. Trends in Distributed systems: A distributed program –A model of distributed executions – Models of communication networks –Global state of a distributed system– Cuts of a distributed component –Past and future cones of an event –Models of process communications - Logical Time: A framework for a system of logical clocks –Scalar time –Vector time – Virtual time- Physical clock synchronization: NTP

UNIT - II MODEL OF DISTRIBUTED COMPUTATIONS **9**

Snapshot algorithms for FIFO channels, Snapshot algorithms for non-FIFO channels, Snapshot algorithm in a causal delivery system ,Necessary and sufficient conditions for consistent global snapshots- Message ordering:Message ordering paradigms – Asynchronous execution with synchronous communication –Synchronous program order on an asynchronous system- Causal order - Total order

UNIT - III MUTUAL EXCLUSION AND DEADLOCK **9**

Distributed mutual exclusion algorithms:Lamport‘s algorithm – Ricart-Agrawala algorithm – Maekawa‘s algorithm – Suzuki–Kasami‘s broadcast algorithm - Deadlock detection in distributed systems: Models of deadlocks – Knapp‘s classification – Chandy-Mirsa-Hass algorithms for AND model and for OR model.

UNIT - IV CHECK POINTING AND ROLLBACK RECOVERY AND AGREEMENT ALGORITHMS **9**

Check pointing and rollback recovery: Issues in failure recovery – Checkpoint-based recovery – Log-based rollback recovery – Koe-Toueg coordinated checkpointing algorithm - Agreement algorithms:Agreement in a failure- free system – Agreement in synchronous systems with failures- Agreement in asynchronous message passing systems with failures

UNIT - V PEER-TO-PEER COMPUTING AND DISTRIBUTED SHARED MEMORY 9

Peer-to-peer computing: Chord distributed hash table- Content addressable networks – Tapestry - Distributed shared memory: Memory consistency models –Shared memory Mutual Exclusion.Wait-Freedom

TOTAL: 45 PERIODS

TEXT BOOKS:

1. Kshemkalyani, Ajay D., and MukeshSinghal. Distributed computing: principles algorithms, and systems.Cambridge University Press, 2011.
2. George Coulouris, Jean Dollimore and Tim Kindberg, Distributed Systems Concepts an Design, Fifth Edition, Pearson Education, 2012.

REFERENCES:

1. Pradeep K Sinha, "Distributed Operating Systems: Concepts and Design", Prentice Hall of India, 2007.
2. MukeshSinghal and Niranjan G. Shivaratri. Advanced concepts in operating systems. McGraw-Hill, Inc., 1994.
3. Tanenbaum A.S., Van Steen M., —Distributed Systems: Principles and Paradigms‖, Pearson Education, 2007.
4. Liu M.L., —Distributed Computing, Principles and Applications‖, Pearson Education, 2004.
5. Nancy A Lynch, —Distributed Algorithms‖, Morgan Kaufman Publishers, USA, 2003.

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

Course Name : Distributed Systems													**Course Code : 20CS7B4**	
CO	**Course Outcomes**												**Unit**	**K-CO**	**POs**	**PSOs**
CE405.1	Outline the issues and challenges in developing distributed applications												1	K2	1, 2, 8,9	1
CE405.2	Discuss the various features of Global state of a distributed computation												1	K2	1, 2, 8,9	1
CE405.3	Describe the needs of message ordering and snapshot recording algorithms in distributed computations												2	K2	1, 2, 8,9	1
CE405.4	Discuss Mutual Exclusion and Deadlock detection algorithms in distributed systems												3	K2	1, 2, 8,9	1
CE405.5	Explain the agreement algorithms and recovery algorithms in distributed systems.												4	K2	1, 2, 8,9	1
CE405.6	Describe the popular distributed systems and distributed shared memory techniques												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**		
CE405.1	2	1						1	1	1			1			
CE405.2	2	1						1	1	1			1			
CE405.3	2	1						1	1	1			1			
CE405.4	2	1						1	1	1			1			
CE405.5	2	1						1	1	1			1			
CE405.6	2	1						1	1	1			1			
C	2	1						1	1	1			1			

20IT7B2	USER INTERFACE DESIGN	L	T	P	C
		3	0	0	3

OBJECTIVES:

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

PRE-REQUISITE: NIL

UNIT I INTRODUCTION **9**

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

UNIT II HUMAN COMPUTER INTERACTION **9**

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

UNIT III WINDOWS **9**

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

UNIT IV MULTIMEDIA **9**

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

UNIT V WINDOWS LAYOUT– TEST **9**

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

TOTAL: 45 PERIODS

TEXT BOOKS

1. Wilbent. O. Galitz, “The Essential Guide To User Interface Design”, John Wiley & Sons, Third Edition, 2007.
2. Ben Sheiderman, “Design The User Interface”, Pearson Education, 6th Edition, 2021.

REFERENCE:

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

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

Course Name : USER INTERFACE DESIGN											Course Code :20IT7B2			
CO	**Course Outcomes**									**Unit**	**K-CO**	**POs**		**PSOs**
CE405.1	Explain the characteristics of graphics interface and their principles.									1	K2	1, 2, 8, 9		1,2
CE405.2	Discuss human characteristics and requirement analysis in user interface design process.									2	K2	1, 2, 8,9,10		1,2
CE405.3	Illustrate the structure and functions of menus.									3	K3	1, 2,3, ,9,10,12		1,2
CE405.4	Describe the characteristics and various controls in windows.									4	K2	1, 2, 8,9,10,12		1,2
CE405.5	Discuss the importance of user feedback and multimedia applications.									5	K2	1, 2, 8, 9,10,12		1.2
CE405.6	Make use of different kinds of tests and visualization techniques for hypermedia and software tools.									5	K3	1, 2,3, 8,9,10,12		1,2
CO-PO Mapping														
CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CE405.1	2	1	-	-	-	-	-	1	1	-	-	-	1	2
CE405.2	2	1	-	-	-	-	-	1	1	-	-	-	1	2
CE405.3	3	2	1	-	-	-	-	1	1	-	-	2	1	2
CE405.4	2	1	-	-	-	-	-	1	1	-	-	2	1	2
CE405.5	2	1	-	-	-	-	-	1	1	-	-	2	1	2
CE405.6	3	2	1	-	-	-	-	1	1	-	-	2	1	2

20IT7B4	SERVICE ORIENTED ARCHITECTURE	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To learn fundamentals of XML
- To provide an overview of Service Oriented Architecture and Web services and their importance
- To learn web services standards and technologies
- To learn service-oriented analysis and design for developing SOA based applications

PRE-REQUISITE:

Course Code: 20CS605
Course Name: Web Technology

UNIT I XML **9**

XML document structure – Well-formed and valid documents – DTD – XML Schema – Parsing XML using DOM, SAX – XPath - XML Transformation and XSL – Xquery.

UNIT II SERVICE ORIENTED ARCHITECTURE (SOA) BASICS **9**

Characteristics of SOA, Benefits of SOA, Comparing SOA with Client-Server and Distributed architectures –- Principles of Service Orientation – Service layers.

UNIT III WEB SERVICES (WS) AND STANDARDS **9**

Web Services Platform – Service descriptions – WSDL – Messaging with SOAP – Service discovery – UDDI – Service-Level Interaction Patterns – Orchestration and Choreography. Case Study

UNIT IV WEB SERVICES EXTENSIONS **9**

WS-Addressing - WS-Reliable Messaging - WS-Policy – WS-Coordination – WS - Transactions - WS-Security –SOA support in J2EE - Examples. Case Study

UNIT V SERVICE ORIENTED ANALYSIS AND DESIGN **9**

SOA delivery strategies – Service oriented analysis – Service Modelling – Service oriented design – Standards and composition guidelines -- Service design – Business process design – Case Study.

TOTAL: 45 PERIODS

TEXT BOOKS

1. Thomas Erl, “Service Oriented Architecture: Concepts, Technology, and Design”, Pearson Education, 2007
2. Sandeep Chatterjee and James Webber, “Developing Enterprise Web Services: An Architect's Guide”, Prentice Hall, 2004

REFERENCES:

1. James McGovern, SameerTyagi, Michael E Stevens, Sunil Mathew, “Java Web Services Architecture”, Elsevier, 2003.
2. Ron Schmelzer et al. “XML and Web Services”, Pearson Education, 2002.
3. Frank P.Coyle, “XML, Web Services and the Data Revolution”, Pearson Education, 2002.

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

Course Name : SERVICE ORIENTED ARCHITECTURE		Course Code : 20IT7B4			
CO	**Course Outcomes**	**Unit**	**K-CO**	**POs**	**PSOs**
CE406.1	Explain the basic concepts of XML, schema and Xquery.	1	K2	1,2,8,9,10	1,2
CE406.2	Outline the Characteristics of Service oriented architecture and service layers	2	K2	1,2,8,9,10	1,2
CE406.3	Illustrate the Web services and WS standards for a given application	3	K3	1,2,3,8,9,10,12	1,2
CE406.4	Illustrate the Web services Policies and coordination for any real time application.	4	K3	1,2,3,8,9,10,12	1,2
CE406.3	Explain service oriented analysis and service modeling	5	K2	1,2,8,9,10	1,2
CE406.4	Illustrate service oriented business process design for any given application	5	K3	1,2,3,8,9,10,12	1,2

CO-PO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CE406.1	2	1	-	-	-	-	-	2	2	1	-	-	3	1
CE406.2	2	1	-	-	-	-	-	2	2	1	-	-	3	1
CE406.3	3	2	1	-	-	-	-	2	2	1	-	1	3	1
CE406.4	3	2	1	-	-	-	-	2	2	1	-	1	3	1
CE406.3	2	1	-	-	-	-	-	2	2	1	-	-	3	1
CE406.4	3	2	1	-	-	-	-	2	2	1	-	1	3	1
C	3	2	1	-	-	-	-	2	2	1	-	1	3	1

20HS601	OPERATIONS RESEARCH	L	T	P	C
		3	0	0	3

OBJECTIVES

- To provide knowledge about optimization techniques and approaches.
- To formulate a real time problem as a mathematical programming model.
- To gain mathematical, computational and communication skills for solving problems.
- To gain knowledge to solve networking and inventory problems.
- To gain knowledge on solving different waiting line models

PREREQUISITE: NIL

UNIT - I LINEAR PROGRAMMING 9

Introduction to Operations Research, Linear programming (LP) – assumptions, properties of LP solutions, Formulations of linear programming problem – Graphical method. Solutions to LPP – simplex, Big M method.

UNIT – II TRANSPORTATION AND ASSIGNMENT MODELS 9

Transportation Problem - Mathematical Model, Types – Balanced and Unbalanced, Solution to Transportation Problem - Finding the initial basic solution, Optimizing the basic feasible solution applying U–V Method (Modi method)

Assignment problem – Hungarian method, Travelling salesman problem - Branch and Bound technique.

UNIT - III NETWORK MODELS 9

Network problem: shortest path – Systematic method, Dijkstra's algorithm, Floyd's algorithm

Minimal spanning tree – PRIM and Kruskal's algorithm, Maximum flow models – linear programming models, maximal flow problem algorithm

Project network representation, Critical Path Method computations, construction of time schedule, linear programming formulation of CPM, PERT networks.

UNIT – IV INVENTORY MODELS 9

Inventory models, Quantity Discount, Purchase Inventory Model - Q System, P System, Multiple-item Model - Shortage Limitation, Inventory Carrying CostConstraint, EOQ Model - Multi-item Joint Replenishment with and without Shortages, Space Constraint.

UNIT - V QUEUEING MODELS 9

Queuing models - Queuing systems and structures – Notation parameter – Single server and multi server models – Poisson input – Exponential service – Constant rate service – Infinite population.

TOTAL : 45 PERIODS

TEXT BOOKS:

1. Hamdy A.Taha "Operations Research – An Introduction", MacMillan India Ltd., 10th Edition,2017.
2. Panneerselvam R, "Operations Research", Prentice Hall India, 2016.
3. Hira.D Gupta.P.K, "Operations Research",S.Chand Publications, 1st Edition, Reprint 2016

REFERENCES:

1. G.Srinivasan, "Operations Research: Principles and Applications", PHI Ltd., 2016.
2. Kanti swarup Gupta.P.K, Man Muhan" „Operations Research: Sultan Chand & Sons India Ltd., 12th Edition,New Delhi 2016.
3. Philips, Ravindran and Solberg, "Operations Research principle and practise", John Wiley, 2016.
4. Hiller and Liberman, Introduction to Operations Research, McGraw Hill, 2015.
5. Ramamurthy P, "Operations Research", New age International Publishers, 2nd edition, 2007.

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

Course Name : Operations Research		**Course Code : 20HS601**			
CO	**Course Outcomes**	**Unit**	**K-CO**	**POs**	**PSOs**
CE405.1	Solve Linear Programming Problems by appropriate technique.	1	K3	1, 2,3,8,9, 10	1
CE405.2	Determine the performance characteristics such as time and cost in solving shortest route, transportation problems with an appropriate model.	1	K3	1, 2,3,8,9, 10	1
CE405.3	Solve the given assignment problem with an appropriate method.	2	K3	1, 2,3,8,9, 10	1
CE405.4	Determine the optimal solution for a project scheduling problem.	3	K3	1, 2,3,8,9, 10	1
CE405.5	Determine the order quantity of goods under different constraints.	4	K3	1, 2,3,8,9, 10	1
CE405.6	Determine the solutions to single and multi channel Queuing problems.	5	K3	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**
CE405.1	3	2	1					1	1	1			1	
CE405.2	3	2	1					1	1	1			1	
CE405.3	3	2	1					1	1	1			1	
CE405.4	3	2	1					1	1	1			1	
CE405.5	3	2	1					1	1	1			1	
CE405.6	3	2	1					1	1	1			1	
C	3	2	1					1	1	1			1	

SEMESTER VIII ELECTIVE IV

20CS8A1	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:

- Peter Mika, Social Networks and the Semantic Webǁ, First Edition, Springer 2007.
- BorkoFurht, Handbook of Social Network Technologies and Applicationsǁ, 1st Edition, Springer, 2010.

REFERENCES:

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

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

Course Name : Social Network Analysis													**Course Code : 20CS8A1**			
CO	**Course Outcomes**												**Unit**	**K-CO**	**POs**	**PSOs**
CE408.1	Explain the semantic web concepts and applications of social network analysis.												1	K2	1, 2, 8,9	1,2
CE408.2	Discuss about modeling and knowledge representation using ontology of social network.												2	K2	1, 2, 8,9	1,2
CE408.3	Illustrate the extraction and mining communities in web social networks.												3	K3	1, 2, 3, 8,9	1,2
CE408.4	Illustrate the various methods for predicting human behaviour in social communities.												4	K3	1, 2, 3, 8,9	1,2
CE408.5	Describe the privacy issues in trust network analysis.												4	K2	1, 2, 8,9	1,2
CE408.6	Make use of visualization techniques for social network applications												5	K3	1, 2, 3, 8,9	1,2
CO-PO Mapping																
CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**		
CE408.1	2	1						1	1	1			2	2		
CE408.2	2	1						1	1	1			2	2		
CE408.3	3	2	1					1	1	1			2	2		
CE408.4	3	2	1			1		1	1	1			2	2		
CE408.5	2	1				1		1	1	1			2	2		
CE408.6	3	2	1		1			1	1	1			2	2		
C	3	2	1		1	1		1	1	1			2	2		

20CS8A2	SOFTWARE DEFINED NETWORKS	L	T	P	C
		3	0	0	3

OBJECTIVES:

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

PRE-REQUISITE: NIL

UNIT - I INTRODUCTION TO SOFTWARE DEFINED NETWORK 9

SDN Origins and Evolution – Introduction – Why SDN? - Centralized and Distributed Control and Data Planes - The Genesis of SDN

UNIT - II OPEN FLOW AND SDN CONTROLLERS 9

Open Flow Specification – Drawbacks of Open SDN, SDN via APIs, SDN via 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 Comprehens Approach, First Edition, Morgan Kaufmann, 2014.
2. Thomas D. Nadeau, Ken Gray, SDN: Software Defined Networks, O'Reilly Media, 2013

REFERENCES:

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

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

Course Name : Software Defined Networks														**Course Code : 20CS8A2**	
CO	**Course Outcomes**													**Unit**	**K-CO**	**POs**	**PSOs**
CE408.1	Explain the key benefits of SDN by separation of Data and Control Planes.													1	K2	1, 2, 8, 9	1
CE408.2	Discuss the openflow specification and different controllers of SDN.													2	K2	1, 2, 8, 9	1
CE408.3	Describe various Data centers and SDN solutions for the Data Center networks.													3	K2	1, 2,8, 9	1
CE408.4	Develop various applications of SDN using current languages and tools.													4	K3	1, 2, 3, 8, 9	1
CE408.5	Explain the various concepts of Network function virtualization in SDN programming.													4	K2	1, 2, 8, 9	1
CE408.6	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**			
CE408.1	2	1						1	1	1			2				
CE408.2	2	1						1	1	1			2				
CE408.3	2	1						1	1	1			2				
CE408.4	3	2	1					1	1	1			2				
CE408.5	3	2						1	1	1			2				
CE408.6	3	2						1	1	1			2				
C	3	2	1					1	1	1			2				

20CS8A3 DIGITAL FORENSICS AND ETHICAL HACKING

L	T	P	C
3	0	0	3

OBJECTIVES:

- To learn computer forensics
- To become familiar with forensics tools
- To learn to analyze and validate forensics data

PRE-REQUISITE: NIL

UNIT - I INTRODUCTION TO COMPUTER FORENSICS 10

Introduction to Traditional Computer Crime, Traditional problems associated with Computer Crime. Introduction to Identity Theft & Identity Fraud. Types of forensic techniques - Incident and incident response methodology - Forensic duplication and investigation. Preparation for IR: Creating response tool kit and IR team. - Forensics Technology and Systems - Understanding Computer Investigation – Data Acquisition.

UNIT - II EVIDENCE COLLECTION AND FORENSICS TOOLS 8

Processing Crime and Incident Scenes – Working with Windows and DOS Systems. Current Computer Forensics Tools: Software/ Hardware Tools.

UNIT - III ANALYSIS AND VALIDATION 9

Validating Forensics Data – Data Hiding Techniques – Performing Remote Acquisition – Network Forensics – Email Investigations – Cell Phone and Mobile Devices Forensics.

UNIT - IV ETHICAL HACKING 9

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

UNIT - V ETHICAL HACKING IN WEB 9

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

TOTAL: 45 PERIODS

TEXT BOOKS :

1. Bill Nelson, Amelia Phillips, Frank Enfinger, Christopher Steuart, Computer Forensics and Investigations, Cengage Learning, India Edition, 2016.
2. CEH official Certfied Ethical Hacking Review Guide, Wiley India Edition, 2015.

REFERENCES:

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

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

Course Name : Digital Forensics and Ethical Hacking		**Course Code : 20CS8A3**			
CO	**Course Outcomes**	**Unit**	**K-CO**	**POs**	**PSOs**
CE408.1	Discuss various forensic techniques and computer investigations	1	K2	1, 2, 8, 9	1, 2
CE408.2	Apply different computer forensic tools to a given scenario	2	K3	1,2,3, 8, 9	1, 2
CE408.3	Compute and validate forensics data for network, email and mobile devices	3	K3	1,2,3, 8, 9	1, 2
CE408.4	Explain various ethical hacking techniques in forensics	4	K2	1, 2, 8, 9	1, 2
CE408.5	Illustrate different hacking methods for web applications	5	K2	1, 2, 8, 9	1, 2
CE408.6	Demonstrate real world hacking techniques in mobile platform	5	K3	1,2,3, 8, 9	1, 2

CO-PO Mapping

CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CE408.1	2	1				3		1	**1**	1			2	2
CE408.2	3	2	1		**3**	3		1	1	1		2	2	2
CE408.3	3	2	1			3		1	1	1			2	2
CE408.4	2	1				3		1	1	1			2	2
CE408.5	2	1				3		1	1	1			2	2
CE408.6	3	2	1		3	3		1	1	1	2	2	2	2
C	3	2	1		3	3		1	1	1	1	2	2	2

20CS8A4	SOFT COMPUTING	L	T	P	C
		3	0	0	3

OBJECTIVES:

1. To learn the basic concepts of Soft Computing
2. To become familiar with various techniques like neural networks, genetic algorithms and fuzzy systems.
3. To integrate various soft computing techniques for complex problems

PRE-REQUISITE: NIL

UNIT - I INTRODUCTION TO SOFT COMPUTING 9

Introduction-Artificial Intelligence-Artificial Neural Networks-Fuzzy Systems-Genetic Algorithm and Evolutionary Programming-Swarm Intelligent Systems-Classification of ANNs-McCulloch and Pitts Neuron Model-Learning Rules: Hebbian and Delta- Perceptron Network-Adaline Network-Madaline Network.

UNIT - II ARTIFICIAL NEURAL NETWORKS 9

Back propagation Neural Networks - Kohonen Neural Network -Learning Vector Quantization -Hamming Neural Network - Hopfield Neural Network- Bi-directional Associative Memory -Adaptive Resonance Theory Neural Networks- Support Vector Machines - Spike Neuron Models.

UNIT - III FUZZY SYSTEMS 9

Introduction to Fuzzy Logic, Classical Sets and Fuzzy Sets - Classical Relations and Fuzzy Relations -Membership Functions -Defuzzification - Fuzzy Arithmetic and Fuzzy Measures - Fuzzy Rule Base and Approximate Reasoning - Introduction to Fuzzy Decision Making.

UNIT - IV GENETIC ALGORITHMS 9

Basic Concepts- Working Principles -Encoding- Fitness Function - Reproduction - Inheritance Operators - Cross Over - Inversion and Deletion -Mutation Operator - Bit-wise Operators -Convergence of Genetic Algorithm.

UNIT - V HYBRID SYSTEMS 9

Hybrid Systems -Neural Networks, Fuzzy Logic and Genetic -GA Based Weight Determination - LR-Type Fuzzy Numbers - Fuzzy Neuron - Fuzzy BP Architecture - Learning in Fuzzy BP- Inference by Fuzzy BP - Fuzzy ArtMap: A Brief Introduction – Soft Computing Tools - GA in Fuzzy Logic Controller Design - Fuzzy Logic Controller.

TOTAL: 45 PERIODS

TEXT BOOKS:

1. N.P.Padhy, S.P.Simon, "Soft Computing with MATLAB Programming", Oxford University Press, 2015.
2. S.N.Sivanandam , S.N.Deepa, "Principles of Soft Computing", Wiley India Pvt. Ltd., 2nd Edition, 2011.
3. S.Rajasekaran, G.A.Vijayalakshmi Pai, "Neural Networks, Fuzzy Logic and Genetic Algorithm, Synthesis and Applications ", PHI Learning Pvt. Ltd., 2017.

REFERENCES:

1. Jyh-Shing Roger Jang, Chuen-Tsai Sun, EijiMizutani, “Neuro-Fuzzy and Sof Computing”, Prentice-Hall of India, 2002.
2. Kwang H.Lee, “First course on Fuzzy Theory and Applications”, Springer, 2005.
3. George J. Klir and Bo Yuan, “Fuzzy Sets and Fuzzy Logic-Theory and Applications” Prentice Hall, 1996.
4. James A. Freeman and David M. Skapura, “Neural Networks Algorithms Applications, and Programming Techniques”, Addison Wesley, 2003.

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

Course Name : Soft Computing		**Course Code : 20CS8A4**			
CO	**Course Outcomes**	**Unit**	**K-CO**	**POs**	**PSOs**
CE408.1	Explain the different categories of soft computing techniques	1	K2	1, 2, 8, 9	1
CE408.2	Illustrate neural networks modeling for different applications	2	K3	1, 2, 3, 8, 9	1
CE408.3	Apply fuzzy design principles for solving various fuzzy problems	3	K3	1, 2, 3, 8,9	1
CE408.4	Explain the different operators and phases of genetic algorithm	4	K2	1, 2, 8, 9	1
CE408.5	Illustrate the techniques for developing hybrid fuzzy based systems	5	K3	1, 2, 3, 8, 9	1
CE408.6	Apply different soft computing tools to solve engineering problems	5	K3	1, 2, 3, 8, 9	1

CO-PO Mapping														
CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO11**	**PSO12**
CE408.1	2	1	-	-	-	-	-	2	2	1	-	-	2	
CE408.2	3	2	1	-	-	-	-	2	2	1	-	1	2	
CE408.3	3	2	1	-	-	-	-	2	2	1	-	1	2	
CE408.4	2	1	-	-	-	-	-	2	2	1	-		2	
CE408.5	3	2	1	-	1	1	-	2	2	1	-	1	2	
CE408.6	3	2	1	-	1	1	-	2	2	1	2	1	2	
C	3	2	1	-	1	1	-	2	2	1	1	1	2	

20IT7B1	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

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

Course Name : CYBER PHYSICAL SYSTEMS											Course Code :20IT7B1			
CO	**Course Outcomes**									**Unit**	**K-CO**	**POs**		**PSOs**
PE3.1.1	Ability to understand knowledge, opportunities, challenges and Logical Foundations of Cyber Physical Systems.									1	K2	1, 2, 8, 9		1,2
PE3.1.2	Ability to develop model for synchronous, asynchronous, continuous and discrete systems.									2	K2	1, 2, 8,9,10		1,2
PE3.1.3	Ability to identify safety specifications and critical properties of Cyber Physical Systems.									3	K2	1, 2, 5, 8, 9		1,2
PE3.1.4	Ability to design and analyze the stability of hybrid systems.									4	K2	1, 2, 5, 8, 9,10		1,2
PE3.1.5	Ability to apply automata for timed systems.									5	K2	1, 2, 5, 8, 9		1.2
PE3.1.6	Ability to understand Zeno Behaviors									5	K2	1, 2, 5, 8, 9		1,2
CO-PO Mapping														
CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
PE3.1.1	2	1			-	-	-	1	1		-	-	1	1
PE3.1.2	2	1			-	-	-	1	1	1	-	-	1	1
PE3.1.3	2	1			1	-	-	1	1	-	-	1	1	1
PE3.1.4	2	1			1	-	-	1	1	1	-	1	1	1
PE3.1.5	2	1			1	-	-	1	1	-	-	1	1	1
PE3.1.6	2	1			1			1	1				1	1
	2	1			1			1	1		1		1	1

20IT8A2	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 know the aspects of risk management
- To become aware of various standards in this area
- To know the technological aspects of Information Security

PRE-REQUISITE:

Course Code: 20CS602
Course Name: Cryptography and Network Security

UNIT - I INTRODUCTION **9**

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

UNIT - II SECURITY INVESTIGATION **9**

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

UNIT- III SECURITY ANALYSIS **9**

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

UNI - IV LOGICAL DESIGN **9**

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

UNIT - V PHYSICAL DESIGN **9**

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

TOTAL: 45 PERIODS

TEXT BOOK

1. Michael E Whitman and Herbert J Mattord, —Principles of Information Security, Vikas Publishing House, New Delhi, 5th Edition 2014
2. Micki Krause, Harold F. Tipton, — Handbook of Information Security Management, Vol 1-3 CRCPress LLC, 6th Edition,2007.

REFERENCES:

1. Stuart McClure, Joel Scrambray, George Kurtz, —Hacking Exposed, Tata McGraw-Hill, 2003
2. Matt Bishop, — Computer Security Art and Science, Pearson/PHI, 2005.

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

Course Name : INFORMATION SECURITY		**Course Code : 20IT8A2**			
CO	**Course Outcomes**	**Unit**	**K-CO**	**POs**	**PSOs**
CE408.1	Discuss the basics of information security	1	K2	1,2,8,9,10 ,12	
CE408.2	Illustrate the legal, ethical and professional issues in information security	2	K2	1,2,8,9,10 ,12	
CE408.3	Demonstrate the aspects of risk management.	3	K2	1,2,8,9,10 ,12	
CE408.4	Aware of various standards in the Information Security System	4	K2	1,2,8,9,10 ,12	1, 2
CE408.5	Describe the design and implementation of Security Techniques.	5	K2	1,2,8,9,10 ,12	1, 2
CE408.6	Identify the technological aspects of Information Security	5	K2	1,2,8,9,10 ,12	1, 2

CO-PO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CE408.1	2	1						2	2	2		2		
CE408.2	2	1						2	2	2		2		
CE408.3	2	1						2	2	2		2		
CE408.4	2	1						2	2	2		2	1	1
CE408.5	2	1						2	2	2		2	1	1
CE408.6	2	1						2	2	2		2	1	1
C	2	1						2	2	2		2	1	1

20EC8A3	ROBOTICS AND AUTOMATION	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To study the various parts of robots and fields of robotics.
- To study the various kinematics and inverse kinematics of robots.
- To study the various kinematics and Robot dynamics.
- To study the trajectory planning and control for robot.
- To study the control of robots for some specific applications.

PRE-REQUISITE: NIL

UNIT - I BASIC CONCEPTS OF ROBOTS 9

Introduction of robots, Classification of robots, Present status and future trends. Basic components of robotic system, Mechanisms and transmission, End effectors, Grippers-different methods of gripping, Specifications of robot.

UNIT - II DRIVE SYSTEMS AND SENSORS 9

Drive system- hydraulic, pneumatic and electric systems Sensors in robot – Touch sensors, Tactile sensor, Proximity and range sensors, Robotic vision sensor, Force sensor, Light sensors, Pressure sensors.

UNIT - III KINEMATICS AND DYNAMICS OF ROBOTS 9

2D, 3D Transformation, Scaling, Rotation, Translation, Homogeneous coordinates, multiple transformation, Simple problems. Matrix representation, Forward and Reverse Kinematics Of Three Degree of Freedom, Homogeneous Transformations, Inverse kinematics of Robot, Robot Arm dynamics, Basics of Trajectory Planning.

UNIT - IV ROBOT CONTROL 9

Robot controls-Point to point control, Continuous path control, Intelligent robot, Control system for robot joint, Control actions, Feedback devices, Encoder, Resolver, LVDT, Motion Interpolations, Adaptive control.

UNIT - V ARTIFICIAL INTELLIGENCE IN ROBOTICS 9

Application of Machine learning – AI, Expert systems; Tele-robotics and Virtual Reality, Micro and Nanorobots, Unmanned vehicles, Cognitive robotics, Evolutionary robotics, Humanoids

TOTAL: 45 PERIODS

TEXT BOOKS:

1. Mikell P Groover, Nicholas G Odrey, Mitchel Weiss, Roger N Nagel, Ashish Dutta, Industrial Robotics, Technology programming and Applications, McGraw Hill, July,2017.
2. Craig. J. J. Introduction to Robotics- mechanics and control, Addison- Wesley, fourth edition,2008

REFERENCES:

1. S.R. Deb, Robotics Technology and flexible automation, Tata McGraw-Hill Education., 2009.
2. Richard D. Klafter, Thomas .A, Chri Elewski, Michael Negin, Robotics Engineering an Integrated Approach, PHI Learning., 2009.

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

Course Name : ROBOTICS AND AUTOMATION				Course Code : 20EC8A3	
CO	**Course Outcomes**	**Unit**	**K-CO**	**POs**	**PSOs**
CE408.1	Explain the basic concepts of Robotics	1	K2	1,2,9,10	1,2
CE408.2	Classify the various sensors used in robotics	2	K4	1,2,3,4,6,7,9,10, 11	1,2
CE408.3	Explain about the differential kinematic in robotics	2	K2	1,2,7, 8,9,10	1,2
CE408.4	Illustrate the various dynamics in robotics	3	K4	1,2,3, 4, 6,7,9,10,11	1,2
CE408.5	Discuss the different controls of Robot	4	K2	1,2, 7, 8,9,10	1,2
CE408.6	Apply AI in the field of robotics	5	K2	1,2,3, 5, 6,8,9,10,11	1,2

COs	**Program Outcomes**												**PSO**	
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CE408.1	2	1							1	1			2	2
CE408.2	3	3	2	1		1	1		1	1	1		2	2
CE408.3	2	1					1	1	1	1			2	2
CE408.4	3	3	2	1		1	1		1	1	1		2	2
CE408.5	2	1					1	1	1	1			2	2
CE408.6	3	2	1		3	2		1	1	1	1	1	2	2
C	3	2	1			1	1		1	1			2	2

SEMESTER VIII ELECTIVE V

20CS8B1	INFORMATION RETRIEVAL TECHNIQUES	L	T	P	C
		3	0	0	3

OBJECTIVES:

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

PRE-REQUISITE:NIL

UNIT - I INTRODUCTION 9

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

UNIT - II MODELING AND RETRIEVAL EVALUATION 9

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

UNIT - III TEXT CLASSIFICATION AND CLUSTERING 9

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

UNIT - IV WEB RETRIEVAL AND WEB CRAWLING 9

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

UNIT - V RECOMMENDER SYSTEM 9

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

TOTAL: 45 PERIODS

TEXT BOOKS:

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

REFERENCES:

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

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

Course Name : INFORMATION RETRIEVAL TECHNIQUES													**Course Code : 20CS8B1**	
CO	**Course Outcomes**												**Unit**	**K-CO**	**POs**	**PSOs**
C409.1	Explain about the IR components and Web Search Engine Framework												1	K2	1, 2, 8, 9	1,2
C409.2	Discuss about various information retrieval models												2	K2	1, 2,8,9	1,2
C409.3	Apply appropriate method of classification or clustering.												3	K3	1, 2, 3, 8,9	1,2
C409.4	Explain the Web Search Engine architecture and ranking functions												4	K2	1, 2,8,9	1,2
C409.5	Discuss about Web Link Analysis algorithms and advanced search												4	K2	1, 2,8,9	1,2
C409.6	Illustrate recommendation techniques and develop content-based Recommender Systems.												5	K4	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**		
C409.1	2	1						1	**1**			2	2	2		
C409.2	2	1						1	1			2	2	2		
C409.3	3	2	1					1	1			2	2	2		
C409.4	2	1						1	1			2	2	2		
C409.5	2	1						1	1			2	2	2		
C409.6	3	2	1		1			1	1			2	2	2		
C	2	2	1		1			1	1			2	2	2		

20CS8B2	GREEN COMPUTING	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To learn the fundamentals of Green Computing.
- To analyze the Green computing Grid Framework.
- To understand the issues related with Green compliance.
- To study and develop various case studies.

PRE-REQUISITE: NIL

UNIT - I FUNDAMENTALS 9

Green IT Fundamentals: Business, IT and the Environment – Green computing: carbon foot print, scoop on power – Green IT Strategies: Drivers, Dimensions, and Goals – Environmentally Responsible Business: Policies, Practices, and Metrics.

UNIT - II GREEN ASSETS AND MODELING 9

Green Assets: Buildings, Data Centers, Networks, and Devices – Green Business Process Management: Modeling, Optimization, and Collaboration – Green Enterprise Architecture – Environmental Intelligence – Green Supply Chains – Green Information Systems: Design and Development Models.

UNIT - III GRID FRAMEWORK 9

Virtualization of IT systems – Role of electric utilities, Telecommuting, teleconferencing and teleporting – Materials recycling – Best ways for Green PC – Green Data center – Green Grid framework.

UNIT - IV GREEN COMPLIANCE 9

Socio-cultural aspects of Green IT – Green Enterprise Transformation Roadmap – Green Compliance: Protocols, Standards, and Audits – Emergent Carbon Issues: Technologies and Future.

UNIT - V CASE STUDIES 9

The Environmentally Responsible Business Strategies (ERBS) – Case Study Scenarios for Trial Runs – Case Studies – Applying Green IT Strategies and Applications to a Home, Hospital, Packaging Industry and Telecom Sector.

TOTAL: 45 PERIODS

TEXT BOOKS:

1. Bhuvan Unhelkar, Green IT Strategies and ApplicationsUsing Environmental, CRC press, 2011.
2. Intelligence, CRC Press, June 2014.Woody Leonhard, Katherine Murray, Green Home computing for dummies, August 2012.

REFERENCES:

1. Alin Gales, Michael Schaefer, MikeEbbers, Green Data Center: Steps for the Journey, Shroff/IBM, 2018.
2. John Lamb, The Greening of IT, Pearson Education, 2009.
3. Jason Harris, Green Computing and Green IT- Best Practices on regulations & industry, Lulu.com, 2008
4. Carl speshocky, Empowering Green Initiatives with IT, John Wiley & Sons, 2010.
5. Wu Chun Feng (editor), Green computing: Large Scale energy efficiency, CRC Press

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

Course Name : GREEN COMPUTING													**Course Code : 20CS8B2**	
CO	**Course Outcomes**												**Unit**	**K-CO**	**POs**	**PSOs**
C409.1	Explain the Green IT strategies and its Policies, Practices and Metrics												1	K2	1, 2, 8, 9	1,2
C409.2	Summarize thegreen computing practices like Green Enterprise Architecture and modeling												2	K2	1, 2,8,9	1,2
C409.3	Illustrate energy saving practices and materials recycling												3	K2	1, 2, 3, 8,9	1,2
C409.4	Explain Green Data center and Green Grid framework												3	K2	1, 2,8,9	1,2
C409.5	Describe technology tools to ensure Green Compliance and reduce carbon foot print												4	K2	1, 2,8,9	1,2
C409.6	Analyze and apply green IT strategies and applications to any real world scenario												5	K4	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**		
C409.1	2	1				2	2	1	**1**	2		2	2	2		
C409.2	2	1				2	2	1	1	2		2	2	2		
C409.3	2	1				2	2	1	1	2		2	2	2		
C409.4	2	1				2	2	1	1	2		2	2	2		
C409.5	2	1				2	2	1	1	2		2	2	2		
C409.6	2	3	2	1		2	2	1	1	2		2	2	2		
C	2	2	1	1		2	2	1	1	2		2	2	2		

20CS8B3 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-Colourtheory-Geometrical Transformations-Introduction-frames of reference-Modeling transformations-scaling the VE-Collision detection.

UNIT - IV DEVELOPMENT TOOLS AND FRAMEWORK 9

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

UNIT - V AUGMENTED AND VIRTUAL REALITY APPLICATION 9

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

TOTAL: 45 PERIODS

TEXT BOOKS:

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

REFERENCES:

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

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

Course Name : VIRTUAL REALITY AND AUGMENTED REALITY		**Course Code : 20CS8B3**			
CO	**Course Outcomes**	**Unit**	**K-CO**	**POs**	**PSOs**
C409.1	Explain the Virtual Reality and Environment, Virtual Reality Requirements and benefits	1	K2	1,2,8,9	1,2
C409.2	Illustrate the visualization techniques for augmented reality	2	K2	1,2,8,9, 10	1,2
C409.3	Discuss the concept of Computer Graphics And Geometric Modeling	3	K2	1,2,8,9	1,2
C409.4	Use various types of Hardware and software in virtual Reality systems	4	K3	1,2,3,8,9, 12	1,2
C409.5	Apply Development Tools And Framework for Virtual Reality	4	K3	1,2,3, 5,6,8,9, 12	1,2
C409.6	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**
C409.1	2	1	-	-	-	-	-	1	**1**	2	-	-	2	3
C409.2	2	1	-	-	-	-	-	1	**1**	2	-	-	2	3
C409.3	2	1	-	-	-	-	-	1	**1**	2	-	-	2	3
C409.4	3	2	1	-	-	-	-	1	**1**	2	-	1	2	3
C409.5	3	2	1	-	2	1	-	2	**2**	2	-	1	2	3
C409.6	3	3	2	1	1	1	-	2	**2**	2	-	1	2	3
C	3	2	1	1	1	1	-	1	**1**	2	-	1	2	3

20CS8B4	BLOCK CHAIN TECHNOLOGY	L	T	P	C
		3	0	0	3

OBJECTIVE:

- Comprehend the structure of a Blockchainnetworks.
- Evaluate security issues relating to Blockchain andcryptocurrency.
- Design and analyze the applications based on Blockchaintechnology.

PRE-REQUISITE:NIL

UNIT - I INTRODUCTION TO BLOCKCHAIN 10

History, Digital Money to Distributed Ledgers, Design Primitives, Protocols, Security, Consensus, Permissions, Privacy

UNIT - II BLOCKCHAIN ARCHITECTURE, DESIGN AND CONSENSUS 8

Basic crypto primitives:Hash, Signature, Hashchain to Blockchain, Basic consensus mechanisms, Requirements for the consensus protocols, PoW and PoS, Scalability aspects of Blockchain consensus protocols

UNIT - III PERMISSIONED AND PUBLIC BLOCKCHAINS 9

Design goals, Consensus protocols for Permissioned Blockchains, Hyperledger Fabric, Decomposing the consensus process, Hyperledger fabric components, Smart Contracts, Chain code design, Hybrid models (PoSandPoW)

UNIT - IV BLOCKCHAIN CRYPTOGRAPHY 9

Different techniques for Blockchain cryptography, privacy and security of Blockchain, multi-sig concept

UNIT - V RECENT TRENDS AND RESEARCH ISSUES IN BLOCKCHAIN 9

Scalability, secure cryptographic protocols on Blockchain, multiparty communication, FinTech and Blockchain applicabilities

TOTAL: 45 PERIODS

TEXT BOOKS:

1. Andreas Antonopoulos,-Mastering Bitcoin, Programming the Open Blockchain,2017.
2. Melanie Swan,-Blockchain, Blueprint for a new Economy, 1st edition, 2015.

REFERENCES:

1. Jonathan B Morley- That Book on Blockchain: A One-Hour Intro,2017.
2. Daniel Drescher-Blockchain Basics: A Non-Technical Introduction in 25 Steps 1st Edition,2017.

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

Course Name : Block Chain Technology														Course Code : 20CS8B4	
CO	**Course Outcomes**													**Unit**	**K-CO**	**POs**	**PSOs**
C409.1	Discuss the basic of block chain in terms of protocols and security and privacy													1	K2	1, 2, 8, 9	1, 2
C409.2	Explain the crypto primitives of block chain architecture													2	K2	1, 2, 8, 9	1, 2
C409.3	Illustrate the appropriate Consensus design for application protocol													2	K2	1, 2, 8, 9	1, 2
C409.4	Apply Hyper ledger Fabric to implement the Block chain													3	K3	1, 2, 3, 5,6,8, 9	1, 2
C409.5	Apply various cryptographic techniques in Block chain cryptography, privacy and security													4	K3	1, 2, 3, 5,6, 8, 9	1, 2
C409.6	Discuss the research issues of Block chain													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**			
C409.1	2	1	-	-	-	-	-	1	**1**	**1**	-	-	2	3			
C409.2	2	1	-	-	-	-	-	1	1	1	-	-	2	3			
C409.3	2	1	-	-	-	-	-	1	1	1	-	-	2	3			
C409.4	3	2	1	-	1	1	-	1	1	1	-	1	2	3			
C409.5	3	2	1	-	1	1	-	1	1	1	-	1	2	3			
C409.6	2	1	-	-	-	-	-	1	1	1	-	-	2	3			
C	3	2	1	-	1	1	-	1	1	1	-	1	2	3			

20IT8B2	SOFTWARE PROJECT MANAGEMENT	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To understand the Software Project Planning and Evaluation techniques.
- To plan and manage projects at each stage of the software development life cycle (SDLC).
- To learn about the activity planning and risk management principles.
- To manage software projects and control software deliverables.
- To develop skills to manage the various phases involved in project management and people management.
- To deliver successful software projects that support organization‘s strategic goals.

PRE-REQUISITE:

Course Code: 20CS502
Course Name: Software Engineering

UNIT I PROJECT EVALUATION AND PROJECT PLANNING 9

Importance of Software Project Management – Activities Methodologies – Categorization of Software Projects – Setting objectives – Management Principles – Management Control – Project portfolio Management – Cost-benefit evaluation technology – Risk evaluation – Strategic program Management – Stepwise Project Planning.

UNIT II PROJECT LIFE CYCLE AND EFFORT ESTIMATION 9

Software process and Process Models – Choice of Process models - mental delivery – Rapid Application development – Agile methods – Dynamic System development Method-Extreme Programming – SCRUM – Managing interactive processes – Basics of Software estimation – Effort and Cost estimation techniques – COSMIC Full function points - COCOMO II A Parametric Productivity Model.

UNIT III ACTIVITY PLANNING AND RISK MANAGEMENT 9

Objectives of Activity planning – Project schedules – Activities – Sequencing and scheduling –Network Planning models – Formulating Network Model - Forward Pass & Backward Pass techniques – Critical path (CRM) method– Risk identification – Assessment – Risk Planning – Risk Management – PERT technique – Monte Carlo simulation –Resource Allocation – Creation of critical patterns – Cost schedules.

UNIT IV PROJECT MANAGEMENT AND CONTROL 9

Framework for Management and control – Collection of data – Visualizing progress – Cost monitoring – Earned Value Analysis- Prioritizing Monitoring - Project tracking – Change control- Software Configuration Management –Managing contracts – Contract Management.

UNIT V STAFFING IN SOFTWARE PROJECTS 9

Managing people – Organizational behavior – Best methods of staff selection – Motivation – The Oldham-Hackman job characteristic model – Stress - Healthy and Safety- Ethical and Programmed concerns – Working in teams –Decision making – Organizational Structures - Team structures – Communications genres – Communication plans – Leadership.

TOTAL: 45 PERIODS

TEXT BOOKS

1. Bob Hughes, Mike Cotterell and Rajib Mall: Software Project Management – Fifth Edition, Tata McGraw Hill, New Delhi, 2012.
2. Robert K. Wysocki "Effective Software Project Management" – Wiley Publication,2019

REFERENCES:

1. Walker Royce: "Software Project Management"- Addison-Wesley, 1998.
2. Gopalaswamy Ramesh, "Managing Global Software Projects" – McGraw Hill Education (India),Fourteenth Reprint 2017.

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

Course Name	**SOFTWARE PROGRAM MANAGEMENT**	**Course Code : 20IT8B2**			
CO	**Course Outcomes**	**Unit**	**K-CO**	**POs**	**PSOs**
C409.1	Explain the software project evaluation techniques and planning	1	K2	1,2,8,9, 10,12	1,2
C409.2	Demonstrate different software process models and cost estimation techniques	2	K2	1,2,8,9, 10,12	1,2
C409.3	Illustrate critical path using network planning models in activity planning	3	K3	1,2,3,8,9 ,10,12	1,2
C409.4	Outline the different phases of risk management process	4	K2	1,2,8,9, 10,12	1,2
C409.5	Explain the need and framework for project management and control	5	K2	1,2,8,9, 10,12	1,2
C409.6	Summarize the organizational behavior and working in teams	5	K2	1,2,8,9, 10,12	1,2

CO-PO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
C409.1	2	1						2	2	2		2	1	1
C409.2	2	1						2	2	2		2	1	1
C409.3	3	2	1					2	2	2		2	1	1
C409.4	2	1						2	2	2		2	1	1
C409.5	2	1						2	2	2		2	1	1
C409.6	2	1						2	2	2		2	1	1
C	2	1	1					2	2	2		2	1	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 a 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/)

Course Name : INTELLECTUAL PROPERTY RIGHTS		Course Code : 20HS6A1			
CO	**Course Outcomes**	**Unit**	**K-CO**	**POs**	**PSOs**
C409.1	Explain the fundamental aspects of Intellectual property Rights which plays a major role in development and management of innovative projects in industries.	1	K2	1,2,8	1,2
C409.2	Describe the patents, patent regime in India and abroad and registration aspects.	2	K2	1,2,8	1,2
C409.3	Describe the copyrights and its related rights and registration aspects.	3	K2	1,2,8	1,2
C409.4	Explain the trademarks and registration aspects.	4	K2	1,2,8	1,2
C409.5	Explain the Design, Geographical Indication (GI), Plant Variety and Layout Design Protection and their registration aspects.	5	K2	1,2,8	1,2
C409.6	Analyze the current trends in IPR and Government steps in fostering IPR	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
C409.1	2	1				1	1	2	2	2			1	1
C409.2	2	1				1	1	2	2	2			1	1
C409.3	2	1				1	1	2	2	2			1	1
C409.4	2	1				1	1	2	2	2			1	1
C409.5	2	1				1	1	2	2	2			1	1
C409.6	2	1				1	1	2	2	2			1	1
C	2	1				1	1	2	2	2			1	1

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 ofEngineering Economics – Engineering efficiency, Economic efficiency, Scope of engineeringeconomics – Element of costs, Marginal cost, Marginal Revenue, Sunk cost, Opportunitycost, Break-even analysis - V ratio, Elementary economic Analysis – Material selection for product Design selection of a product, Process planning.

UNIT - II COST ESTIMATION AND MACRO ECONOMICS 9

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

UNIT - III VALUE ENGINEERING 9

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

UNIT - IV PROJECT APPRAISAL AND ANALYSIS 9

Methods of comparison of alternatives – present worth method (Revenue dominated cashflow diagram), Future worth method (Revenue dominated cash flow diagram, cost dominatedcash flow diagram), Annual equivalent method (Revenue dominated cash flow diagram, costdominatedcashflowdiagram),rate ofreturnmethod,Examplesin allthemethods.

UNIT - V DEPRECIATION 9

Depreciation- Introduction, Straight line method of depreciation, declining balance method ofdepreciation-Sum of the years digits method of depreciation, sinking fund method ofdepreciation/ 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 ofeconomic lifeofasset.

TOTAL: 45 PERIODS

TEXT BOOKS:

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

REFERENCES:

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

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

Course Name : ECONOMICS FOR ENGINEERS		**Course Code : 20HS8B2**			
CO	**Course Outcomes**	**Unit**	**K-CO**	**POs**	**PSOs**
C409.1	Describe the concept of engineering economics	1	K2	1,2,8	1,2
C409.2	Comprehend macroeconomic principles	2	K2	1,2,8	1,2
C409.3	Decision making in diverse business set up	3	K2	1,2,8	1,2
C409.4	Explain the Inflation & Price Change	3	K2	1,2,8	1,2
C409.5	Explain Present Worth Analysis	4	K2	1,2,8	1,2
C409.6	Apply the principles of economics through various case studies	5	K3	1,2,3,8	1,2

CO-PO mapping

CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
C409.1	2	1				1	1	2	2	2			1	1
C409.2	2	1				1	1	2	2	2			1	1
C409.3	2	1				1	1	2	2	2			1	1
C409.4	2	1				1	1	2	2	2			1	1
C409.5	2	1				1	1	2	2	2			1	1
C409.6	2	1				1	1	2	2	2	2		1	1
C	2	1				1	1	2	2	2	1		1	1

SEMESTER VII – OPEN ELECTIVE

20OE405	MACHINE LEARNING TECHNIQUES	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To provide a broad survey of different machine learning approaches and techniques
- To understand the principles and concepts of machine learning
- To understand neural networks concepts
- To learn regression and reinforcement learning
- To develop programming skills that helps to build real world applications based on machine learning

PRE-REQUISITE: NIL

UNIT - I INTRODUCTION **9**

Introduction: Machine learning: What and why? - Types of Machine Learning - Supervised Learning -Unsupervised Learning - The Curse of dimensionality - Over and under fitting - Model selection - Error analysis and validation - Parametric vs. non-parametric models.

UNIT - II CLASSIFICATION **9**

Types of Machine Learning - Supervised Learning - Classification models - Naïve Bayes Classifier – Decision trees - Support Vector Machines - KNN model - Dimensionality reduction - PCA.

UNIT - III CLUSTERING **9**

Clustering approaches - Mean Shift clustering - Clustering data points and features - Bi-clustering - Multi-view clustering - K-Means clustering - K-medians clustering - Expectation Maximization (EM).

UNIT - IV REGRESSION **9**

Linear models for regression - Ridge Regression - Bayesian linear regression - Logistic models for regression - Bayesian logistic Regression- Reinforcement Learning.

UNIT - V ARTIFICIAL NEURAL NETWORKS **9**

Neural networks - Biological motivation for Neural Network - Neural network Representation - Perceptron – Feed forward networks - Multilayer Networks and Back Propagation Algorithms - Hidden layer representation – Application of neural network.

TOTAL: 45 PERIODS

TEXT BOOKS

1. Kevin P. Murphy, “Machine Learning: A Probabilistic Perspective”, MIT Press, 2012.
2. Ethem Alpaydin, “Introduction to Machine Learning”, Second Edition, Prentice Hall of India, 2010.

REFERENCES

1. Laurene Fausett, “Fundamentals of Neural Networks, Architectures, Algorithms and Applications”, Pearson Education, 2008.
2. Tom Mitchell, “Machine Learning”, McGraw-Hill, 1997.
3. C. M. Bishop, “Pattern Recognition and Machine Learning”, Springer, 2007.

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

Course Name : MACHINE LEARNING TECHNIQUES				Course Code : 20OE405			
CO	**Course Outcomes**	**Unit**	**K-CO**	**POs**	**PSOs**		
CO1	Discuss the principles and concepts of machine learning and different approaches and techniques	1	K2	1, 2, 8, 9			
CO2	Illustrate different classification techniques for various data sets	2	K3	1,2,3,8,9, 12			
CO3	Utlize clustering approaches for implementing unsupervised learning on data sets	3	K3	1,2,3,8,9, 12			
CO4	Make use of regression models based on supervised learning for data prediction	4	K3	1,2,3,8,9, 12			
CO5	Build an appropriate neural network for learning features in a given data set	5	K3	1,2,3,5,6,8,9, 12			
CO6	Apply neural network for solving real world machine learning problems	5	K3	1,2,3,5,6,8,9, 12			

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

20OE406	JAVA SCRIPT PROGRAMMING	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To understand Definition, Evolution and Nature of JavaScript
- To understand the basics of Script Writing
- To Learn Java Script Names, Objects, and Methods
- To Create Dynamic Web Pages
- To understand the method of Adding Interactivity to a Web Page.

PRE-REQUISITE: NIL

UNIT - I JAVA SCRIPT BASICS 9

JAVA Script Basics: An introduction to JavaScript– Advantages & Limitations of Java Script. Syntax, Variables, Variable Naming Rules and JavaScript Data Types, Expressions and Operators, Flow Control

UNIT - II OBJECTS AND ARRAYS 9

Creating objects, Object Attributes, Serializing Object, Object Methods Represent Multiple values in Java Script, JavaScript DOM, Arrays: Creating Arrays, Array elements, Multi dimensional Arrays, Array Methods , Functions and Methods.

UNIT - III ADDING INTERACTIVITY TO A WEB PAGE 9

Controlling Script Flow, Storing Tasks within Functions, Using Conditional Statements for Decision Making, if Statements, if-else Conditional Statements, Using the Date Object, for Conditional Statements, while Conditional Statements, break and continue Statements, with Statements, Creating Functions in JavaScript, Declaring a Function, Designing a Simple Function.

UNIT - IV CLIENT SIDE JAVASCRIPT 9

Embedding Java Script in HTML, Execution of JS Program, Dialog boxes, Error Handling & Exceptions. Event Handling: Types of Events, Event Handlers, Document load Events, Mouse Events, Keyboard Events, Drag and Drop Events, Text Events.

UNIT - V JAVA SCRIPT VALIDATION 9

Working with Forms: Accessing the form element, The form object, Accessibility, Validation, Using form-based navigation, Form widgets in libraries and HTML5. Errors and Exceptions, Form Validation, Validation-Built-in objects-Event Handling, DHTML with JavaScript

TOTAL: 45 PERIODS

TEXT BOOKS:

1. David Flanagan JavaScript: The Definitive Guide, 6th Edition,O'Relly, 2011
2. David Sawyer McFarland JavaScript & jQuery: The Missing Manual 3rd Edition, 2014

REFERENCES:

1. Marijn Haverbeke Eloquent JavaScript 3rd Edition, No Starch Press, 2018
2. Michael Moncur Teach yourself Java Script in 24 Hours SAMS Publication 2007

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

Course Name : JAVA SCRIPTING													Course Code : 20OE406	
CO	**Course Outcomes**												**Unit** **K-CO** **POs**	**PSOs**
CO1	Summarize various java script components like data types, expressions, operators etc.												1 K2 1, 2, 8, 9	
CO2	Discuss the various JavaScript elements, methods, properties, functions and objects												2 K2 1, 2, 8, 9	
CO3	Apply appropriate user experience and interactive design concepts to custom websites												3 K3 1, 2, 3,8, 9,12	
CO4	Apply the event handling methods in client side scripting												4 K3 1, 2, 3,8, 9,12	
CO5	Develop interactive web pages using HTML5 and media tags.												5 K3 1, 2, 3, 5,8,9,12	
CO6	Demonstrate HTML5 integration with JavaScript scripting skills in a variety of student designed projects												5 K3 1,2,3,5,8,9, 10,11,12	
CO-PO Mapping														
CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**		
CO1	2	1	-	-	-	-	-	1	**1**	**1**	-	-		
CO2	2	1	-	-	-	-	-	1	1	1	-	-		
CO3	3	2	1	-	-	-	-	1	1	1	-	1		
CO4	3	2	1	-	-	-	-	1	1	1	-	1		
CO5	3	2	1	-	1	-	-	1	1	1	-	1		
CO6	3	2	1	-	1	-	-	1	1	2	2	1		
C	3	2	1	-	1	-	-	1	1	2	1	1		

20OE407	COMPUTER GRAPHICS	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To Gain knowledge about graphics hardware devices and software used.
- To Understand the two dimensional graphics and their transformations.
- To Understand the three dimensional graphics and their transformations.
- Appreciate illumination and color models.
- Be familiar with understand animation techniques.

PRE-REQUISITE: NIL

UNIT - I INTRODUCTION 9

Survey of computer graphics, Overview of graphics systems – Video display devices, Raster scan systems, Random scan systems, Graphics monitors and Workstations, Input devices, Hard copy Devices, Graphics Software; Output primitives – points and lines, line drawing algorithms, loading the frame buffer, line function; circle and ellipse generating algorithms.

UNIT - II TWO DIMENSIONAL GRAPHICS 9

Two dimensional geometric transformations – Matrix representations and homogeneous coordinates, composite transformations; Two dimensional viewing – viewing pipeline, viewing coordinate reference frame; widow-to-viewport coordinate transformation, Two dimensional viewing functions; clipping operations – point, line, and polygon clipping algorithms.

UNIT - III THREE DIMENSIONAL GRAPHICS 10

Three dimensional concepts; Three dimensional object representations – Polygon surfaces- Polygon tables- Plane equations - Polygon meshes; Curved Lines and surfaces, Quadratic surfaces; Blobby objects; Spline representations – Bezier curves and surfaces - B-Spline curves and surfaces. TRANSFORMATION AND VIEWING: Three dimensional geometric and modeling transformations – Translation, Rotation, Scaling, composite transformations; Three dimensional viewing – viewing pipeline, viewing coordinates, Projections, Clipping.

UNIT - IV ILLUMINATION AND COLOUR MODELS 8

Light sources - basic illumination models – halftone patterns and dithering techniques; Properties of light - Standard primaries and chromaticity diagram; Intuitive colour concepts - RGB colour model - YIQ colour model - CMY colour model - HSV colour model - HLS colour model; Colour selection.

UNIT - V ANIMATIONS & REALISM 9

Animation Graphics: Design of Animation sequences – animation function – raster animation –key frame systems – motion specification –morphing – tweening. Computer Graphics Realism: Tiling the plane – Recursively defined curves – Koch curves – C curves – Dragons – space filling curves – fractals – Grammar based models – fractals – turtle graphics – ray tracing.

TOTAL: 45 PERIODS

TEXT BOOKS:

1. John F. Hughes, Andries Van Dam, Morgan Mc Guire ,David F. Sklar , James D. Foley, StevenK. Feiner and Kurt Akeley, Computer Graphics: Principles and Practice", 3rd Edition, Addison-Wesley Professional, 2013.
2. Donald Hearn and Pauline Baker M, "Computer Graphics", Prentice Hall, New Delhi, 2007

REFERENCES:

1. Donald Hearn and M. Pauline Baker, Warren Carithers,"Computer Graphics With Open GL",4th Edition, Pearson Education, 2010.
2. Jeffrey McConnell, "Computer Graphics: Theory into Practice", Jones and Bartlett Publishers, 2006.
3. Hill F S Jr., "Computer Graphics", Maxwell Macmillan", 1990.
4. Peter Shirley, Michael Ashikhmin, Michael Gleicher, Stephen R Marschner, Erik Reinhard, Kelvin Sung, and AK Peters, Fundamental of Computer Graphics, CRC Press, 2010.

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

Course Name : COMPUTER GRAPHICS		**Course Code : 20OE407**			
CO	**Course Outcomes**	**Unit**	**K-CO**	**POs**	**PSOs**
CO1	Explain the hardware devices and software used in graphics systems.	1	K2	1, 2, 8,9	
CO2	Apply two dimensional graphics and transformation	2	K3	1, 2, 3, 8,9	
CO3	Apply three dimensional graphics and transformation	3	K3	1, 2, 3, 8,9	
CO4	Demonstrate the clipping techniques to graphics.	2,3	K3	1, 2, 3,8,9	
CO5	Discuss about basic illumination and colour models.	4	K2	1, 2, 8,9	
CO6	Explain the animation sequences and various methods in graphics realism	5	K2	1, 2, 8,9	

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

20OE408	ESSENTIALS OF 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 data sets 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 tools

PRE-REQUISITE: NIL

UNIT - I INTRODUCTION 9

Knowledge domains of Data Analysis, Understanding structured and unstructured data, data analytic tools, applications of data analytics.

UNIT – II DATA PREPROCESSING 9

Data Preprocessing : Data Cleaning –Data Integration - Data Reduction – Data Transformation – Handling Missing Data

UNIT – III CLASSIFICATION AND CLUSTERING 9

Mining Various Kinds of Association Rules – Correlation Analysis, Classification: SVM & Kernel Methods Cluster Analysis, Types of Data in Cluster Analysis, K means, Partitioning Methods, Hierarchical Methods, Density Based 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 - Real Time Analytics Platform (RTAP) Applications. Case Study: Stock Market Predictions

UNIT - V DATA ANALYTICS USING R

Introduction to R Programming: data types in R - built-in functions - Data Manipulation: Data Cleaning, functions used in Data Inspection - Data Visualization: graphical functions, various graphs like tableplot, histogram, Boxplot

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. Kun Ren, Learning R programming, Packt publishing, 2016

REFERENCES:

1. Michael Berthold, David J. Hand, Intelligent Data Analysis, Springer, Second Edition, 2007.
2. Emerging Business Intelligence and Analytic Trends for Today's Businesses", Wiley, 2013.
3. Richard Cotton, "Learning R – A Step-by-step Function Guide to Data Analysis, ,O'Reilly Media, 2013.
4. Jiawei Han, Micheline Kamber and Jian Pei - Data Mining: Concepts and Techniques", Third Edition, ISBN 0123814790,

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

Course Name : ESSENTIALS OF DATA ANALYTICS												Course Code : 20OE408		
CO	**Course Outcomes**							**Unit**	**K-CO**	**POs**		**PSOs**		
CO1	Explain the basic concepts of Data Analytic.							1	K2	1, 2,8,9				
CO2	Describe the Data Analysis preprocessing Techniques.							2	K2	1, 2, 8,9				
CO3	Explain about how missing data will be handled during preprocessing.							2	K2	1, 2, 8,9				
CO4	Apply the Classification and Clustering algorithm for a given data set.							3	K3	1, 2,3,8,9				
CO5	Apply the different mining techniques for real time analytics applications.							4	K3	1, 2, 3,8,9				
CO6	Explain the Hadoop related tools such as HBase, Cassandra, Pig, and Hive for big data analytics							5	K2	1, 2,8,9				
CO-PO Mapping														
CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**		
CO1	2	1						1	**1**	**1**		1		
CO2	2	1						1	**1**	1		1		
CO3	2	1						1	**1**	1		1		
CO4	3	2	1					1	**1**	1		1		
CO5	3	2	1					1	**1**	1		1		
CO6	2	1			2			1	**1**	1		1		
C	2	1	1		1			1	**1**	1		1		