K.L.N. COLLEGE OF ENGINEERING

Pottapalayam – 630 612, Sivagangai District

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

Estd: 1994

FINAL YEAR CURRICULUM AND SYLLABUS

REGULATIONS 2020

For Under Graduate Program

B. TECH – INFORMATION TECHNOLOGY

CHOICE BASED CREDIT SYSTEM

(For the students admitted from the academic year 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 Entrepreneurshipand to nurture their character with social concern and to pursue their career in the areas ofResearch and Industry.

VISION OF THE DEPARTMENT

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

MISSION OF THE DEPARTMENT

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

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PROGRAM SPECIFIC OUTCOMES (PSOs)

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

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

PROGRAM EDUCATIONAL OBJECTIVES (PEOs)

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

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

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

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PROGRAM OUTCOMES (POs)

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

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

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

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

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

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

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

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

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

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

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

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

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REGULATIONS 2020

For Under Graduate Program

B. TECH – INFORMATION TECHNOLOGY

CHOICE BASED CREDIT SYSTEM

CATEGORY OF COURSES

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

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

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

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

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

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

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

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

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REGULATIONS – 2020
CHOICE BASED CREDIT SYSTEM
B. TECH – INFORMATION TECHNOLOGY
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		Open Elective – II	OE	3	3	0	0	3
3		Professional Elective - II	PE	3	3	0	0	3
4		Professional Elective – III	PE	3	3	0	0	3
THEORY CUM PRACTICAL								
5	20IT701	Cryptography Concepts and Techniques	PC	5	3	0	2	4
PRACTICAL								
6	20CS7L1	Data Analytics Laboratory	PC*	4	0	0	4	2
7	20IT7L1	Mini Project	EEC	4	0	0	4	2
TOTAL				25	15	0	10	20

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	20IT8L1	Project work	EEC	20	0	0	20	10
TOTAL				26	6	0	20	16

PROFESSIONAL ELECTIVE – II

SL NO	COURSE CODE	COURSE TITLE	Category	Contact Periods	L	T	P	C
1	20IT7A1	FOSS and Cloud Computing	PE	3	3	0	0	3
2	20IT7A2	Evolutionary Algorithms	PE	3	3	0	0	3
3	20IT7A3	Formal Languages and Automata Theory	PE	3	3	0	0	3
4	20CS7A2	Agile Methodologies	PE*	3	3	0	0	3
5	20IT7A4	Deep Learning	PE	3	3	0	0	3
6	20CS7A4	Natural Language Processing	PE*	3	3	0	0	3
7	20HS7A2	Total Quality Management	PE	3	3	0	0	3

PROFESSIONAL ELECTIVE – III

SL NO	COURSE CODE	COURSE TITLE	Category	Contact Periods	L	T	P	C
1	20IT7B1	Cyber Physical Systems	PE	3	3	0	0	3
2	20IT7B2	User Interface Design	PE*	3	3	0	0	3
3	20IT7B3	Parallel Computing Architecture	PE	3	3	0	0	3
4	20CS7B1	C# and .Net Programming	PE*	3	3	0	0	3
5	20CS7B2	Wireless Adhoc and Sensor Networks	PE*	3	3	0	0	3
6	20IT7B4	Service Oriented Architecture	PE*	3	3	0	0	3
7	20IT7B5	Building Enterprise Application	PE	3	3	0	0	3

PROFESSIONAL ELECTIVE – IV

SL NO	COURSE CODE	COURSE TITLE	Category	Contact Periods	L	T	P	C
1	20IT8A1	Ethical Hacking	PE	3	3	0	0	3
2	20CS8A1	Social Network Analysis	PE*	3	3	0	0	3
3	20EC8A3	Robotics and Automation	PE	3	3	0	0	3
4	20IT8A2	Information Security	PE*	3	3	0	0	3
5	20CS8A3	Digital Forensics And Ethical Hacking	PE*	3	3	0	0	3
6	20IT8A3	R and Python Programming for Data Science	PE	3	3	0	0	3

PROFESSIONAL ELECTIVE – V

SL NO	COURSE CODE	COURSE TITLE	Category	Contact Periods	L	T	P	C
1	20IT8B1	TCP/IP Network Program and Management	PE	3	3	0	0	3
2	20CS8B1	Information Retrieval Techniques	PE*	3	3	0	0	3
3	20CS8B2	Green Computing	PE*	3	3	0	0	3
4	20IT8B2	Software Project Management	PE*	3	3	0	0	3
5	20CS8B3	Virtual Reality and Augmented Reality	PE*	3	3	0	0	3
6	20CS8B4	Block Chain Technology	PE*	3	3	0	0	3
7	20HS6A1	Intellectual Property Rights	PE	3	3	0	0	3

OPEN ELECTIVE – II   OFFERED TO OTHER DEPARTMENT

SL NO	COURSE CODE	COURSE TITLE	Category	Contact Periods	L	T	P	C
THEORY								
1	20OE505	Information Security Essentials	OE	3	3	0	0	3
2	20OE506	Principles of Cyber Physical Systems	OE	3	3	0	0	3
3	20OE507	Concepts of Ethical Hacking	OE	3	3	0	0	3
4	20OE508	Introduction to User Interface	OE	3	3	0	0	3

OPEN ELECTIVE – II

SL NO	COURSE CODE	COURSE TITLE	Category	Contact Periods	L	T	P	C
THEORY								
1	20OE105	Solar Photovoltaic Fundamentals and Applications	OE	3	3	0	0	3
2	20OE108	Industrial Safety Practices	OE	3	3	0	0	3
3	20OE206	Fundamentals of Fibre Optics and Lasers	OE	3	3	0	0	3
4	20OE305	Fundamentals of Image Processing	OE	3	3	0	0	3
5	20OE307	Fundamentals of Digital Signal Processing	OE	3	3	0	0	3
6	20OE406	Java Scripting	OE	3	3	0	0	3
7	20OE407	Computer Graphics	OE	3	3	0	0	3
8	20OE606	Modern Technologies for Vehicles	OE	3	3	0	0	3
9	20OE705	Logic and Distributed Control System	OE	3	3	0	0	3
10	20OE706	Industrial computer Network	OE	3	3	0	0	3

		L	T	P	C
20CS701	**DATA ANALYTICS**	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 Pre processing : 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 Algorithm

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	-	2	-	-	1	1	-	1	1	1	2
C401.6	2	1	-	-	2	-	-	1	1	-	-	1	1	2
C	2	1	1	-	1	-	-	1	1	1	-	1	1	1

10

20IT701	CRYPTOGRAPHY CONCEPTS AND TECHNIQUES	L	T	P	C
		3	0	2	4

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

PRE-REQUISITE:
Course Code:20CS501
Course Name: Computer Networks

UNIT I   INTRODUCTION   9

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

LAB COMPONENT   6

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

UNIT II   SYMMETRIC CRYPTOGRAPHY   9

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

LAB COMPONENT   6

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

UNIT III   PUBLIC KEY CRYPTOGRAPHY   9

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

LAB COMPONENT   6

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

UNIT IV   MESSAGE AUTHENTICATION AND INTEGRITY   9

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

LAB COMPONENT   6

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

UNIT V   SECURITY PRACTICE AND SYSTEM SECURITY TECHNIQUES   9
Electronic Mail security – PGP, S/MIME – IP security – Web Security - *System Security Techniques:*
Intruders-Intrusion Detection–Password Management– Malicious software – viruses – Firewalls-
Firewall Design Principles-Trusted Systems.

LAB COMPONENT   6
1. Demonstrate intrusion detection system (ids) using any tool eg. Snort or any other s/w.
2. Automated Attack and Penetration Tools Exploring N-Stalker, a Vulnerability Assessment Tool
3. Defeating Malwarei) Building Trojans ii) Rootkit Hunter

TOTAL: 75 PERIODS

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

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

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

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

Course Name : CRYPTOGRAPHY CONCEPTS AND TECHNIQUES		Course Code : 20IT701			
CO	**Course Outcomes**	**Unit**	**K-CO**	**POs**	**PSOs**
C405.1	Understand the fundamentals of networks security, security architecture, threats and vulnerabilities.	1	K2	1, 2, 8, 9	1
C405.2	Apply the different cryptographic operations of symmetric cryptographic algorithms	2	K2	1, 2,3, 8, 9, 10	1
C405.3	Apply the different cryptographic operations of public key cryptography	3	K2	1, 2, 3, 8,9, 10	1
C405.4	Apply the various Authentication schemes to simulate different applications.	4	K3	1,2,,8, 9,12	1
C405.5	Understand various Security practices and System security standards	4	K3	1, 2, 3,8,9,12	1
C405.6	Build cryptosystems by applying symmetric and public key encryption algorithms.	5	K2	1,2,3,5, 8, 9,12	1,2
C405.7	Demonstrate the network security system using open source tools	5	K2	1, 2,3 5,8,9,12	1.2
CO-PO Mapping					

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
C405.1	2	1			-	-	-	1	1	-	-	-	1	-
C405.2	3	2	1		-	-	-	1	1	1	-	-	1	-
C405.3	3	2	1		-	-	-	1	1	1	-	-	1	-
C405.4	2	1			-	-	-	1	1	-	-	1	1	-
C405.5	2	1			-	-	-	1	1	1	-	1	1	-
C405.6	3	2	1		1	-	-	1	1	-	-	1	1	2
C405.7	3	2	1		1	-	-	1	1	-	-	1	1	1
C405	3	2	1		1			1	1	-	-	1	1	1

		L	T	P	C
20CS7L1	**DATA ANALYTICS LABORATORY**	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

LIST OF EXPERIMENTS

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 Standarddeviation.
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:

TOTAL: 60 PERIODS

LIST OF SOFTWARE FOR A BATCH OF 30 STUDENTS:

- Software Requirements: R / Python

OUTCOMES:

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

Course Name : Data Analytics Laboratory		Course Code : 20CS7L1			
CO	**Course Outcomes**	**Exp.No**	**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 pre-processing 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

		L	**T**	**P**	**C**
20IT7L1	**MINI PROJECT**	**0**	**0**	**4**	**2**

OBJECTIVES:
- To develop the students own innovative prototype ideas.
- To train the students in preparing mini project reports and examination.

PRE-REQUISITE: NIL

The students in a group of 2 to 4 works on a topic approved by the head of the department and prepare a comprehensive mini project report after completing the work to the satisfaction. The progress of the project is evaluated based on a minimum of two reviews. The review committee may be constituted by the Head of the Department. A mini project report is required at the end of the semester. The mini project work is evaluated based on oral presentation and the mini project report jointly by external and internal examiners constituted by the Head of the Department.

TOTAL: 60 PERIODS

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

Course Name : Mini Project			Course Code : 20IT7L1			
CO	**Course Outcomes**	**Experiments**	**K-CO**	**POs**		**PSOs**
C407.1	Identify and apply the real world and societal importance problems inthe Information Technology and its allied area**s**	-	K3	1,2,3,6,7,8,9,10, 11,12		1,2
C407.2	Identify, analyze, design, implement and handle prototype projectswith a complete and organized solution methodologies	-	K4	1,2,3,4,5,6,7,8, 9,10,11,12		1,2
C407.3	Apply modern engineering tools for solution	-	K4	1,2,3,4,5,6,7,8, 9,10,11,12		1,2
C407.4	Contribute as an individual or in a team in development of technical projects	-	K6	1,2,3,4,5,6,7,8, 9,10,11,12		1,2
C407.5	Develop effective communication skills for presentation of project related activities	-	K5	1,2,3,4,5,6,7,8, 9,10,11,12		1,2
C407.6	Prepare reports and examination following professional ethics	-	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	2	1	3	3	3	2	2	2	3	2	3	3
C407.5	3	3	2	1	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	1	2	3	3	3	3	3	3	2	3	3

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

OBJECTIVES:

- To develop the ability to solve a specific problem right from its identification and literature review till the successful solution of the same.
- To train the students in preparing project reports and to face reviews and viva voce examination.
- The students in a group of 3 to 4 works on a topic approved by the head of the department under the guidance of a faculty member and prepare 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.

OUTCOMES:

• On Completion of the project work students will be in a position to take up any challenging practical problems and find solution by formulating proper methodology.

PRE-REQUISITE: ALL CORE COURSES & LABORATORIES

TOTAL: 300 PERIODS

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

Course Name : PROJECT WORK		Course Code : 20IT8L1			
CO	Course Outcomes	Exp	K –CO	POs	PSOs
C410.1	Identify and apply the real world and societal importance problems in the Electrical and its allied area.	-	K4	1-12	1,2
C410.2	Identify, analyze, design, implement and handle prototype projects with a complete and organized solution methodologies	-	K4	1-12	1,2
C410.3	Apply modern engineering tools for solution	-	K4	1-12	1,2
C410.4	Contribute as an individual or in a team in development of technical projects	-	K4	1-12	1,2
C410.5	Develop effective communication skills for presentation of project related activities	-	K4	1-12	1,2
C410.6	Prepare reports and examination following professional ethics	-	K4	1-12	1,2

CO-PO Mapping

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

PROFESSIONAL ELECTIVE II

20IT7A1	FOSS AND CLOUD COMPUTING	L	T	P	C
		3	0	0	3

OBJECTIVES:
- To learn the context and operation of Free & Open Source Software (FOSS) communities with associated software projects.
- To be familiar with Web servers and cloud platform.
- To acquire 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:
Course Code: 20CS402,20CS404
Course Name: Database Management Systems, Operating Systems

UNIT I   INTRODUCTION TO FOSS   9
Introduction to Open sources – Need of open sources- Advantages of open sources – Application of open sources-, open source operating system – Linux: Introduction- General Overview – Kernel Mode and User Mode –Advanced concepts – Development with Linux – OSS Installation - Four degrees of freedom - FOSS Licensing Models - FOSS Licenses – GPL- AGPL- LGPL - FDL - Implications – FOSS examples.

UNIT II   WEBSERVER AND OPEN SOURCE CLOUD   9
Apache HTTP Server and its flavors – Lighttpd - Tornado HTTP static File Server - WAMP server, MySQL, PHP, PYTHON - PERL as development platform-Introduction to Cloud, FOSS Cloud Software Environment Open Stack – History and overview, Characteristics, Features, Architecture, Components, Open Stack Cloud Operating System.

UNIT III   CLOUD ARCHITECTURE, SERVICES AND STORAGE   9
Layered Cloud Architecture Design – NIST Cloud Computing Reference Architecture – Public, Private and Hybrid Clouds - IaaS – PaaS – SaaS – Architectural Design Challenges – Cloud Storage – Storage-as-a-Service – Advantages of Cloud Storage – Cloud Storage Providers – S3.

UNIT IV   RESOURCE MANAGEMENT AND SECURITY IN CLOUD   9
Inter Cloud Resource Management – Resource Provisioning and Resource Provisioning Methods – Global Exchange of Cloud Resources – Security Overview – Cloud Security Challenges – Software as a Service Security – Security Governance – Virtual Machine Security – IAM – Security Standards.

UNIT V   CLOUD TECHNOLOGIES AND ADVANCEMENTS   9
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. RAO M N, Fundamentals of Open-source software, PHI New Delhi, 2015
2. Rittinghouse, John W., and James F. Ransome, "Cloud Computing: Implementation, Management and Security", CRC Press, 2017.

REFERENCES:
1. RachnaKapur, Mario Briggs, Getting started with open source development, First Edition, IBM corporation, July 2010
2. Toby Velte, Anthony Velte, Robert Elsenpeter, "Cloud Computing - A Practical Approach", Tata Mcgraw Hill, 2010.
3. George Reese, "Cloud Application Architectures: Building Applications and Infrastructure in the Cloud: Transactional Systems for EC2 and Beyond (Theory in Practice)", O'Reilly, First Edition, 2009.

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

Course Name : FOSS AND CLOUD COMPUTING				Course Code : 20ITA1	
CO	Course Outcomes	Unit	K-CO	POs	PSOs
PE2.1.1	Acquire the knowledge of FOSS licensing models.	1	K3	1, 2,3,4,5,6, 7,8, 9	1,2
PE2.1.2	Work with Web servers and explore the open-source cloud platform	2	K3	1, 2,3, 10,11	1,2
PE2.1.3	Use the architecture of compute and storage cloud, service and delivery models.	3	K3	1, 2,3,4,5,6, 7,8, 9	1,2
PE2.1.4	Analysis the core issues of cloud computing such as resource management and security.	4	K3	1, 2,3, 10,11, 12	1,2
PE2.1.5	Aware and use of current cloud technologies.	4	K3	1, 2,3,4,5, 6,7,8, 9,12	1.2
PE2.1.6	Evaluate and choose the appropriate technologies, algorithms and approaches for implementation	5	K3	1,2,3, 10,11 12	1,2
CO-PO Mapping					

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
PE2.1.1	3	2	1	2	2	2	2	2	2	-	-		2	2
PE2.1.2	3	2	1	-	-	-	-	-	-	2	2		2	2
PE2.1.3	3	2	1	2	2	2	2	2	2				2	2
PE2.1.4	3	2	1	-	-	-	-	-	-	2	2	2	2	2
PE2.1.5	3	2	1	2	2	2	2	2	2			2	2	2
PE2.1.6	3	2	1	-	-	-	-	-	-	2	2	2	2	2
PE2.1	3	2	1	1	1	1	1	1	1	1	1	1	2	2

20IT7A2	EVOLUTIONARY ALGORITHMS	L	T	P	C
		3	0	0	3

OBJECTIVES:
- To study the concepts of simple evolutionary algorithms
- To understand the concepts of development Systems
- To solve the problems using immune system-based algorithms
- To solve the problems using different behaviour systems
- To learn the various evolutionary algorithms based on collective systems and their applications

PRE-REQUISITE:
Course Code:20CS604
Course Name: Machine Learning

UNIT I   EVOLUTIONARY SYSTEMS   9
Pillars of Evolutionary Theory – Genotype – Artificial Evolution – Genetic Representations – Initial Population –Fitness Functions – Selection and Reproduction –Genetic Operators – Evolutionary Measures – Types of Evolutionary Algorithms – Schema Theory – Human – Competitive Evolution – Evolutionary Electronics –Lessons –Role of Abstraction – Extrinsic and Intrinsic Evolution – Evolutionary Digital Design – Evolutionary Analog Design –Multiple Objectives and Constraints.

UNIT II   DEVELOPMENTAL SYSTEMS   9
Potential Advantages of a Developmental Representation –Rewriting Systems – Synthesis of Developmental Systems– Evolution and Development – Defining Artificial Evolutionary Developmental Systems – Evolutionary Rewriting Systems – Evolutionary Developmental Programs – Evolutionary Developmental Processes.

UNIT III   IMMUNE SYSTEMS   9
Biological Immune Systems Working – Constituents of Biological Immune Systems – Lessons for Artificial Immune Systems – Algorithms and Applications – Shape Space – Negative Selection Algorithm – Clonal Selection Algorithm –Examples.

UNIT IV   BEHAVIORAL SYSTEMS   9
Behaviour in Cognitive Science – Behaviour in Artificial Intelligence – Behaviour–Based Robotics –Biological Inspiration for Robots –Robots as Biological Models – Robot Learning – Evolution of Behavioural Systems – Evolution and Learning in Behavioural Systems – Evolution and Neural Development in Behavioural Systems – Coevolution of Body and Control – Toward Self–Reproduction – Simulation and Reality.

UNIT V   COLLECTIVE SYSTEMS   9
Biological Self–Organization – Particle Swarm Optimization – Ant Colony Optimization – Swarm Robotics – Co-evolutionary Dynamics: Biological Models – Artificial Evolution of Competing – Artificial Evolution of Cooperation.

TOTAL: 45 PERIODS

TEXT BOOKS
1. Dario Floreano, Claudio Mattiussi, "Bio-Inspired Artificial Intelligence: Theories, Methods, and Technologies", The MIT Press, 2008.
2. Alain Petrowski , Sana Ben Hamida, "Evolutionary Algorithms", Wiley Publications, First Edition, 2017

REFERENCES:
1. A.E. Eiben , J. E. Smith , "Introduction to Evolutionary Computing" , Springer 2019
2. Xinjie Yu, Mitsuo Gen, "Introduction to Evolutionary Algorithms", Springer, 2010

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

Course Name : EVOLUTIONARY ALGORITHMS		Course Code : 20IT7A2			
CO	**Course Outcomes**	**Unit**	**K-CO**	**POs**	**PSOs**
PE2.2.1	Acquire the knowledge of operations and functions of Evolutionary systems	1	K2	1, 2, 8, 9.10	1,2
PE2.2.2	Understand the techniques of Development Systems	2	K3	1, 2,3, 8,9	1,2
PE2.2.3	Solve problems using Immune Systems	3	K3	1, 2, 3,8,9,10	1,2
PE2.2.4	Identify the various applications for behavioral systems	4	K2	1, 2, 8,9	1,2
PE2.2.5	Implement solutions to various problems based on Collective systems.	5	K3	1, 2,3,5,8,9,10	1.2
PE2.2.6	Apply the appropriate evolutionary algorithms for any real time application	5	K3	1,2, 3,5,8, 9	1,2
CO-PO Mapping					

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
PE2.2.1	2	1			-	-	-	1	1	1-	-	-	1	1
PE2.2.2	3	2	1		-	-	-	1	1		-	-	1	1
PE2.2.3	3	2	1		-	-	-	1	1	1	-	-	1	1
PE2.2.4	2	1			-	-	-	1	1	-	-	1	1	1
PE2.2.5	3	2	1		2	-	-	1	1	1	-	1	1	1
PE2.2.6	3	2	1		2	-	-	1	1	-	-	1	1	1
PE2.1	3	2	1		1	-	-	1	1	-	-	1	1	1

		L	**T**	**P**	**C**
20IT7A3	**FORMAL LANGUAGES AND AUTOMATA THEORY**	3	0	0	3

OBJECTIVES:
- To understand basic concepts of a finite automata for a given language.
- To introduce concepts in automata theory and theory of computation.
- To identify different formal language classes and their relationships
- To design grammars and recognizers for different formal languages
- To distinguish between decidability and un-decidability of problems

PRE-REQUISITE: NIL

UNIT - I   INTRODUCTION TO AUTOMATA   9

Introduction to formal proof – Additional forms of proof – Inductive proofs –Finite Automata (FA) – Deterministic Finite Automata (DFA) – Non-deterministic Finite Automata (NFA) – Finite Automata with Epsilon transitions- Equivalence and minimization of Automata.

UNIT - II   REGULAR EXPRESSION   9

Regular Expressions, Finite Automata and Regular Expressions, Applications of Regular Expressions, Proving Languages Not to Be Regular, Closure Properties of Regular Languages, Equivalence and Minimization of Automata – Pumping Lemma.

UNIT- III   CONTEXT FREE GRAMMARS AND LANGUAGES   9

Context-Free Grammar (CFG) – Parse Trees – Ambiguity in grammars and languages – Simplification of CFGs - Normal forms for CFGs: CNF and GNF -Closure properties of CFLs - Decision Properties of CFLs: Emptiness - Finiteness and Membership – Pumping lemma for CFLs.

UNIT- IV   PUSHDOWN AUTOMATA   9

Definition of the Pushdown automata – Languages of a Pushdown Automata – Equivalence of Pushdown automata and CFG-Acceptance by final State-Acceptance by empty stack– Deterministic Pushdown Automata- Equivalence of acceptance by empty stack and final state - Conversion of CFG to PDA and PDA to CFG.

UNIT - V   TURNING MACHINE AND UNDECIDABILITY   9

Basic model - definition and representation - Instantaneous Description - Language acceptance by TM - Variants of Turing Machine - TM as Computer of Integer functions - Universal TM - Church's Thesis - Recursive and recursively enumerable languages - Halting problem - Introduction to Undecidability - Undecidable problems about TMs - Post correspondence problem (PCP) - Modified PCP and undecidable nature of post correspondence problem - Introduction to recursive function theory.

TOTAL: 45 PERIODS

TEXT BOOKS:
1. John E.Hopcroft, Rajeev Motwani, and Jeffrey D.Ullman, "Introduction to Automata Theory, Languages and Computation",Third Edition, Pearson Education, 2014.
2. Theory of Computer Science – Automata languages and computation, K.L.P.Mishra and N.Chandrashekaran, 3rd edition, PHI.2008

REFERENCES:
1. Martin J. C., "Introduction to Languages and Theory of Computations", Fourth Edition, TMH, 2010.
2. Peter Linz, "An Introduction to Formal Language and Automata", Narosa Pub. House, 5th Edition, 2011.
3. H.R.Lewis and C.H. Papadimitriou, "Elements of the theory of Computation", Second Edition.Pearson Education, 2015

OUTCOMES:

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

Course Name : FORMAL LANGUAGES AND AUTOMATA THEORY		Course Code : 20IT7A3				
CO	**Course Outcomes**	**Unit**	**K-CO**	**POs**	**PSOs**	
PE2.3.1	Design finite automata or regular expression for any tokenization task	1	K3	1,2,3,8,9,10	1,2	
PE2.3.2	Employ a finite state machine for modeling and solving computing problems.	2	K3	1,2,3,8,9	1,2	
PE2.3.3	Design context free grammars for formal languages.	3	K3	1,2,3,8,9,10	1,2	
PE2.3.4	Use Turing machines to accept and recognize languages.	4	K3	1,2,3,8,9,12	1,2	
PE2.3.5	Distinguish between decidability and undecidability.	5	K3	1,2,3,5,8,9,10,12	1.2	
PE2.3.6	Apply mathematical and formal techniques for solving real-time problems	5	K3	1,2,3,5,8, 9,12	1,2	

CO-PO Mapping													
CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
PE2.3.1	3	2	1		-	-	-	1	1	1	-	-	1	1
PE2.3.2	3	2	1		-	-	-	1	1		-	-	1	1
PE2.3.3	3	2	1		-	-	-	1	1	1	-	-	1	1
PE2.3.4	3	2	1		-	-	-	1	1	-	-	1	1	1
PE2.3.5	3	2	1		-	-	-	1	1	1	-	1	1	1
PE2.3.6	3	2	1		-	-	-	1	1	-	-	1	1	1
PE2.3	3	2	1		1	-	-	1	1	1	-	1	1	1

20CS7A2	AGILE METHODOLOGIES	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To Provide iterative, incremental development process leads to faster delivery of moreuseful 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 testingtechniques 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 Sciencell, Springer, 2009.
2. Ken Schwaber And Mike Beedle, Agile Software Development With Scrum, Pearson Education, 2015. ISBN-13: 9780132074896
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 andAgileTeams", Addison Wesley, 2008
2. Craig Larman, ―Agile and Iterative Development: A Manager_s Guidell, Addison-Wesley, 200
3. Kevin C. Desouza, ―Agile Information Systems: Conceptualization, Construction, and Managementll, Butterworth-Heinemann, 2007.
4. Mike Cohn, Succeeding With Agile : Software Development Using Scrum, Pearson Education Limited, 2016, ISBN-13: 9789332547964
5. Alistair Cockburn, Agile Software Development: The Cooperative Game", Addison Wesley,2006.

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**
PE2.4.1	Explain the fundamentals of agile and project management	1	K2	1, 2, 8,9,11	1,2
PE2.4.2	Discuss the components of agile scrum framework.	2	K2	1, 2, 8, 9	1,2
PE2.4.3	Discuss the requirements engineering process in agile.	3	K2	1, 2, 8,9	1,2
PE2.4.4	Describe the different types of testing in agile framework.	3	K2	1, 2,5, 8, 9	1,2
PE2.4.5	Explain Agile software design and development practices.	4	K2	1, 2,8,9, 11	1,2
PE2.4.6	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**
PE2.4.1	2	1						1	**1**	1	1		1	2
PE2.4.2	2	1						1	1	1	1		1	2
PE2.4.3	2	1						1	1	1	1		1	2
PE2.4.4	2	1			1			1	1	1			1	2
PE2.4.5	2	1						1	1	1	1		1	2
PE2.4.6	2	1			1			1	1	1			1	2
C	2	1			1			1	1	1	1		1	2

20IT7A4	DEEP LEARNING	L	T	P	C
		3	0	0	3

OBJECTIVES:
● To understand the basic ideas and principles of Neural Networks
● To understand the basic concepts of Big Data and Statistical Data Analysis
● To familiarize the student with The Image Processing facilities like Tensorflow and Keras
● To learn to use deep learning tools and framework for solving real-life problems
● To use Python for Deep Learning

PRE-REQUISITE: NIL

UNIT I   INTRODUCTION TO NEURAL NETWORKS   9
Basic concept of Neurons – Perceptron Algorithm – Feed Forward and Back Propagation Networks

UNIT II   INTRODUCTION TO DEEP LEARNING   9
Feed Forward Neural Networks – Gradient Descent – Back Propagation Algorithm – Vanishing Gradient problem – Mitigation – RelU Heuristics for Avoiding Bad Local Minima – Heuristics for Faster Training – Nestors Accelerated Gradient Descent – Regularization – Dropout.

UNIT III   CONVOLUTIONAL NETWORKS   9
Convolution operation – Motivation – Pooling – Convolution and Pooling as strong prior – Efficient convolution algorithms – Unsupervised features – Sequence Modeling: Recurrent and Recursive Nets – LSTM Networks – Applications – Computer Vision – Speech Recognition – Natural Language Processing.

UNIT IV   DEEP LEARNING ARCHITECTURES   9
LSTM, GRU, Encoder/Decoder Architectures – Autoencoders – Standard- Sparse – Denoising – Contractive- Variational Autoencoders – Adversarial Generative Networks – Autoencoder and DBM

UNIT V   DEEP LEARNING WITH PYTHON   9
Introduction to Keras and Tensorflow – Deep Learning for computer vision – convnets – Deep Learning for Text and Sequences – Generative Deep Learning – Text Generation with LSTM – DeepDream – Neural Style Transfer – Generating images with variational auto encoders – Generative Adversarial Networks (GAN).

TOTAL: 45 PERIODS

TEXT BOOKS
1.Ian Goodfellow, Yoshua Bengio, Aaron Courville, "Deep Learning", The MIT Press, 2016
2.Nikhil Buduma and Nicholas Lacascio, "Fundamentals of Deep Learning", First Edition, O.Reilly, 2017

REFERENCES:
1.Josh Patterson, Adam Gibson "Deep Learning: A Practitioner's Approach", O'Reilly Media, 2017
2.Laura Graesser, Wah Loon Keng "Foundations of Deep Reinforcement Learning: Theory and Practice in Python" Addison-Wesley Professional -2020
3.Francois Chollet, "Deep Learning with Python", Manning Publications, 2018.
4.Jon Krohn, Grant Beyleveld, Aglaé Bassens "Deep Learning Illustrated: A Visual, Interactive Guide to Artificial Intelligence", 1st edition Addison-Wesley Professional 2019
5.Navin Kumar Manaswi, "Deep Learning with Applications Using Python", Apress, 2018

OUTCOMES:

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

Course Name : Deep Learning			Course Code : 20IT7A4		
CO	**Course Outcomes**	**Unit**	**K-CO**	**POs**	**PSOs**
PE2.5.1	Explain the basic concepts of neural network	1	K2	1,2,8,9.	1,2
PE2.5.2	Identify the deep learning algorithms for various domains	2	K2	1,2,3, 8,9,10	1,2
PE2.5.3	Explain about basics of Convolutional Neural Networks	3	K2	1,2,5, 8,9,12	1,2
PE2.5.4	Apply appropriate deep learning models for analyzing the data.	4	K3	1,2,3,5,8,9,10,12	1,2
PE2.5.5	Illustrate the concept of Tensor Flow/Keras in deep learning	5	K3	1,2,3,5,8, 9,12	1.2
PE2.5.6	Develop an application using deep learning techniques	5	K3	1,2,3,4,5,8, 9	1,2

CO-PO Mapping													
CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
PE2.5.1	2	1			-	-	-	1	1		-	-	1	1
PE2.5.2	2	1			-	-	-	1	1	1	-	-	1	1
PE2.5.3	2	1			1	-	-	1	1	-	-	1	1	1
PE2.5.4	3	2	1		1	-	-	1	1	1	-	1	1	1
PE2.5.5	3	2	1		1	-	-	1	1	-	-	1	1	1
PE2.5.6	3	3	2	1	1			1	1				1	1
C	3	2	1	1	1			1	1		1		1	1

20CS7A4   **NATURAL LANGUAGE PROGRAMMING**   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   9
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   9
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   SEMANTIC 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 and James H Martin," Speech and Language Processing: An
introduction to Natural Language Processing, Computational Linguistics and Speech
Recognition", Prentice Hall, 2nd Edition, 2008.
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 Javall, 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
   Retrievalll, 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**	
PE2.6.1	Explain the basic challenges of NLP and describe a given text with basic Language features	1	K2	1,2, 8,9&10	1,2	
PE2.6.2	Clasify the various word class analysis involved in NLP and tokenization the given text	2	K2	1,2, 8,9&10	1,2	
PE2.6.3	Discuss the rule based system to tackle morphology and syntax of a language	3	K2	1,2, 8,9&10	1,2	
PE2.6.4	Explain the basic knowledge of Semantic Analysis	4	K2	1,2, 8,9&10	1,2	
PE2.6.5	Compute word similarity using different thesaurus and distributional methods	4	K3	1,2, 8,9&10	1,2	
PE2.5.6	Generalise the use of different statistical approaches for different types of NLP applications	5	K3	1,2, 8,9&10	1,2	

CO-PO Mapping														
CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
PE2.6.1	2	1						1	1	1			2	2
PE2.6.2	2	1						1	1	1			2	2
PE2.6.3	2	1						1	1	1			2	2
PE2.6.4	2	1						1	1	1			2	2
PE2.6.5	3	2	1					1	1	1			2	2
PE2.5.6	3	2	1		2			1	1	1			2	2
C	2	1	1		2			1	1	1			2	2

| | **L** | **T** | **P** | **C** |

20HS7A2　　　　　　**TOTAL QUALITY MANAGEMENT**

| **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

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

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**
PE2.7.1	Explain basic concepts, TQM framework, Barriers and Benefits of TQM.	I	K3	1,2,3,11		1, 2
PE2.7.2	Explain the TQM Principles for application.	II	K3	1,2,3,8,11		2
PE2.7.3	Define the basics of Six Sigma and Traditional tools, New tools, Benchmarking and FMEA.	III	K2	1,2,3,4,5,11,12		2
PE2.7.4	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
PE2.7.5	Illustrate and apply QMS and EMS in any organization.	V	K3	1,2,3,4,11,12		2
PE2.7.6	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**

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
PE2.7.1	3	2	1	-	-	-	-	-	-	-	2	-	1	2
PE2.7.2	3	2	1	-	-	-	-	1	-	-	2	-	1	2
PE2.7.3	3	2	1	1	2	-	-	-	-	-	2	1	1	2
PE2.7.4	3	2	1	2	2	-	1	-	-	-	2	-	1	2
PE2.7.5	3	2	1	-	-	-	-	-	-	-	2	1	1	2
PE2.7.6	3	2	1	-	1	-	-	-	-	-	2	1	1	2

Professional Elective – III

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 hvbrid 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

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:
Course Code: 20IT501
Course Name: Web Programming

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**
PE3.2.1	Explain the characteristics of graphics interface and their principles.		1	K2	1, 2, 8, 9	1,2
PE3.2.2	Discuss human characteristics and requirement analysis		2	K2	1, 2, 8,9,10	1,2
PE3.2.3	Illustrate the structure and functions of menus.		3	K3	1, 2,3, ,9,10,12	1,2
PE3.2.4	Describe the characteristics and various controls in windows.		4	K2	1, 2, 8,9,10,12	1,2
PE3.2.5	Discuss the importance of user feedback and multimedia applications.		5	K2	1, 2, 8, 9,10,12	1.2
PE3.2.6	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**
PE3.2.1	2	1	-	-	-	-	-	1	1	-	-	-	1	2
PE3.2.2	2	1	-	-	-	-	-	1	1	-	-	-	1	2
PE3.2.3	3	2	1	-	-	-	-	1	1	-	-	2	1	2
PE3.2.4	2	1	-	-	-	-	-	1	1	-	-	2	1	2
PE3.2.5	2	1	-	-	-	-	-	1	1	-	-	2	1	2
PE3.2.6	3	2	1	-	-	-	-	1	1	-	-	2	1	2

20IT7B3	PARALLEL COMPUTING	L	T	P	C
		3	0	0	3

OBJECTIVES:
● To understand the basic concepts in parallel computing architecture
● To be familiar with the taxonomies and parallel programming models
● To be able to identify promising applications of parallel computing
● To develop parallel algorithms and implement prototype parallel programs using MPI and Open MP
● To evaluate the performance metrics of parallel programs with various measures

PRE-REQUISITE:
Course Code: 20CS401
Course Name: Computer Organization and Architecture

UNIT I   INTRODUCTION TO PARALLEL COMPUTING AND ARCHITECTURES   9

Motivating parallelism –scope– parallel programming platform – implicit parallelism – limitations of system memory performance–Dichotomy - physical organization of parallel platforms – communication cost in parallel machines –Routing Mechanisms.

UNIT II   PARALLEL ALGORITHM DESIGN   9

Decomposition Techniques – Recursive – Data – Explorative – Speculative – Hybrid - Tasks and interaction –characteristics – Mapping techniques for Load Balancing – Schemes - Static Mapping – Dynamic Mapping –Interaction Overhead – Parallel algorithm models

UNIT III   MESSAGE PASSING PARADIGM   9

Principles of message passing programming – Basic building block– send and receive – MPI – Library–Communicators – Examples - topologies and embedding – collective communication – shared memory programming – parallel loops – data parallelism – critical section – functional parallelism.

UNIT IV   PARALLEL PROGRAMMING   9

Sieve of Eratosthenes – sequential algorithm – Data Decomposition – parallel algorithm– analysis - Floyd's Algorithm – Design parallelism – analysis – Matrix Multiplication - Sorting - parallel quick sort – hyper quick sort – regular sampling – Combinatorial search – parallel Backtracking – parallel branch and bound- parallel alpha-beta search –analysis.

UNIT V   PERFORMANCE ANALYSIS AND APPLICATIONS   9

Sources of overhead – Performance Metrics – Execution Time – Total Parallel overhead –- speed up – efficiency –cost – Amdahl's law – Asymptotic analysis – Preserving Model Privacy for Machine Learning in Distributed Systems: Privacy preservation- Data classification - Model evaluation - A New Algorithm for Parallel Connected-Component Labeling on GPUs – Connected component labeling Algorithms.

TOTAL: 45 PERIODS

TEXT BOOKS
1. AnanthGrama, George Karypis, Vipin Kumar, and Anshul Gupta, "Introduction to Parallel Computing",2nd edition, Addison Wesley, 2003.
2. M J Quinn, "Parallel Programming in C with MPI and OpenMP ", 1st edition, McGraw-Hill Higher Education, 2004.

REFERENCES:
1. Ted G. Lewis and H. El-Rewini ``Introduction to Parallel Computing'', Prentice-Hall, 1992.
2.Ian Foster ``Designing and Building Parallel Programs'', Addison Wesley, 1995
3.David E. Culler &Jaswinder Pal Singh, "Parallel Computing Architecture: A Hardware/Software

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

Course Name : PARALLEL COMPUTING				Course Code :20IT7B3		
CO	**Course Outcomes**	**Unit**	**K-CO**	**POs**		**PSOs**
PE3.3.1	Analyze the need for parallel computing	1	K2	1,2,8,9		1,2
PE3.3.2	Design parallel algorithm using various decomposition and mapping techniques	2	K2	1,2,8,9,10		1,2
PE3.3.3	Apply message passing paradigm for a parallel algorithm	3	K2	1,2,8,9,12		1,2
PE3.3.4	Design parallel programs for any existing sequential algorithm	4	K2	1,2,8,9,10,12		1,2
PE3.3.5	Analyze the complexity and performance metrics of code when parallelization is done	5	K2	1,2,8,9,12		1.2
PE3.3.6	Acquire the knowledge of parallel computing architecture, algorithms and its application.	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**
PE3.3.1	2	1			-	-	-	1	1		-	-	1	1
PE3.3.2	2	1			-	-	-	1	1	1	-	-	1	1
PE3.3.3	2	1				-	-	1	1	-	-	1	1	1
PE3.3.4	2	1				-	-	1	1	1	-	1	1	1
PE3.3.5	2	1				-	-	1	1	-	-	1	1	1
PE3.3.6	2	1						1	1				1	1
	2	1						1	1		1		1	1

	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 datausing 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.   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**
PE3.4.1	Describe the core syntax and features of C#	1	K2	1, 2, 8, 9,10	2
PE3.4.2	Illustrate in detail about Lambda Expression, Event Listeners, Memory Management and Pointers	2	K3	1, 2, 3, 8, 9,10	2
PE3.4.3	Illustrate file manipulation and ADO.NET using libraries	3	K3	1, 2,3,5,8,9,10	2
PE3.4.4	Develop a simple form and events handling using ASP.NET	4	K3	1,2,3,5,8, 9,10	2
PE3.4.5	Make use of CLR for execution of a .NET application	5	K3	1,2,3,5,8,9,10	2
PE3.4.6	Compare features of .NET framework and .NET compact framework	5	K2	1, 2, 8, 9,10	2
CO-PO Mapping						

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
PE3.4.1	2	1						1	**1**	**1**				1
PE3.4.2	3	2	1					1	1	1				1
PE3.4.3	3	2	1		2			1	1	1				1
PE3.4.4	3	2	1		2			1	1	1				1
PE3.4.5	3	2	1		2			1	1	1				1
PE3.4.6	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   9
              WIRELESS NETWORKS**

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   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 Protocolsǁ, Pearson Education, 2006.
2. Holger Karl, Andreas Willing, ―Protocols and Architectures for Wireless Sensor Networksǁ, John Wiley & Sons, Inc., 2005.

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**
PE3.5.1	Explain the basic concepts of wireless networks and challenges of Adhoc and sensor networks.	1	K2	1, 2, 8, 9,10	1
PE3.5.2	Classify the design issues and different categories of MAC protocols.	2	K2	1, 2, 8, 9,10	1
PE3.5.3	Explain the various Adhoc routing protocols and transport layer mechanisms.	3	K2	1, 2, 8, 9,10	1
PE3.5.4	Discuss the sensor characteristics and Data relaying and aggregation strategies.	4	K2	1, 2, 8, 9,10	1
PE3.5.5	Describe the different WSN MAC layer protocols.	4	K2	1, 2, 8, 9,10	1
PE3.5.6	Illustrate the issues of routing, QoS and Localization related performance measurements in WSN	5	K2	1, 2, 8, 9,10	1
CO-PO Mapping													
CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
PE3.5.1	2	1						2	2	1			2	
PE3.5.2	2	1						2	2	1			2	
PE3.5.3	2	1						2	2	1			2	
PE3.5.4	2	1						2	2	1			2	
PE3.5.5	2	1						2	2	1			2	
PE3.5.6	2	1						2	2	1			2	
C	2	1						2	2	1			2	

	L	T	P	C

20IT7B4   **SERVICE ORIENTED ARCHITECTURE**

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: 20IT501
Course Name: Web Programming

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:

CO	Course Outcomes	Unit	K-CO	POs	PSOs
Course Name : SERVICE ORIENTED ARCHITECTURE		Course Code : 20IT7B4			
PE3.6.1	Explain the basic concepts of XML, schema and Xquery.	1	K2	1,2,8,9,10	1,2
PE3.6.2	Outline the Characteristics of Service oriented architecture and service layers	2	K2	1,2,8,9,10	1,2
PE3.6.3	Illustrate the Web services and WS standards for a	3	K3	1,2,3,8,9,10,12	1,2
PE3.6.4	Illustrate the Web services Policies and coordination for any real time application.	4	K3	1,2,3,8,9,10,12	1,2
PE3.6.5	Explain service oriented analysis and service modeling	5	K2	1,2,8,9,10	1,2
PE3.6.6	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
PE3.6.1	2	1	-	-	-	-	-	2	2	1	-	-	3	1
PE3.6.2	2	1	-	-	-	-	-	2	2	1	-	-	3	1
PE3.6.3	3	2	1	-	-	-	-	2	2	1	-	1	3	1
PE3.6.4	3	2	1	-	-	-	-	2	2	1	-	1	3	1
PE3.6.5	2	1	-	-	-	-	-	2	2	1	-	-	3	1
PE3.6.6	3	2	1	-	-	-	-	2	2	1	-	1	3	1
C	3	2	1	-	-	-	-	2	2	1	-	1	3	1

20IT7B5	BUILDING ENTERPRISE APPLICATION	L 3	T 0	P 0	C 3

OBJECTIVES:
● To explore the fundamental concepts of Enterprise application
● To develop skills that will enable them to construct application of high quality
● To understand the process of developing new technology and the role of experimentation
● To introduce ethical and professional issues in developing application
● To understand the concepts of different testing strategies

PRE-REQUISITE:
Course Code: 20CS502
Course Name: Software Engineering

UNIT I   INTRODUCTION TO ENTERPRISE APPLICATIONS & REQUIREMENTS   9

Introduction to enterprise applications and their types- software engineering methodologies- life cycle of raising an enterprise application- introduction to skills required to build an enterprise application- key determinants of successful enterprise applications- and measuring the success of enterprise applications- Inception of enterprise applications- enterprise analysis- business modeling- requirements elicitation- use case modeling- prototyping- non functional requirements- requirements validation- planning and estimation.

UNIT II   ANALYSIS- DESIGN CONCEPTS AND PRINCIPLES   9

Concept of architecture- views and viewpoints- enterprise architecture- logical architecture- technical architecture- design- different technical layers- best practices- data architecture and design – relational- XML- and other structured data representations.

UNIT III   ARCHITECTURAL DESIGN CONCEPTS   9

Infrastructure architecture and design elements - Networking- Internetworking- and Communication Protocols- IT Hardware and Software- Middleware- Policies for Infrastructure Management- Deployment Strategy- Documentation of application architecture and design.

UNIT IV   CONSTRUCTION   9

Construction readiness of enterprise applications - defining a construction plan- defining a package structure- setting up a configuration management plan- setting up a development environment- introduction to the concept of Software Construction Maps- construction of technical solutions layers- methodologies of code review- static code analysis- build and testing- dynamic code analysis – code profiling and code coverage.

UNIT V   TESTING   9

Types and methods of testing an enterprise application- testing levels and approaches- testing environments- integration testing- performance testing- penetration testing- usability testing- globalization testing and interface testing- user acceptance testing- rolling out an enterprise application.

TOTAL: 45 PERIODS

TEXT BOOKS

1. Raising Enterprise Applications – Published by John Wiley- authored by AnubhavPradhan- Satheesha B. Nanjappa- Senthil K. Nallasamy- VeerakumarEsakimuthu, Wiley India Pvt. Ltd., 2012
2. Building Java Enterprise Applications – Published by O'Reilly Media- authored by Brett McLaughlin-2002.

REFERENCES:
1.Software Requirements: Styles & Techniques - authored by SorenLauesen – published by Addison-Wesley Professional-2002
2.Software Systems Requirements Engineering: In Practice- - authored by Brain Berenbach- Daniel J.Paulish- Juergen Kazmeier – published by McGraw-Hill/Osborne Media-2009
3.Managing Software Requirements: A Use Case   Approach- authored by Dean Leffingwell 2nd edition   –published by Pearson-2003
4.Software Architecture: A Case Based Approach- authored by Vasudevavarma – published by Pearson-2009
5.Software Testing Principles and Practices authored by Naresh Chauhan –published by Oxford University Press – 2010

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

Course Name : BUILDING ENTERPRISE APPLICATION		Course Code : 20IT7B5			
CO	**Course Outcomes**	**Unit**	**K-CO**	**POs**	**PSOs**
PE3.7.1	Identify functional and non-functional requirements for the given scenario	1	K2	1,2,8,9	1,2
PE3.7.2	Analyze different concepts of software architectures	2	K2	1, 2, 3, 8, 9,10	1,2
PE3.7.3	Acquire the knowledge of architectural design concepts.	3	K2	1, 2,3, 8, 9,12	1,2
PE3.7.4	Construct different solution layers for an enterprise application	4	K2	1,2,3,8,9,10,12	1,2
PE3.7.5	Apply different testing strategies while developing enterprise application	5	K2	1,2,3,8,9,12	1,2
PE3.7.6	Discover the requirements of building enterprise application	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
PE3.7.1	2	1			-	-	-	1	1		-	-	1	1
PE3.7.2	2	1			-	-	-	1	1	1	-	-	1	1
PE3.7.3	2	1			-	-	-	1	1	-	-	1	1	1
PE3.7.4	2	1			-	-	-	1	1	1	-	1	1	1
PE3.7.5	2	1			-	-	-	1	1	-	-	1	1	1
PE3.7.6	2	1			-			1	1				1	1
C	2	1			-			1	1	1		1	1	1

Professional Elective – IV

20IT8A1	ETHICAL HACKING	L	T	P	C
		3	0	0	3

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

PRE-REQUISITE:
Course Code: 20IT701
Course Name: Cryptography Concepts and Techniques

UNIT - I   EHICAL HACKING OVERVIEW & VULNERABILITIES   9
Introduction to Hacking – Understanding the Importance of Security – Concept of Ethical Hacking and Essential Terminologies - Phases involved in Hacking – Types of Hacker Attacks – Vulnerability Research - Exploit- Penetration Testing – Penetration Testing Methodologies – Social Engineering

UNIT - II   FOOTPRINTING & PORT SCANNING   9
Introduction to Footprinting – Information Gathering Methodology– Footprinting Tools – Introduction to Scanning – Scanning Methodology – Tools – Port Scanning – Introduction to Enumeration – Enumeration Techniques – Enumeration Procedure – Tools - Google Hacking

UNIT- III   SYSTEM HACKING   9
Introduction – Various methods of Password cracking – Password Cracking Websites – Password Guessing – Role of Eavesdropping - Password Cracking Tools – Password Cracking Countermeasures – Escalating Privileges – Executing Applications – Keystroke Loggers and Spyware - Understanding Sniffers, Comprehending Active and Passive Sniffing, ARP Spoofing and Redirection, DNS and IP Sniffing, HTTPS Sniffing.

UNIT-IV   HACKING WEB SERVICES & SESSION HIJACKING   9
Web application vulnerabilities - Application coding errors - SQL injection into Back-end Databases - Cross-site scripting - Cross-site request forging - Authentication bypass - Web services and related flaws - Protective http headers - Understanding Session Hijacking - Phases involved in Session Hijacking - Types of Session Hijacking - Session Hijacking Tools

UNIT - V   HACKING WIRELESS NETWORKS AND MOBILE SECURITY   9
Wireless Security : Introducing Aircrack - Role of WEP, Cracking WEP Keys, Sniffing Traffic, Wireless DOS attacks, WLAN Scanners, WLAN Sniffers, Hacking Tools, Securing Wireless   Network   -
Mobile Security : Android vsiOS security model, Threat Models, Information Tracking – Rootkits – Threats in Mobile Applications – Analyzer for Mobile Apps to Discover Security Vulnerabilities.

TOTAL: 45 PERIODS

TEXT BOOKS
1. EC-Council, "Ethical Hacking and Countermeasures: Attack Phases", Cengage Learning, 2010.
2. RafayBoloch, "Ethical Hacking and Penetration Testing Guide", CRC Press, 2014.

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

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

Course Name : ETHICAL HACKING						Course Code : 20IT8A1		
CO	**Course Outcomes**					**Unit**	**K-CO**	**POs**	**PSOs**
PE4.1.1	Identify security threats, vulnerabilities, countermeasures related to ethical hacking.					1	K2	1, 2, 8, 9	1,2
PE4.1.2	Protect data assets and exposed to Scanning and Enumeration methodologies and tools.					2	K2	1, 2, 3, 8, 9	1.2
PE4.1.3	Defend a computer against a variety of security attacks using sniffers at different layers.					3	K2	1, 2, 3, 8, 9,12	1,2
PE4.1.4	Practice and use safe techniques on the World Wide Web.					4	K2	1,2,3,8,10,9,12	1,2
PE4.1.5	Identify the hacking mechanisms on how a wireless network is hacked.					5	K2	1,2,3,8,9,12	1,2
PE4.1.6	Describe the hacking mechanism to secure the mobile applications					5	K2	1,2,8,9,10	1,2
CO-PO Mapping									
CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
PE4.1.1	2	1			-	-	-	1	1		-	-	1	1
PE4.1.2	2	1			-	-	-	1	1		-	-	1	1
PE4.1.3	2	1			-	-	-	1	1	-	-	1	1	1
PE4.1.4	2	1			-	-	-	1	1	1	-	1	1	1
PE4.1.5	2	1			-	-	-	1	1	-	-	1	1	1
PE4.1.6	2	1						1	1	1			1	1
C	2	1						1	1	1		1	1	1

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   9
**   REPRESENTATION**
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   9
**   NETWORKS**
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.

UNI - IV   PREDICTING HUMAN BEHAVIOUR AND PRIVACY ISSUES   9
Understanding and predicting human behaviour for social communities - User data management - Inference and Distribution - Enabling new human experiences - Reality mining - Context - Awareness - Privacy in online social networks - Trust in online environment - Trust models based on subjective logic - Trust network analysis - Trust transitivity analysis - Combining trust and reputation - Trust derivation based on trust comparisons - Attack spectrum and countermeasures...

UNIT - V   VISUALIZATION AND APPLICATIONS OF SOCIAL NETWORKS   9
Graph theory - Centrality - Clustering - Node-Edge Diagrams - Matrix representation - Visualizing online social networks, Visualizing social networks with matrix-based representations - Matrix and Node-Link Diagrams - Hybrid representations - Applications - Cover networks - Community welfare - Collaboration networks - Co-Citation networks.

TOTAL: 45 PERIODS

TEXT BOOKS
1.   Peter Mika, ―Social Networks and the Semantic Web‖, First Edition, Springer 2007.
2.   Borko Furht, ―Handbook of Social Network Technologies and Applications‖, 1st Edition,Springer, 2010.
REFERENCES:
1.   Guandong Xu ,Yanchun Zhang and Lin Li, ―Web Mining and Social Networking – Techniques and applications‖, First Edition, Springer, 2011.
2.   Dion Goh and Schubert Foo, ―Social information Retrieval Systems: Emerging Technologies and Applications for Searching the Web Effectively‖, IGI Global Snippet, 2008.
3.   Max Chevalier, Christine Julien and Chantal Soulé-Dupuy, ―Collaborative and Social Information Retrieval and Access: Techniques for Improved user Modelling‖, IGI Global Snippet, 2009.
4.   John G. Breslin, Alexander Passant and Stefan Decker, ―The Social Semantic Web‖, Springer, 2009.

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

Course Name : Social Network Analysis			Course Code : 20CS8A1			
CO	Course Outcomes	Unit	K-CO	POs		PSOs
PE4.2.1	Explain the semantic web concepts and applications of social network analysis.	1	K2	1, 2, 8,9,10		1,2
PE4.2.2	Discuss about modeling and knowledge representation using ontology of social network.	2	K2	1, 2, 8,9,10		1,2
PE4.2.3	Illustrate the extraction and mining communities in web social networks.	3	K3	1, 2, 3, 8,9,10		1,2
PE4.2.4	Illustrate the various methods for predicting human behaviour in social communities.	4	K3	1, 2, 3, 8,9,10		1,2
PE4.2.5	Describe the privacy issues in trust network analysis.	4	K2	1, 2, 8,9,10		1,2
PE4.2.6	Make use of visualization techniques for social network applications	5	K3	1, 2, 3, 8,9,10		1,2
CO-PO Mapping						
CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
PE4.2.1	2	1						1	1	1			2	2
PE4.2.2	2	1						1	1	1			2	2
PE4.2.3	3	2	1					1	1	1			2	2
PE4.2.4	3	2	1			1		1	1	1			2	2
PE4.2.5	2	1				1		1	1	1			2	2
PE4.2.6	3	2	1		1			1	1	1			2	2
C	3	2	1		1	1		1	1	1			2	2

		L	T	P	C
20EC8A3	**ROBOTICS AND AUTOMATION**	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 SYSTEM 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.

UNI - 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, ChriElewski, 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
PE4.3.1	Explain the basic concepts of Robotics.	1	K2	1,2,9,10	3
PE4.3.2	Classify the various sensors used in robotics.	2	K3	1,2,3,4,6,7,9,10,11	3
PE4.3.3	Explain about the differential kinematic in robotics.	2	K2	1,2,7,8,9,10	3
PE4.3.4	Classify the various dynamics in robotics.	3	K3	1,2,3,4,6,7,9,10,11	3
PE4.3.5	Discuss the different controls of Robot.	4	K2	1,2,7,8,9,10	3
PE4.3.6	Apply AI in the field of robotics.	5	K3	1,2,3,5,6,8,9,10,11	3

CO-PO Mapping														
CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
PE4.3.1	2	1							1	1					1
PE4.3.2	3	3	2	1		1	1		1	1	1				1
PE4.3.3	2	1					1	1	1	1					1
PE4.3.4	3	3	2	1		1	1		1	1	1				1
PE4.3.5	2	1					1	1	1	1					1
PE4.3.6	3	2	1		3	2		1	1	1	1	1			1
C	3	2	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: 20IT701
Course Name: Cryptography Concepts and Techniques

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**
PE4.4.1	Discuss the basics of information security	1	K2	1,2,8,9,10,12		
PE4.4.2	Illustrate the legal, ethical and professional issues in information security	2	K2	1,2,8,9,10,12		
PE4.4.3	Demonstrate the aspects of risk management.	3	K2	1,2,8,9,10,12		
PE4.4.4	Aware of various standards in the Information Security System	4	K2	1,2,8,9,10,12		1, 2
PE4.4.5	Describe the design and implementation of Security Techniques.	5	K2	1,2,8,9,10,12		1, 2
PE4.4.6	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
PE4.4.1	2	1						2	2	2		2		
PE4.4.2	2	1						2	2	2		2		
PE4.4.3	2	1						2	2	2		2		
PE4.4.4	2	1						2	2	2		2	1	1
PE4.4.5	2	1						2	2	2		2	1	1
PE4.4.6	2	1						2	2	2		2	1	1
C	2	1						2	2	2		2	1	1

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   9

Introduction to Traditional Computer Crime, Traditional problems associated with Computer Crime. Introduction to Identity Theft & Identity Fraud. Types of CF 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 FORENSIC TOOLS   9

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.

UNI - 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 Investigationsǁ, Cengage Learning, India Edition, 2016.
2. CEH official Certfied Ethical Hacking Review Guide, Wiley India Edition, 2015.

REFERENCES:

1.   John R.Vacca, ―Computer Forensicsǁ, Cengage Learning, 2005
2.   MarjieT.Britz, ―Computer Forensics and Cyber Crimeǁ: An Introductionǁ, 3rd Edition, Prentice Hall, 2013.
3.   AnkitFadia ― Ethical Hackingǁ Second Edition, Macmillan India Ltd, 2006
4.   Kenneth C.Brancik ―Insider Computer Fraudǁ 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**
PE4.5.1	Discuss various forensic techniques and computer investigation	1	K2	1, 2, 8, 9,10	1, 2
PE4.5.2	Apply different computer forensic tools to a given scenario	2	K3	1,2,3, 8, 9,10	1, 2
PE4.5.3	Compute and validate forensics data for network, email and mobile devices	3	K3	1,2,3, 8, 9,10	1, 2
PE4.5.4	Explain various ethical hacking techniques in forensics	4	K2	1, 2, 8, 9,10	1, 2
PE4.5.5	Illustrate different hacking methods for web applications	5	K2	1, 2, 8, 9,10	1, 2
PE4.5.6	Demonstrate real world hacking techniques in mobile platform	5	K3	1,2,3, 8, 9,10	1, 2

CO-PO Mapping														
CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
PE4.5.1	2	1				3		1	**1**	1			2	2
PE4.5.2	3	2	1		3	3		1	1	1		2	2	2
PE4.5.3	3	2	1			3		1	1	1			2	2
PE4.5.4	2	1				3		1	1	1			2	2
PE4.5.5	2	1				3		1	1	1			2	2
PE4.5.6	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

20IT8A3	R AND PYTHON PROGRAMMING FOR DATA SCIENCE	L	T	P	C
		3	0	0	3

OBJECTIVES:
● To understand the basics of R programming and Python programming.
● To introduce concepts of functional programming and data manipulation statements in R.
● To study about the packages to implement machine learning techniques in R
● To work using Numpy and pandas libraries
● To study about applying scikit learn for supervised learning and clustering

PRE-REQUISITE:
Course Code: 20GE101 & 20CS701
Course Name: Problem Solving using Python Programming & Data Analytics

UNIT - I   INTRODUCTION   9
Data Science: Introduction to Data Science- Data Science Cycle: Data Analysis Sequence- Data Acquisition Pipeline-Report Structure - Data Science Vs Data analytics.
R Programming: R environmental setup– Installation – R Studio – Programming with R – R as a calculator – Dealing with Missing Values – Using R Packages – Expression – Data Types – Data Structures – Control Structures – Functions – Lazy Evaluation – Recursive Functions
Python Programming: Data Structures, writing functions, control flow, common data analysis libraries SciPy, Pandas and SciKit-Learn etc).

UNIT - II   DATA MANIPULATION AND FUNCTIONAL PROGRAMMING   9
Creating a R Markdown – YAML – Markdown language – R Code in Markdown documents – Data Manipulation – Data Import and Export – Manipulation data with dplyr – Vectorizing Functions – Apply Family – Infix operator – Replacement Functions – Function with arguments & return – Filter, Map and Reduce.

UNIT- III   MACHINE LEARNING   9
Dealing with large dataset – Sampling – Regression – Linear Regression – Logistic Regression – Evaluating and Validating Models – Cross Validation – Classification – Decision Trees– Neural Network – Support Vector Machine – Unsupervised Learning - Clustering - Association Rule Mining.

UNI - IV   DATA PROCESSSING   9
Python Jupyter –Ipython shell commands; Arrays – universal functions – aggregations – broadcasting – comparison – masks – Boolean logic – fancy indexing – sorting – structured arrays; Pandas Objects – Data indexing and selection – Operating on Data in pandas – Handling missing data – Combining Data sets – Aggregation and grouping – Vectorized string operations –Time series data .Case Study

UNIT - V   SUPERVISED LEARNING AND UNSUPERVISED LEARNING   9
Hyper parameters and model validation – Feature engineering – Naïve Bayes – Support Vector Machine – Linear Regression – Decision Trees and Random Forest – Principal Component Analysis – In depth manifold learning – Model Evaluation-Cross validation – Grid search – Metrics and scoring- k-Means clustering – Agglomerative Clustering – DBSCAN – Gaussian mixture models – Kernel Density Estimation. Case Study

TOTAL: 45 PERIODS

TEXT BOOKS
1. Jake Vander Plas, "Python Data Science Handbook", O'Reilly, 2016
2. Thomas Mailund, ―Beginning Data Science in R – Data Analysis, Visualisation and Modelling for the Data Scientist‖, Apress Publication, 2018.
3. John Chambers, ―Software for Data Analysis: Programming with R ―, Springer; First Edition. 2008.
4. Andreas C. Muller, "Introduction to Machine learning with Python", O'Reilly, 2016

REFERENCES:
1. TorstenHothorn, Brian S. Everitt, ―A Handbook of Statistical Analyses Using R,Chapman and Hall/CRC; Second edition, 2017
2. John Paul Mueuller, Luca Massaron, "Python for Data Science for Dummies", Wiley,2019
3. Samir Madhavan, "Mastering Python for Data Science", 2015

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

Course Name : R AND PYTHON PROGRAMMING FOR DATA SCIENCE		Course Code : 20IT8A3			
CO	**Course Outcomes**	**Unit**	**K-CO**	**POs**	**PSOs**
PE4.6.1	Apply the basics of R programming and Python Programming with its datatypes.	1	K3	1, 2, 3,4,8, 9	2
PE4.6.2	Able to apply the functional programming and data manipulation statements in R	2	K3	1,2,3,4,8, 9,10	2
PE4.6.3	Identify packages to implement machine learning techniques in R.	3	K3	1,2,3,4,5,8, 9,12	2
PE4.6.4	Use Numpy and pandas libraries on data sets for pre-processing	4	K3	1,2,3,4,5,8,9,10,12	2
PE4.6.5	Apply Scikit learn to perform supervised learning and clustering	5	K3	1,2,3,4,5,8, 9	2
PE4.6.6	Apply the concepts of various data analytics techniques to solve real time problems.	5	K3	1,2,3,4,5, 8, 9	2

CO-PO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
PE4.6.1	3	2	1	1	-	-	-	1	1		-	-	1	1
PE4.6.2	3	2	1	1	-	-	-	1	1	1	-	-	1	1
PE4.6.3	3	2	1	1	1	-	-	1	1	-	-	1	1	1
PE4.6.4	3	2	1	1	1	-	-	1	1	1	-	1	1	1
PE4.6.5	3	2	1	1	1	-	-	1	1	-	-	1	1	1
PE4.6.6	3	2	1	1	1			1	1				1	1
C	3	2	1	1	1			1	1	1		1	1	1

Professional Elective – V

		L	T	P	C
20IT8B1	**TCP/IP NETWORK PROGRAM AND MANAGEMENT**	3	0	0	3

OBJECTIVES:

● To Understand general concepts and architecture behind network management
● To study concepts and terminology associated with SNMP.
● To study about the statistics collection using remote network monitoring
● To Understand the practical issues in extending RMON1 to RMON2
● To understand the compatibility of SNMPv1 with SNMPv2

PRE-REQUISITE:

Course Code: 20CS501
Course Name: Computer Networks

UNIT I   NETWORK MANAGEMENT FUNDAMENTALS   9

Network Monitoring – Network Monitoring Architecture, Performance Monitoring, Fault Monitoring, Account Monitoring, Network Control – Configuration Control, Security Control

UNIT II   NETWORK MANAGEMENT USING SNMP V1   9

SNMP Network Management concepts – SNMP Management Information – structure of Management information – Standard Management Information Base – MIB II, Ethernet Interface MIB – SNMP-Basic Concepts – Protocol Specification – Transport Level Support – SNMP Group – Practical Issues.

UNIT III   REMOTE NETWORK MONITORING RMON1   9

Statistics Collection –Basics Concepts – Statistics Group – History Group – Host Group – hostTopN Group – Matrix Group – matrix Group – Alarms and Filters – alarm Group – filter Group – Packet capture Group – event Group – Practical issues

UNIT IV   REMOTE MONITORING RMON2   9

Overview – Protocol Discovery Group – Protocol Distribution Group – Address Map Group – RMON2 Host Groups – RMON2 Matrix Groups – User History Collection Group – Probe Configuration Group – Extensions to RMON1 for RMON2 devices – Practical issues

UNIT V   NETWORK MANAGEMENT USING SNMP V2   9

SNMPv2 Management Information – structure of management information – SNMPv2 Protocol – Protocol Operations – Transport Mappings – Coexistence with SNMPv1 – MIB and Conformance – SNMPv2 Management Information Base – Conformance Statements – Evolution of the Interface Group of MIB-II

TOTAL: 45 PERIODS

TEXT BOOKS

1. William Stallings, "SNMP,SNMPv2,SNMPv3 and RMON 1 and RMON 2", Pearson Education, Third Edition,2021
2. Steven T.Karris, "Network Design and Management", Orchard Publications, 2009.

REFERENCES:

1. Larry Walsh, "SNMP MIB Handbook", 2008.
2. Adrian Farell," Network Management: Know It All", Morgan-Kaufmann,2011.
3. Laura Chappell and Gerals combs, "Wireshark Network Analysis", 2nd Edition, 2012
4. Stephen B.Morris,"Network Management, MIBs and MPLS: Principles, Design and Implementation", Addison Wesley,2003.
5. Dinesh Chandra Verma," Principles of Computer System and Network Management", Springer, 2009

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

Course Name TCP/IP NETWORK PROGRAM AND MANAGEMENT								Course Code : 20IT8B1					
CO	**Course Outcomes**							**Unit**	**K-CO**	**POs**			**PSOs**
PE5.1.1	Perform Network monitoring using various schemes							1	K2	1,2,8,9			1,2
PE5.1.2	Able to use SNMPv1 for simple network management							2	K2	1,2,3,8,9,10			1.2
PE5.1.3	Able to acquire various statistics using RMON1							3	K2	1,2,3,8,9,12			1,2
PE5.1.4	Identify the issues in RMON1 for RMON2 devices							4	K2	1,2,3,8,9,10,12			1,2
PE5.1.5	Differentiate the information base of SNMPv1 and SNMPv2							5	K2	1,2,3,8,9,12			1,2
PE5.1.6	Acquire the knowledge of various remote login procedure and management							5	K2	1,2,8,9,10			1,2
CO-PO Mapping													
CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
PE5.1.1	2	1			-	-	-	1	1		-	-	1	1
PE5.1.2	2	1			-	-	-	1	1	1	-	-	1	1
PE5.1.3	2	1			-	-	-	1	1	-	-	1	1	1
PE5.1.4	2	1			-	-	-	1	1	1	-	1	1	1
PE5.1.5	2	1			-	-	-	1	1	-	-	1	1	1
PE5.1.6	2	1						1	1				1	1
C	2	1						1	1	1		1	1	1

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 Baeza-Yates and Berthier Ribeiro-Neto, ―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 Handbookǁ, 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
PE5.2.1	Explain about the IR components and Web Search Engine Framework	1	K2	1,2,8,9	1,2
PE5.2.2	Discuss about various information retrieval models	2	K2	1,2,8,9	1,2
PE5.2.3	Apply appropriate method of classification or clustering.	3	K3	1,2,3,8,9	1,2
PE5.2.4	Explain the Web Search Engine architecture and ranking functions	4	K2	1,2,8,9	1,2
PE5.2.5	Discuss about Web Link Analysis algorithms and advanced search	4	K2	1,2,8,9	1,2
PE5.2.6	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
PE5.2.1	2	1						1	**1**			2	2	2
PE5.2.2	2	1						1	1			2	2	2
PE5.2.3	3	2	1					1	1			2	2	2
PE5.2.4	2	1						1	1			2	2	2
PE5.2.5	2	1						1	1			2	2	2
PE5.2.6	3	2	1		1			1	1			2	2	2
C	2	2	1		1			1	1			2	2	2

		L	**T**	**P**	**C**
20CS8B2	**GREEN COMPUTING**	**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 Applications-Using Environmental Intelligence, CRC Press, June 2014.
2. Woody Leonhard, Katherine Murray, ―Green Home computing for dummies, August 2012.

REFERENCES:
1. Alin Gales, Michael Schaefer, Mike Ebbers, ―Green Data Center: steps for the Journey, Shroff/IBM rebook, 2011.
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**
PE5.3.1	Explain the Green IT strategies and its Policies, Practices and Metrics	1	K2	1,2,8,9,10	1,2
PE5.3.2	Summarize thegreen computing practices like Green Enterprise Architecture and modeling	2	K2	1,2,8,9,10	1,2
PE5.3.3	Illustrate energy saving practices and materials recycling	3	K2	1,2,3,8,9,10	1,2
PE5.3.4	Explain Green Data center and Green Grid framework	3	K2	1,2,8,9,10	1,2
PE5.3.5	Describe technology tools to ensure Green Compliance and reduce carbon foot print	4	K2	1,2,8,9,10	1,2
PE5.3.6	Analyze and apply green IT strategies and applications to any real world scenario	5	K4	1,2,3,5,8,9,10	1,2

CO-PO Mapping														
CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
PE5.3.1	2	1				2	2	1	**1**	2		2	2	2
PE5.3.2	2	1				2	2	1	1	2		2	2	2
PE5.3.3	2	1				2	2	1	1	2		2	2	2
PE5.3.4	2	1				2	2	1	1	2		2	2	2
PE5.3.5	2	1				2	2	1	1	2		2	2	2
PE5.3.6	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

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**
PE5.4.1	Explain the software project evaluation techniques and planning	1	K2	1,2,8,9,10	-
PE5.4.2	Demonstrate different software process models and cost estimation techniques	2	K2	1,2,8,9,10	-
PE5.4.3	Illustrate critical path using network planning models in activity planning	3	K3	1,2,3,8,9,10	-
PE5.4.4	Outline the different phases of risk management process	4	K2	1,2,8,9,10	1,2
PE5.4.5	Explain the need and framework for project management and control	5	K2	1,2,8,9,10	1,2
PE5.4.6	Summarize the organizational behavior and working in teams	5	K2	1,2,8,9,10	1,2

CO-PO Mapping														
CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
PE5.4.1	2	1						2	2	2		2		
PE5.4.2	2	1						2	2	2		2		
PE5.4.3	3	2	1					2	2	2		2		
PE5.4.4	2	1						2	2	2		2	1	1
PE5.4.5	2	1						2	2	2		2	1	1
PE5.4.6	2	1						2	2	2		2	1	1
C	2	1	1					2	2	2		2	1	1

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-Colour theory-Geometrical Transformations-Introduction-frames of reference-Modeling transformations-scaling the VE-Collision detection.

UNI - 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

Introduction-Engineering-Entertainment-Science-Training

TOTAL: 45 PERIODS

TEXT BOOKS

1.Jernej Barbic-Mirabelle D'Cruz Marc Erich Latoschik,Mel slater 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 Kaufmann, 2013
3. Alan Craig, William Sherman and Jeffrey Will, Developing Virtual Reality Applications, Foundations of Effective Design, Morgan Kaufmann, 2009.
4.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**
PE5.5.1	Explain the Virtual Reality and Environment, Virtual Reality Requirements and benefits	1	K2	1,2,8,9	1,2
PE5.5.2	Illustrate the visualization techniques for augmented reality	2	K2	1,2,8,9, 10	1,2
PE5.5.3	Discuss the concept of Computer Graphics And Geometric Modeling	3	K2	1,2,8,9	1,2
PE5.5.4	Use various types of Hardware and software in virtual Reality systems	4	K3	1,2,3,8,9, 12	1,2
PE5.5.5	Apply Development Tools And Framework for Virtual Reality	4	K3	1,2,3, 5,6,8,9, 12	1,2
PE5.5.6	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
PE5.5.1	2	1	-	-	-	-	-	1	1	2	-	-	2	3
PE5.5.2	2	1	-	-	-	-	-	1	1	2	-	-	2	3
PE5.5.3	2	1	-	-	-	-	-	1	1	2	-	-	2	3
PE5.5.4	3	2	1	-	-	-	-	1	1	2	-	1	2	3
PE5.5.5	3	2	1	-	2	1	-	2	2	2	-	1	2	3
PE5.5.6	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

OBJECTIVES:
- Comprehend the structure of a Blockchain networks.
- Evaluate security issues relating to Block chain and cryptocurrency.
- Design and analyze the applications based on Blockchain technology.

PRE-REQUISITE: NIL

UNIT - I   INTRODUCTION TO BLOCKCHAIN   9

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

UNIT - II   BLOCKCHAIN ARCHITECTURE, DESIGN AND CONSENSUS   9

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 (PoS and PoW).

UNI - 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**
PE5.6.1	Discuss the basic of block chain in terms of protocols and security and privacy	1	K2	1,2,8,9,10	1, 2
PE5.6.2	Explain the crypto primitives of block chain architecture	2	K2	1,2,8,9,10	1, 2
PE5.6.3	Illustrate the appropriate Consensus design for application protocol	2	K2	1,2,8,9,10	1, 2
PE5.6.4	Apply Hyper ledger Fabric to implement the Block chain	3	K3	1,2,3,5,6,8,9,10	1, 2
PE5.6.5	Apply various cryptographic techniques in Block chain cryptography, privacy and security	4	K3	1,2,3,5,6,8,9,10	1, 2
PE5.6.6	Discuss the research issues of Block chain	5	K2	1,2,8,9,10	1, 2

CO-PO Mapping													
CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
PE5.6.1	2	1	-	-	-	-	-	1	1	1	-	-	2	3
PE5.6.2	2	1	-	-	-	-	-	1	1	1	-	-	2	3
PE5.6.3	2	1	-	-	-	-	-	1	1	1	-	-	2	3
PE5.6.4	3	2	1	-	1	1	-	1	1	1	-	1	2	3
PE5.6.5	3	2	1	-	1	1	-	1	1	1	-	1	2	3
PE5.6.6	2	1	-	-	-	-	-	1	1	1	-	-	2	3
C	3	2	1	-	1	1	-	1	1	1	-	1	2	3

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.
● 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.

UNI - IV   TRADEMARKS   9
Concept of Trademarks - Different kinds of marks (brand names, logos, signatures, symbols, well known marks, certification marks and service marks) - Non Registrable Trademarks - Registration of Trademarks - Rights of holder and assignment and licensing of marks - Infringement, Remedies & Penalties - Trademarks registry and appellate board.

UNIT - V   OTHER FORMS OF IP & REGISTRATION PROCESS   9
Design: meaning and concept of novel and original - Procedure for registration, effect of registration and term of protection. Geographical Indication (GI): meaning, and difference between GI and trademarks - Procedure for registration, effect of registration and term of protection. IPR registration process through government website-modalities and publications. Plant Variety Protection: meaning and benefit sharing and farmers' rights – Procedure for registration, effect of registration and term of protection. Layout Design Protection: meaning – Procedure for registration, effect of registration and term of protection.

TOTAL: 45 PERIODS

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

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

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

Course Name : INTELLECTUAL PROPERTY RIGHTS			Course Code : 20HS6A1			
CO	**Course Outcomes**		**Unit**	**K-CO**	**POs**	**PSOs**
PE5.7.1	Explain the fundamental aspects of Intellectual property Rights which plays a major role in development and management of innovative projects in industries.		1	K2	1,2,8,9,10	1,2
PE5.7.2	Describe the patents, patent regime in India and abroad and registration aspects.		2	K2	1,2,8,9,10	1,2
PE5.7.3	Describe the copyrights and its related rights and registration aspects.		3	K2	1,2,8,9,10	1,2
PE5.7.4	Explain the trademarks and registration aspects.		4	K2	1,2,8,9,10	1,2
PE5.7.5	Explain the Design, Geographical Indication (GI), Plant Variety and Layout Design Protection and their registration aspects.		5	K2	1,2,8,9,10	1,2
PE5.7.6	Analyze the current trends in IPR and Government steps in fostering IPR		5	K3	1,2,3,8,9,10	1,2
CO-PO mapping						
CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
PE5.7.1	2	1				1	1	2	2	2			1	1
PE5.7.2	2	1				1	1	2	2	2			1	1
PE5.7.3	2	1				1	1	2	2	2			1	1
PE5.7.4	2	1				1	1	2	2	2			1	1
PE5.7.5	2	1				1	1	2	2	2			1	1
PE5.7.6	2	1				1	1	2	2	2			1	1
C	2	1				1	1	2	2	2			1	1

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

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

PRE-REQUISITE: NIL

UNIT - I   INTRODUCTION   9

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

UNIT - II   SECURITY INVESTIGATION   9

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

UNIT- III   SECURITY ANALYSIS   9

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

UNI - IV   LOGICAL DESIGN   9

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

UNIT - V   PHYSICAL DESIGN   9

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

TOTAL: 45 PERIODS

TEXT BOOKS

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

REFERENCES:

1.Stuart McClure, Joel Scrambray, George Kurtz, ―Hacking Exposed‖, Tata McGraw- Hill, 2003
2. Matt Bishop, ― Computer Security Art and Science‖, Pearson/PHI, 2002.

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

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

CO-PO Mapping

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

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

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

PRE-REQUISITE: NIL

UNIT I   INTRODUCTION   9
Introduction-key features of cyber physical systems- Continuous dynamics: actor models- properties of systems-feedback control-Discrete dynamics: Discrete systems- Finite state machines

UNIT II   SYNCHRONOUS AND ASYNCHRONOUS MODEL   9
Synchronous model: Reactive components-properties of components-composing components- synchronous design, Asynchronous model- asynchronous processes- asynchronous design primitives- coordination protocols.

UNIT III   SAFETY AND LIVENESS REQUIREMENT   9
Safety specifications- verifying invariants- Enumerative search- Temporal logic- Model checking- reachability analysis- proving liveness

UNIT IV   TIMED MODEL AND REAL-TIME SCHEDULING   9
Timed processes- Timing based protocols: Timing-Based Distributed Coordination-Audio Control Protocol- Timed automata: Model of Timed Automata-Region Equivalence-Matrix-Based Representation for Symbolic Analysis, Real-time scheduling.

UNIT V   HYBRID SYSTEMS   9
Classes of Hybrid systems-Hybrid dynamic models: Hybrid Processes-Process Composition-Zeno Behaviors-Stability- designing hybrid systems- linear hybrid automata

TOTAL: 45 PERIODS

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

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

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

Course Name : PRINCIPLES OF CYBER PHYSICAL SYSTEMS				Course Code :20OE506	
CO	**Course Outcomes**	**Unit**	**K-CO**	**POs**	**PSOs**
OE5.6.1	Ability to understand knowledge, opportunities, challenges and Logical Foundations of Cyber Physical Systems.	1	K2	1, 2, 8, 9	1,2
OE5.6..2	Ability to develop model for synchronous, asynchronous, continuous and discrete systems.	2	K2	1, 2, 8,9,10	1,2
OE5.6..3	Ability to identify safety specifications and critical properties of Cyber Physical Systems.	3	K2	1, 2, 5, 8, 9	1,2
OE5.6..4	Ability to design and analyze the stability of hybrid systems.	4	K2	1, 2, 5, 8, 9,10	1,2
OE5.6..5	Ability to apply automata for timed systems.	5	K2	1, 2, 5, 8, 9	1.2
OE5.6..6	Ability to understand Zeno Behaviors	5	K2	1, 2, 5, 8, 9	1,2

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

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

OBJECTIVES:

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

PRE-REQUISITE: NIL

UNIT - I   EHICAL HACKING OVERVIEW & VULNERABILITIES   9

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

UNIT - II   FOOTPRINTING & PORT SCANNING   9

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

UNIT- III   SYSTEM HACKING   9

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

UNIT-IV   HACKING WEB SERVICES & SESSION HIJACKING   9

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

UNIT - V   HACKING WIRELESS NETWORKS AND MOBILE SECURITY   9

Wireless Security : Introducing Aircrack - Role of WEP, Cracking WEP Keys, Sniffing Traffic, Wireless DOS attacks, WLAN Scanners, WLAN Sniffers, Hacking Tools, Securing Wireless   Network   -
Mobile Security : Android vsiOS security model, Threat Models, Information Tracking – Rootkits – Threats in Mobile Applications – Analyzer for Mobile Apps to Discover Security Vulnerabilities.

TOTAL: 45 PERIODS

TEXT BOOKS

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

REFERENCES:

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

OUTCOMES:

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

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

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

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

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

PRE-REQUISITE: NIL

UNIT I   INTRODUCTION   9

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

UNIT II   HUMAN COMPUTER INTERACTION   9

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

UNIT III   WINDOWS   9

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

UNIT IV   MULTIMEDIA   9

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

UNIT V   WINDOWS LAYOUT– TEST   9

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

TOTAL: 45 PERIODS

TEXT BOOKS

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

REFERENCES:

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

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

Course Name : INTRODUCTION TO USER INTERFACE													Course Code :20OE508		
CO	**Course Outcomes**										**Unit**	**K-CO**	**POs**		**PSOs**
OE5.8.1	Design effective dialog using HCI.										1	K2	1, 2, 8, 9		1,2
OE5.8.2	Design effective HCI for individuals.										2	K2	1, 2, 8, 9,10		1,2
OE5.8.3	Explain the structures and functions of Menus.										3	K2	1, 2, 8, 9,12		1,2
OE5.8.4	Explain the various controls in Windows.										4	K2	1, 2, 8, 9,10,12		1,2
OE5.8.5	Assess the importance of user feedback and multimedia applications..										5	K2	1, 2, 8, 9,12		1.2
OE5.8.6	Explain the HCI implications for designing hypermedia, and learn about World Wide Web and software tools.										5	K2	1, 2, 8, 9		1,2
CO-PO Mapping															
CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	
OE5.8.1	2	1			-	-	-	1	1		-	-	1	2	
OE5.8.2	2	1			-	-	-	1	1	1	-	-	1	2	
OE5.8.3	2	1			-	-	-	1	1	-	-	1	1	2	
OE5.8.4	2	1			-	-	-	1	1	1	-	1	1	2	
OE5.8.5	2	1			-	-	-	1	1	-	-	1	1	2	
OE5.8.6	2	1			-			1	1				1	2	
c	2	1			-			1	1		1		1	2	