R22

M.Tech. (SOFTWARE ENGINEERING)

M.Tech. R22 CBCS Curriculum

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

An Autonomous, ISO 9001:2015 & QS I-Gauge Diamond Rated Institute, Accredited by NAAC with 'A++' Grade
NBA Accreditation for B.Tech. CE, EEE, ME, ECE, CSE, EIE, IT Programmes
Approved by AICTE, New Delhi, Affiliated to JNTUH, NIRF 113 Rank in Engineering Category
Recognized as "College with Potential for Excellence" by UGC
Vignana Jyothi Nagar, Pragathi Nagar, Nizampet (S.O), Hyderabad – 500 090, TS, India.
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DEPARTMENT OF

COMPUTER SCIENCE AND ENGINEERING

VISION OF THE DEPARTMENT

To achieve academic and research excellence in essential technologies of Computer Science and Engineering by promoting a creative environment for learning and innovation.

MISSION OF THE DEPARTMENT

- To provide dynamic, innovative and flexible curriculum which equip the students with the necessary problem driven skills to strengthen their career prospects and potential to pursue higher studies.
- To foster inquisitive-driven research among students and staff so as to reinforce the domain knowledge and address contemporary societal issues.
- To inculcate ethical values, leadership qualities and professional behaviour skills for improving the living standards of people

M.TECH.
(SOFTWARE ENGINEERING)

M.TECH. (SE)

PROGRAM EDUCATIONAL OBJECTIVES

PEO-I: Develop technologically competent computer professionals in todays IT centric scenario by training them in the contemporary software engineering principles and paradigms.

PEO-II: Provide students a deep insight into various cutting edge technologies & tools and thereby creating diverse career opportunities.

PEO-III: Improve analytical, logical and presentation skills of the students by applying evolving technologies of software engineering in developing practical solutions to complex problems in consonance with the legal and ethical responsibilities.

PEO-IV: Provide the students with project engineering and management skills catering to the changing industry needs and constraints across the advancing domains of computing.

PEO-V: Prepare the students to take up research oriented projects, industry internships and entrepreneurship endeavors by training them to work with multi-disciplinary teams and engaging them for life-long learning in pursuit of their professional accomplishment.

M.TECH. (SE)

PROGRAM OUTCOMES

PO-1: An ability to independently carry out research / investigation and development work to solve practical problems.

PO-2: An ability to write and present a substantial technical report / document.

PO-3: Students should be able to demonstrate a degree of mastery over the area as per the specialization of the program. The mastery should be at a level higher than the requirements in the appropriate bachelor program.

PO-4: Integrate the knowledge of software engineering principles and paradigms in the design of system components and processes to meet the specific needs of the industry.

PO-5: Apply the cutting-edge technologies, skills and CASE tools necessary to identify, analyze and formulate solutions to complex engineering problems with societal commitment.

PO-6: Recognize the need to engage in lifelong learning that helps to explore all dimensions of software engineering practices and contemporary technologies with ethical values.

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY, HYDERABAD
M.TECH. I YEAR COURSE STRUCTURE AND SYLLABUS

(SOFTWARE ENGINEERING)

I SEMESTER **R22**

Course Type	Course Code	Name of the Course	L	T	P	Credits
Professional Core-I	22PC1SE01	Software Quality Assurance and Testing	3	0	0	3
Professional Core-II	22PC1CP02	Advanced Problem Solving	3	0	0	3
Professional Core-III	22PC1CP03	Machine Learning	3	0	0	3
Professional Elective-I	22PE1SE01	Software Reengineering	3	0	0	3
	22PE1SE02	Object Oriented Modeling				
	22PE1SE03	Software Metrics				
	22PE1CP01	Advanced Network Programming				
	22PE1CN06	Data Science				
Professional Elective-II	22PC1CP01	Distributed Computing	3	0	0	3
	22PE1CP04	Information Retrieval Systems				
	22PE1SE04	Formal Methods in Software Engineering				
	22PE1CP06	Scripting Languages				
	22PE1SE05	Digital Forensics				
Professional Core Lab-I	22PC2SE01	Software Testing and Case Tools Laboratory	0	0	2	1
Professional Core Lab-II	22PC2CP01	Advanced Problem Solving Laboratory	0	0	2	1
Communication Skills	22SD5HS01	Communication Skills for Academic and Research Writing	0	0	2	1
Project	22PW4SE01	Technical Seminar	0	0	4	2
Mandatory	22MN6HS01	Research Methodology and IPR	2	0	0	0
Total			**17**	**0**	**10**	**20**

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY, HYDERABAD
M.TECH. I YEAR COURSE STRUCTURE AND SYLLABUS

(SOFTWARE ENGINEERING)

II SEMESTER **R22**

Course Type	Course Code	Name of the Course	L	T	P	Credits
Professional Core-IV	22PC1SE02	Software Requirements and Estimation	3	0	0	3
Professional Core-V	22PC1CP04	Cryptography and Network Security	3	0	0	3
Professional Core-VI	22PC1CP06	Big Data Analytics	3	0	0	3
Professional Elective-III	22PE1CP09	Cloud Computing	3	0	0	3
	22PE1CP10	Soft Computing				
	22PE1CP11	Advanced Operating Systems				
	22PE1SE06	Software Architecture and Design Patterns				
	22PC1CP05	Internet of Things				
Professional Elective-IV	22PE1SE07	Advanced Software Engineering Principles and Practices	3	0	0	3
	22PE1CP14	Deep Learning and its Applications				
	22PE1SE08	Software Defined Networks				
	22PE1SE09	Web Services and Service Oriented Architecture				
	22PE1CP15	Natural Language Processing				
Professional Core Lab-III	22PC2CP04	Cryptography and Network Security Laboratory	0	0	2	1
Professional Core Lab-IV	22PC2CP03	Big Data Analytics Laboratory	0	0	2	1
Industry Engagement	22SD5SE01	Industry Engagement	0	0	2	1
Project	22PW4SE02	Mini-Project	0	0	4	2
Mandatory	22MN6HS02	Ancient Wisdom	2	0	0	0
Total			**17**	**0**	**10**	**20**

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY, HYDERABAD
M.TECH. II YEAR COURSE STRUCTURE AND SYLLABUS

(SOFTWARE ENGINEERING)

III SEMESTER **R22**

Course Type	Course Code	Name of the Course	L	T	P	Credits
Professional Elective-V	22PE1CP21	Block Chain Technology	3	0	0	3
	22PE1CN08	Artificial Intelligence				
	22PE1CP23	Quantum Computing				
	22PE1SE10	Software Conceptual Design				
	22PE1LI03	Digital Image Processing				
Open Elective	22OE1CN01	Business Analytics	3	0	0	3
	22OE1AM01	Industrial Safety				
	22OE1AM02	Operations Research				
	22OE1AM03	Entrepreneurship and Start-ups				
	22OE1PS01	Waste to Energy				
Project	22PW4SE03	Project Part - I	0	0	16	8
Total			**6**	**0**	**16**	**14**

IV SEMESTER **R22**

Course Type	Course Code	Name of the Course	L	T	P	Credits
Project	22PW4SE04	Project Part - II	0	0	28	14
Total			**0**	**0**	**28**	**14**

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

M.Tech. I Semester

(22PC1SE01) SOFTWARE QUALITY ASSURANCE AND TESTING

TEACHING SCHEME		
L	T/P	C
3	0	3

EVALUATION SCHEME				
SE	CA	ELA	SEE	TOTAL
30	5	5	60	100

COURSE PRE-REQUISITES: Basic knowledge on Software Engineering

COURSE OBJECTIVES:
- To define quality and understand various quality standards
- To recognize metrics, measurements and methodology for assessing software quality
- To understand steps involved in testing process and test factors
- To analyze taxonomy of testing tools and automated testing tools
- To remember steps involved in testing process and testing specialized systems

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Analyze the importance of Software Quality Assurance process and Standards
CO-2: Demonstrate Quality Metrics and it's methodology
CO-3: Illustrate test documentation policies and compare different testing techniques
CO-4: Analyze taxonomy of testing tools and automated testing tools
CO-5: Outline testing process of specialized systems

COURSE ARTICULATION MATRIX:
*(Define Correlation of Course Outcomes with Program Outcomes and Program Specific Outcomes using **mapping levels 1 = Slight, 2 = Moderate and 3 = Substantial**)*

CO	PROGRAM OUTCOMES (PO)					
	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6
CO-1	3	2	3	3	2	2
CO-2	3	3	3	3	3	2
CO-3	3	3	2	3	3	3
CO-4	3	3	2	3	3	2
CO-5	3	3	3	2	3	3

UNIT-I:
Software Quality Assurance Framework and Standards SQA Framework: What is Quality? Software Quality Assurance, Components of Software Quality Assurance- Software Quality Assurance Plan: Steps to develop and implement a Software Quality Assurance Plan – Quality Standards: ISO9000 and Companion ISO Standards, CMM, CMMI, PCMM, 6Sigma.

UNIT-II:
Software Quality Assurance Metrics and Measurement Software Quality Metrics: Product Quality metrics, In-Process Quality Metrics, Metrics for Software Maintenance, Software Quality metrics methodology: Establish quality requirements, Identify

Software quality metrics, Implement the Software quality metrics, analyze Software metrics results, validate the Software quality metrics-Software quality indicators.

UNIT-III:

Software Testing Strategy and Environment: Establishing testing policy, structured approach to testing, test factors, Economics of System Development Life Cycle (SDLC) Testing Software Testing Methodology.

Defects hard to find, verification and validation, functional and structural testing, work bench concept, eight considerations in developing testing methodologies, testing tactics checklist.

UNIT-IV:

Software Testing Techniques: Black-Box, Boundary value, Bottom-up, Branch coverage, Cause-Effect graphing, CRUD, Database, Exception, Gray-Box, Histograms, Inspections, JADs, Pare to Analysis, Prototyping, Random Testing, Risk-based Testing, Regression Testing, Structured Walk through, Thread Testing, Performance Testing, White-Box Testing.

UNIT-V:

Software Testing Tools: Taxonomy of Testing tools. Methodology to evaluate automated testing tools, Load Runner, QTP, Silk test, Java Testing Tools, Eleven Step Testing Process, Testing Client/Server Web applications. Testing off the Shelf Components, Testing a Data Warehouse.

TEXT BOOKS:

1. Software Testing and Continuous Quality Improvement, William E. Lewis, Gunasekaran Vcerapillai, 2nd Edition, Auerbach Publications
2. Effective Methods for Software Testing, William E. Perry, 2nd Edition, Wiley India, 2006
3. Metrics and Models for Software Quality Engineering, Stephen Kan, Pearson Education

REFERENCES:

1. Software Testing Tools, K. V. K. K. Prasad, Dreamtech,2008
2. Testing and Quality Assurance for Component based Software, Gao Tsao and Wu, Artech House Publishers
3. Software Testing Techniques, Bories Beizer, 2nd Edition, Dreamtech
4. Managing the Testing Process, Rex Black, Wiley
5. Handbook of Software Quality Assurance, G. Gordon Schulmeyer, James McManus, 2nd Edition, International Thomson Computer Press

ONLINE RESOURCES:

1. https://onlinecourses.nptel.ac.in/noc20_cs19/preview
2. https://www.udemy.com/course/software-quality-assurance/

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

M.Tech. I Semester

(22PC1CP02) ADVANCED PROBLEM SOLVING

TEACHING SCHEME		
L	T/P	C
3	0	3

EVALUATION SCHEME				
SE	CA	ELA	SEE	TOTAL
30	5	5	60	100

COURSE PRE-REQUISITES: Basic knowledge on UG level course Data Structures and Algorithm Design and Analysis

COURSE OBJECTIVES:

- To introduce the advanced methods of designing and analyzing algorithms
- To choose appropriate algorithms and use it for a specific problem
- To familiarize basic paradigms and data structures used to solve advanced algorithmic problems
- To understand different classes of problems concerning their computation difficulties

COURSE OUTCOMES: After completion of the course, the student should be able to

CO-1: Understand different advanced data structures and classes of problems concerning their computation difficulties

CO-2: Analyze the complexity/performance of different algorithms and data structures operations

CO-3: Categorize the different problems in various classes according to their complexity

CO-4: Identify appropriate data structure and algorithms design technique and use it for a specific problem solving

CO-5: Apply advanced problem-solving skills in various domains

COURSE ARTICULATION MATRIX:

*(Define Correlation of Course Outcomes with Program Outcomes and Program Specific Outcomes using **mapping levels 1 = Slight, 2 = Moderate and 3 = Substantial**)*

CO	PROGRAM OUTCOMES (PO)					
	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6
CO-1	3	1	3	3	3	1
CO-2	3	1	3	3	3	1
CO-3	3	1	3	3	3	1
CO-4	3	2	3	3	3	1
CO-5	3	2	3	3	3	2

UNIT-I:

Abstract Data Type: Priority Queue, Min/Max Heap, Binomial Heaps, Fibonacci heaps. Hashing: Implementation of Dictionaries, Review of Hashing, Hash Function, Collision Resolution Techniques in Hashing, Separate Chaining, Open Addressing, Linear Probing, Quadratic Probing, Double Hashing, Rehashing, Extendible Hashing. counting and radix sorting techniques.

Trees: AVL Trees, Red Black Trees, B-Trees, Tries.

UNIT-II:

Text Processing: Sting Operations, Brute-Force Pattern Matching, The Boyer-Moore Algorithm, The Knuth-Morris -Pratt Algorithm, The Longest Common Subsequence Problem (LCS), Applying Dynamic Programming to the LCS Problem. Introduction to Convex Hull, finding the convex hull and Graham scan approach.

UNIT-III:

Graph: Definitions and Elementary Algorithms: Shortest Path in Graphs: BFS, Dijkasra's, Bellman-Ford, Floyd-Warshall algorithm, DFS, topological sorting amortized analysis.
Modulo Representation of Integers/Polynomials: Chinese Remainder Theorem, Conversion between base-representation and modulo-representation. Polynomial addition and multiplication.

UNIT-IV:

Flow-Networks: Maxflow-min cut theorem, Ford-Fulkerson Method to compute maximum flow, Edmond-Karp maximum-flow algorithm.
Matrix Computations: Strassen's algorithm and introduction to divide and conquer paradigm, inverse of a triangular matrix, LUP-decomposition.

UNIT-V:

Linear Programming: Geometry of the feasibility region and Simplex algorithm
NP Hard and NP-Complete problems: P, NP, NP-complete and NP-hard. Cook's theorem Recent Trends in problem solving paradigms using recent searching and sorting techniques by applying recently proposed data structures.

TEXT BOOKS:

1. Data Structures and Algorithm Analysis in C++, Mark Allen Weiss, 2nd Edition, Pearson, 2004
2. Introduction to Algorithms, Cormen, Leiserson, Rivest, Stein
3. Fundamentals of Computer Algorithms, E. Horrowitz, S. sahni, S. Rajasekaran, Second Edition, University Press, 2007

REFERENCES:

1. Algorithm Design – Foundations, Analysis, and Internet Algorithms, M. T. Goodrich, R. Tomassia, John Wiley, 2002
2. The Design and Analysis of Computer Algorithms, Aho, Hopcroft, Ullman
3. Algorithm Design, Kleinberg and Tardos
4. Design analysis and Algorithms, Hari Mohan Pandy, University Science Press, 2009

ONLINE RESOURCES:

1. http://cs161.stanford.edu
2. https://www.ics.uci.edu/~eppstein/161/960312.html
3. https://www.cmi.ac.in/~madhavan/teaching.html

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

M.Tech. I Semester

(22PC1CP03) MACHINE LEARNING

TEACHING SCHEME		
L	T/P	C
3	0	3

EVALUATION SCHEME				
SE	CA	ELA	SEE	TOTAL
30	5	5	60	100

COURSE PRE-REQUISITES: Basic knowledge on Linear Algebra, Probability, Statistics and Linear Algebra

COURSE OBJECTIVES:

- To learn the concept of how to learn patterns and concepts from data without being explicitly programmed
- To design and analyse various machine learning algorithms and techniques
- To explore supervised and unsupervised learning paradigms of machine learning
- To learn recommendation technique and various feature selection strategies

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Understand the basic concepts of machine learning and their usage
CO-2: Classify and Compare pros and cons of various supervised machine learning models
CO-3: Analyse various unsupervised machine learning approaches and paradigms mathematically
CO-4: Evaluate machine learning algorithms and elaborate feature selection methods
CO-5: Explore different learning techniques and recommendation systems

COURSE ARTICULATION MATRIX:
*(Define Correlation of Course Outcomes with Program Outcomes and Program Specific Outcomes using **mapping levels 1 = Slight, 2 = Moderate and 3 = Substantial**)*

CO	PROGRAM OUTCOMES (PO)					
	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6
CO-1	3	3	3	3	3	3
CO-2	3	3	3	3	3	3
CO-3	3	2	3	3	3	2
CO-4	3	2	2	3	3	2
CO-5	3	3	3	2	3	2

UNIT-I:
Introduction: Basic definitions, Issues in Machine Learning, types of learning, hypothesis space and inductive bias, evaluation, cross-validation, Over fitting and Under fitting, Linear Regression: Introduction, Linear Models for Regression.

UNIT-II:
Supervised Learning (Regression/Classification): Introduction, Nearest-Neighbours, Decision Trees, Bayes Rule& Naive Bayes, Logistic Regression Support Vector

Machines, Perceptron, multilayer networks, and the back propagation algorithm, Beyond Binary Classification.

UNIT-III:

Unsupervised Learning:

Clustering: Introduction, K-mean clustering, K-medoids clustering, Hierarchical clustering, Agglomerative clustering, Divisive clustering. Dimensionality Reduction, Linear Discriminant Analysis, PCA and kernel PCA.

UNIT-IV:

Evaluating Machine Learning algorithms and Feature Selection: forward search, backward search, univariate, multivariate feature selection approach, Ensemble Methods: Boosting, Bagging, Random Forests

UNIT-V:

Other Topics in Machine Learning- Semi-supervised Learning, Active Learning, Reinforcement Learning, Collaborative filtering-based Recommendation Systems

TEXT BOOKS:

1. Machine Learning: A Probabilistic Perspective, Kevin Murphy, MIT Press, 2012
2. Machine Learning, Tom Mitchell, First Edition, McGraw-Hill, 1997
3. Pattern Recognition and Machine Learning, Christopher Bishop, Springer, 2007

REFERENCES:

1. Machine Learning: An Algorithmic Perspective, Stephen Marshland, Taylor & Francis
2. Introduction to Machine Learning, Ethem Alpaydin, Second Edition, MIT Press, 2010
3. The Elements of Statistical Learning, Trevor Hastie, Robert Tibshirani, Jerome Friedman

ONLINE RESOURCES:

1. Introduction to Machine Learning - Course (nptel.ac.in)
2. Supervised Machine Learning: Regression and Classification | Coursera
3. Free Online Course: Applied Machine Learning in Python from Coursera | Class Central
4. Free Online Course: Machine Learning with Python from Coursera | Class Central

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

M.Tech. I Semester

(22PE1SE01) SOFTWARE REENGINEERING

TEACHING SCHEME		
L	T/P	C
3	0	3

EVALUATION SCHEME				
SE	CA	ELA	SEE	TOTAL
30	5	5	60	100

COURSE PRE-REQUISITES: Basic knowledge on Software Engineering

COURSE OBJECTIVES:

- To understand and analyze the importance and basic concepts of software reengineering
- To identify the standards in software reengineering
- To describe the concepts of organizing and reorganizing process
- To analyze the need of Software Reuse Tools

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Illustrate the importance of Software reengineering
CO-2: Outline the standards in Software reengineering
CO-3: Make use of the concepts of organizing and reorganizing process in present industry
CO-4: Compare various Software Reuse Tools
CO-5: Understand various software reengineering methods

COURSE ARTICULATION MATRIX:
*(Define Correlation of Course Outcomes with Program Outcomes and Program Specific Outcomes using **mapping levels 1 = Slight, 2 = Moderate and 3 = Substantial**)*

CO	PROGRAM OUTCOMES (PO)					
	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6
CO-1	2	2	3	3	2	1
CO-2	2	2	2	3	3	2
CO-3	2	3	3	2	3	2
CO-4	3	3	3	2	3	2
CO-5	3	1	2	3	2	3

UNIT-I:
Introduction: The Need, What is reuse, Types of reuse, Domain Analysis, Hypertext.
Software Lifecycle: Requirements, Design, Implementation, Testing and Documentation, Maintenance, Standards.

UNIT-II:
Management: Software Team Organization, Process Modelling, Software Project Modelling, Scheduling
Reengineering Concepts: Reengineering Objectives, General Models of Software Reengineering.

UNIT-III:
Software Reliability Methods, Dealing with Software reliability, Reengineering Phases and Tasks, Reengineering Implementation.
Standards: Expectations, Existing Related Standards, Recommendations, Conclusion.

UNIT-IV:
Enterprise & Standards:
Reuse Framework: Process Idioms and Sources, Reuse management, Asset creation, Asset management, Asset Utilization, Cost Vs Benefits, legal Issues.
Software Reuse Tools: CASE, Practitioner, MUCH, Soft class, User Interface Generator.

UNIT-V:
Organize to Reorganize:
Organizing: Indexing, Document Outlines, Domain Models, Code Organizing, Framework. Retrieving: Retrieval specification, Document Retrieval, Program **Retrieval, Reorganizing:** Retrieved Component suitability, Program reorganizing, Code generators, Testing after Reuse.
Case Studies: IBM Reuse and Boblingen Experience, HP Reuse, Motorola Reuse.

TEXT BOOKS:

1. Reengineering Software–How to Reuse Programming to Build New, State-of-the-Art Software, Roy Rada, 2nd Edition, Eric Dobby Publishing
2. Application Software Reengineering, Afshar Alam, Tendai Padenga, Pearson Education, 2010

REFERENCES:

1. Secrets of Reverse Engineering, Eldad Eilal, Wiley
2. Advancement in Software Maintenance Management: Technologies and Solutions, Macario Polo, Ed. Idea Group Publishing, 2003
3. Software Reengineering, Robert S. Arnold, IEEE Comp. Society

ONLINE RESOURCES:
1. https://nptel.ac.in/courses/106105182

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

M.Tech. I Semester

(22PE1SE02) OBJECT ORIENTED MODELING

TEACHING SCHEME		
L	T/P	C
3	0	3

EVALUATION SCHEME				
SE	CA	ELA	SEE	TOTAL
30	5	5	60	100

COURSE PRE-REQUISITES: Basic knowledge on Software Engineering

COURSE OBJECTIVES:

- To list and discuss the object-oriented concepts, principles, and artifacts related to classes and relationships for modeling (CRC approach)
- To illustrate the communication across the objects for a specified behavior (use case) through interaction diagrams
- To outline the various states a process/thread undergoes based on the occurrence of events and the mode for deploying the components being built
- To explain the industry software modeling practice through various processes

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Illustrate object-oriented concept representation through artifacts of UML
CO-2: Model the real-world application and its detailed state at a point in time using a UML (Unified Modeling Language) class and object diagrams
CO-3: Identify the activities in the object-oriented development life cycle phases
CO-4: Describe the use cases to develop functional requirements and test cases for a software system
CO-5: Apply the activities in the different phases of the object-oriented development life cycle for case studies

COURSE ARTICULATION MATRIX:
*(Define Correlation of Course Outcomes with Program Outcomes and Program Specific Outcomes using **mapping levels 1 = Slight, 2 = Moderate and 3 = Substantial**)*

CO	PROGRAM OUTCOMES (PO)					
	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6
CO-1	2	2	3	3	2	1
CO-2	2	2	3	3	2	1
CO-3	2	2	3	3	2	1
CO-4	2	2	3	3	2	1
CO-5	2	2	3	3	2	1

UNIT-I:
Introduction to UML: The meaning of Object Orientation, object identity, Encapsulation, information hiding, polymorphism, generosity, importance of modeling, principles of modeling, object-oriented modeling, conceptual model of the UML, Architecture.
The Unified Process: use case driven, architecture centric, iterative, and incremental.
The Four Ps: people, project, product, and process.

Iterative Incremental Process: iterative incremental in brief, why iterative incremental development? The iterative approach is risk driven, the generic iteration.

UNIT-II:

Basic Structural Modeling: Classes, Relationships, common Mechanisms, and diagrams. Class & Object Diagrams: Terms, concepts, modeling techniques for Class & Object Diagrams.

Advanced Structural Modeling: Advanced classes, Advanced relationships, Interfaces types and roles, packages, instances and object diagrams.

UNIT-III:

Collaboration Diagrams: Terms, Concepts, depicting a message, polymorphism in collaboration diagrams, iterated messages, use of self in messages.

Sequence Diagrams: Terms, concepts, depicting asynchronous messages with/without priority, callback mechanism, broadcast messages.

UNIT-IV:

Use Case Driven Process: why use case, capturing use cases, analysis, design, and implementation to realize the use cases, testing the use cases.

Basic Behavioral Modeling: Use cases, Use case Diagrams, Activity Diagrams.

Advanced Behavioral Modeling: Events and signals, state machines, processes and Threads, time and space, state chart diagrams.

UNIT-V:

Architectural Modeling: Component, Deployment, Component diagrams and Deployment diagrams.

Architecture-Centric Process: Architecture in brief, why we need architecture, use cases and architecture, the steps to architecture, an architecture description.

Case Studies: Automation of a Library, Software Simulator application.

TEXT BOOKS:

1. The Unified Modelling Language User Guide, Grady Booch, James Rumbaugh, Ivar Jacobson, Pearson Education
2. The Unified Software Development Process, Ivar Jacobson, Grady Booch, James Rumbaugh, Pearson Education
3. Fundamentals of Object-Oriented Design in UML, Meilir Page-Jones, Pearson Education

REFERENCES:

1. Modeling Software Systems Using UML2, Pascal Roques, Wiley-Dreamtech
2. Object Oriented Analysis & Design, Atul Kahate, McGraw Hill
3. Object-Oriented Analysis and Design with the Unified Process, John, Cengage Learning
4. W. Satzinger, Robert B Jackson and Stephen D Burd
5. UML 2 Toolkit, Hans-Erik Eriksson, Magnus Penker, Brian Lyons, David Fado, Wiley Dreamtech

ONLINE RESOURCES:

1. https://onlinecourses.nptel.ac.in/noc22_cs99/preview
2. https://www.udemy.com/course/introduction-to-object-oriented-modelling-design/

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

M.Tech. I Semester

(22PE1SE03) SOFTWARE METRICS

TEACHING SCHEME		
L	T/P	C
3	0	3

EVALUATION SCHEME				
SE	CA	ELA	SEE	TOTAL
30	5	5	60	100

COURSE PRE-REQUISITES: Basic knowledge on Software Engineering

COURSE OBJECTIVES:
- To be aware of core metrics for product, quality, process
- To familiarize with the concepts of software quality and tools for quality metrics
- To learn more about software liability
- To understand important concepts of complexity metrics and OO metrics

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Analyze connections of Software engineering measurements with the multidisciplinary history of measurement theory
CO-2: Demonstrate social and ethical issues associated with human performance measurement
CO-3: Assess the quality of a proposed metric
CO-4: Understand the commercial and organizational contexts of software metrics

COURSE ARTICULATION MATRIX:
*(Define Correlation of Course Outcomes with Program Outcomes and Program Specific Outcomes using **mapping levels 1 = Slight, 2 = Moderate and 3 = Substantial**)*

CO	PROGRAM OUTCOMES (PO)					
	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6
CO-1	2	3	2	3	3	1
CO-2	2	3	2	3	3	1
CO-3	2	3	2	3	3	1
CO-4	2	3	2	3	3	1

UNIT-I:
The History and Evolution of Software Metrics: Evolution of the Software industry and evolution of Software measurements – The cost of counting function point metrics – The paradox of reversed productivity for high-Level languages- The Varieties of functional metrics. – Variations in application size and productivity rates – Future Technical Developments in Functional Metrics- Software measures and metrics not based on function points.

UNIT-II:
Measuring Software Quality: Quality control and international competition – Defining quality for measurement and estimation – Five steps to Software quality control- Measuring Software defect removal- Measuring Defect removal efficiency – Measuring the costs of defect removal – Evaluating defect prevention methods – Measuring customer reported defects- Measuring invalid defects.

UNIT-III:

Process Metrics: In-Process Metrics for Software Testing - Test Progress S Curve - Testing Defect Arrivals Over Time - Product Size Over Time - CPU Utilization - Effort/Outcome Model. Complexity Metrics and Models - Lines of Code - Halstead's Software Science - Cyclomatic Complexity. - Syntactic Constructs - Structure Metrics.

UNIT-IV:

Mechanics of Measurement: Software Assessments – Software Baselines – Software Benchmarks- What a Baseline analysis covers – Developing or Acquiring a baseline data collection Instrument – Administering the data collection questionnaire – Analysis and aggregation of the Baseline data.

Measurement and Data Assessment: Measuring and Analyzing Customer Satisfaction - Surveys - Data Collection - Sampling Methods - Analyzing Satisfaction Data.

UNIT-V:

Conducting In- Process Quality Assessments - Preparation - Evaluation - Quantitative Data - Qualitative Data- Evaluation Criteria - Overall Assessment.

Measurements, Metrics and Industry Leadership: Measures and metrics of industry leaders – Measures, metrics and innovation – Measurements, metrics and outsource litigation – Measurements, metrics and behavioral changes – Commercial Software measurement tools.

TEXT BOOKS:

1. Applied Software Measurement: Global Analysis of Productivity and Quality, Caper Jones, Third Edition, McGraw Hill, 2008
2. Metrics and Models in Software Quality Engineering, Stephen H. Kan, Addison Wesley, 2011

REFERENCES:

1. Object-Oriented Software Metrics, Mark Lorenz, Jeff Kidd, Prentice Hall, 2000
2. Software Testing Principles and Practices, Naresh Chauhan, Oxford University Press, 2010

ONLINE RESOURCES:

1. https://www.youtube.com/watch?v=KqDlDubS-OU
2. https://cosmolearning.org/video-lectures/software-metrics-and-quality/

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

M.Tech. I Semester

(22PE1CP01) ADVANCED NETWORK PROGRAMMING

TEACHING SCHEME		
L	T/P	C
3	0	3

EVALUATION SCHEME				
SE	CA	ELA	SEE	TOTAL
30	5	5	60	100

COURSE PRE-REQUISITES: Basic knowledge on Computer Networks

COURSE OBJECTIVES:

- To introduce the student to Unix/Linux kernel programming techniques
- To teach advanced C systems programming and debugging techniques in a Unix/Linux environment
- To introduce the concepts of files and Directories to manage the Linux Environment through C Programming
- To provide knowledge in working with the core operating systems Concepts Signals in Linux Environment
- To teach how to manage the Inter process communication by using the IPC techniques and Introduce the student to socket programming to manage the connections between client and server

COURSE OUTCOMES: After completion of this course, the student should be able to

CO-1: Understand the Linux Operating system by commands and develop c programs

CO-2: Analyse the files and directories in Linux environment by developing C Applications

CO-3: Implement system programs to control the processes using signals

CO-4: Understand Inter process communication and client-server applications

CO-5: Develop programs on Network Programming

COURSE ARTICULATION MATRIX:

*(Define Correlation of Course Outcomes with Program Outcomes and Program Specific Outcomes using **mapping levels 1 = Slight, 2 = Moderate and 3 = Substantial**)*

CO	PROGRAM OUTCOMES (PO)					
	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6
CO-1	3	1	2	2	2	1
CO-2	2	-	1	1	-	-
CO-3	2	1	2	-	2	-
CO-4	2	-	-	2	2	1
CO-5	3	2	2	3	1	2

UNIT–I:

Linux Utilities: File handling utilities, Security by file permissions, Process utilities, Disk utilities, Networking utilities, Filters, Text processing utilities and Backup utilities.

Bourne again shell(bash) - Introduction, pipes and redirection, here documents, running a shell script, the shell as a programming language, shell meta characters, file name substitution, shell variables, command substitution, shell commands, the

environment, quoting, test command, control structures, arithmetic in shell, shell script examples.
Review of C programming concepts-arrays, strings (library functions), pointers, function pointers, structures, unions, libraries in C.

UNIT–II:
Files- File Concept, File types File System Structure, Inodes, File Attributes, file I/O in C using system calls, kernel support for files, file status information-stat family, file and record locking-lockf and fcntl functions, file permissions- chmod, fchmod, file ownership-chown, lchown , fchown, links-soft links and hard links – symlink, link, unlink. File and Directory management – Directory contents, Scanning Directories- Directory file APIs. Process- Process concept, Kernel support for process, process attributes, process control – process creation, replacing a process image, waiting for a process, process termination, zombie process, orphan process.

UNIT–III:
Signals- Introduction to signals, Signal generation and handling, Kernel support for signals, Signal function, unreliable signals, reliable signals, kill, raise , alarm, pause, abort, sleep functions. Interprocess Communication - Introduction to IPC mechanisms, Pipes- creation, IPC between related processes using unnamed pipes, FIFOs-creation, IPC between unrelated processes using FIFOs(Named pipes), differences between unnamed and named pipes, popen and pclose library functions, Introduction to message queues, semaphores and shared memory.
Message Queues- Kernel support for messages, UNIX system V APIs for messages, client/server example.
Semaphores-Kernel support for semaphores, UNIX system V APIs for semaphores.

UNIT–IV:
Shared Memory- Kernel support for shared memory, UNIX system V APIs for shared memory, client/server example.
Network IPC - Introduction to Unix Sockets, IPC over a network, Client-Server model, Address formats(Unix domain and Internet domain), Socket system calls for Connection Oriented - Communication, Socket system calls for Connectionless-Communication, Example-Client/Server Programs- Single Server-Client connection, Multiple simultaneous clients, Socket options – setsockopt, getsockopt, fcntl.

UNIT–V:
Network Programming in Java-Network basics, TCP sockets, UDP sockets (datagram sockets), Server programs that can handle one connection at a time and multiple connections (using multithreaded server), Remote Method Invocation (Java RMI)-Basic RMI Process, Implementation details-Client-Server Application.

TEXT BOOKS:

1. Unix System Programming using C++, T. Chan, PHI
2. Unix Concepts and Applications, Sumitabha Das, 4th Edition, TMH
3. An Introduction to Network Programming with Java, Jan Graba, Springer, 2010

REFERENCES:

1. Unix Network Programming, W. R. Stevens, PHI
2. Java Network Programming, E. R. Harold, 3rd Edition, SPD, O'Reilly
3. Linux System Programming, Robert Love, O'Reilly, SPD

4. Advanced Programming in the UNIX environment, W. R. Stevens, 2nd Edition, Pearson Education
5. UNIX for programmers and users, Graham Glass, 3rd Edition, King Ables, Pearson Education

ONLINE RESOURCES:

1. https://onlinecourses.nptel.ac.in/noc23_cs35/preview
2. http://vlabs.iitkgp.ernet.in/ant/

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

M.Tech. I Semester

(22PE1CN06) DATA SCIENCE

TEACHING SCHEME		
L	T/P	C
3	0	3

EVALUATION SCHEME				
SE	CA	ELA	SEE	TOTAL
30	5	5	60	100

COURSE OBJECTIVES:

- To build the fundamentals of data science
- To learn techniques and tools for transformation of data
- To gain knowledge of statistical data analysis techniques utilized in business decision making
- To develop design skills and understanding purpose and working of machine learning algorithms
- To impart design thinking capability to handle big data problems

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Demonstrate proficiency with statistical analysis of data
CO-2: Demonstrate skill in data management
CO-3: Build and assess data-based models
CO-4: Apply data science concepts and methods to solve problems in real-world contexts and will communicate these solutions effectively
CO-5: Develop relevant programming abilities

COURSE ARTICULATION MATRIX:
*(Define Correlation of Course Outcomes with Program Outcomes and Program Specific Outcomes using **mapping levels 1 = Slight, 2 = Moderate and 3 = Substantial**)*

CO	PROGRAM OUTCOMES (PO)					
	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6
CO-1	3	3	3	1	2	2
CO-2	3	2	2	2	2	2
CO-3	2	3	2	2	2	2
CO-4	3	3	2	2	2	2
CO-5	2	2	2	2	2	2

UNIT-I:

Introduction: Understanding relation between Artificial Intelligence, Machine learning, and Data Science; What is Data Science? - Extracting Meaningful Patterns, Building Representative Models, Combination of Statistics, Machine Learning, and Computing, Learning Algorithms, Associated Fields; Case for Data Science – Volume, Dimensions, Complex Questions; Data Science Classification; Data Science Algorithms; Data Science Tasks and Examples; Overview of Core algorithms

Data Science Process: Crisp data mining framework vs Data science process; Prior Knowledge – Objective, Subject Area, Data, Causation vs Correlation; Data Preparation, Modeling - Training and Testing Datasets, Learning Algorithms, Evaluation of the Model; Ensemble Modeling; Application

UNIT-II:

Data Exploration: Objectives of data exploration; Datasets – Types of data; Descriptive statistics – Univariate Exploration, Multivariate Exploration; Data Visualization - Univariate Visualization (Histogram, Quartile, Distribution chart), Multivariate Visualization (Scatter plot, Scatter multiple, Scatter matrix, Bubble chart, Density chart); Visualizing High dimensional data (Parallel chart, deviation chart, and Andrews curves)

Exploratory Data Analytics: Descriptive Statistics – Mean Standard Deviation, dispersion, Skewness and Kurtosis, statistical-interference-Correlation Statistics – ANOVA.

UNIT-III:

Regression Methods: Linear Regression; Multiple Linear Regression; Logistic Regression.

Classification: Decision trees; Rule Induction; k-NEAREST NEIGHBORS; Naïve Bayesian; ANN; SVM; Ensemble learners.

Clustering: Prototype-based clustering, Density clustering, Hierarchical clustering, Model-based clustering; K-MEANS CLUSTERING, Density-Based Spatial Clustering of Applications with Noise (DB SCAN)

Model Evaluation: Confusion matrix, ROC and AUC, Lift curves.

UNIT-IV:

Anomaly Detection: Concepts - Causes of outliers, Anomaly detection techniques; Distance-Based outlier detection; Density-based outlier detection; Local outlier factor.

Time Series Forecasting: Taxonomy of time Series forecasting; Time series decomposition – Classical decomposition, Implementation, Smoothing based methods, Regression based methods, Machine learning methods – Windowing, Neural network autoregressive, Performance evaluation – Validation dataset (MAE, RMSE, MAPE, MASE), Siding window validation.

UNIT-V:

Deep learning: The AI Winter - Conceptual architecture of a perceptron, how it works - Regression Models as Neural Networks, Gradient Descent, Need for Backpropagation, Classifying More Than 2 Classes: Softmax, Convolutional Neural Networks, Dense Layer, Dropout Layer, Recurrent Neural Networks, Autoencoders, Related AI Models - Reinforcement Learning (RL) and Generative adversarial network (GAN).

TEXT BOOK:

1. Data Science - Concepts and Practice, Vijay Kotu, Bala Deshpande, Data Science, 2nd Edition, Morgan Kaufmann, 2019

REFERENCES:

1. Structural Analysis, Devdas Menon, Narosa Publishers, 2018
2. Data Science from Scratch - First Principles with Python, Joel Grus, O'Reilly Media, 2015
3. Foundations of Data Science, Avrim Blum, John Hopcroft, Ravindran Kannan, Cambridge University Press, 2020
4. Big Data and Analytics, Seema Acharya, Subhashini Chellappan, Wiley, 2019

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

M.Tech. I Semester

(22PE1CP04) INFORMATION RETRIEVAL SYSTEMS

TEACHING SCHEME		
L	T/P	C
3	0	3

EVALUATION SCHEME				
SE	CA	ELA	SEE	TOTAL
30	5	5	60	100

COURSE OBJECTIVES:

- To familiarize with Boolean and vector space retrieval models, evaluation and interface issues, text index construction and scoring
- To develop intelligent systems by applying the methods such as Prediction, Forecasting, Classification, Clustering and Optimization
- To build working systems that assist users in finding useful information on the Web

COURSE OUTCOMES: After completion of the course, the student should be able to

CO-1: Understand the relationships between the Repository Systems

CO-2: Apply knowledge of data structures and indexing methods in information retrieval Systems

CO-3: Implement supervised and unsupervised algorithms on the Information systems

CO-4: Enhance the Search results applying Search techniques for better visualization to reducing the overhead of the user

CO-5: Explore the multimedia Information Retrieval to acquire the knowledge on audio, video and image data

COURSE ARTICULATION MATRIX:

*(Define Correlation of Course Outcomes with Program Outcomes and Program Specific Outcomes using **mapping levels 1 = Slight, 2 = Moderate and 3 = Substantial**)*

CO	PROGRAM OUTCOMES (PO)					
	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6
CO-1	3	2	3	2	2	2
CO-2	3	2	3	3	1	1
CO-3	2	3	3	3	2	3
CO-4	3	3	3	2	1	1
CO-5	2	2	2	1	1	1

UNIT–I:

Introduction: Definition, Objectives, Functional Overview, Relationship to DBMS, Digital libraries and Data Warehouses, Information Retrieval System Capabilities – Search, Browse, Miscellaneous.

UNIT–II:

Cataloging and Indexing: Objectives, Indexing Process, Automatic Indexing, Information Extraction Data Structures: Introduction, Stemming Algorithms, Inverted file structures, N – gram data structure, PAT data structure, Signature file structure, Hypertext data structure.

UNIT–III:

Automatic Indexing: Classes of automatic indexing, Statistical Indexing, Natural language, Concept indexing, Hypertext linkages. Document and Term Clustering: Introduction, Thesaurus generation, Item clustering, Hierarchy of clusters

Support vector machines and machine learning on documents. Flat clustering. Hierarchical clustering. Matrix decompositions and latent semantic indexing.

UNIT–IV:

User Search Techniques: Search statements and binding, Similarity measures and ranking, Relevance feedback, Selective dissemination of information search, weighted searches of Boolean Systems, Searching the Internet and hypertext Information Visualization: Introduction to Information Visualization, Cognition and Perception, Information Visualization Technologies

Text Search Algorithms: Introduction, Software text search algorithms, Hardware text search systems.

UNIT–V:

Multimedia Information Retrieval: Spoken Language Audio Retrieval, Non-Speech Audio Retrieval, Graph Retrieval, Imagery Retrieval, Video Retrieval.

Machine learning in IR, Introduction to Web search basics, Web crawling and indexes, Link analysis

TEXT BOOKS:

1. Information Storage and Retrieval Systems: Theory and Implementation, Kowalski, Gerald, Mark T. Maybury, Springer
2. Modern Information Retrieval, Ricardo Baeza – Yates, Pearson Education, 2007
3. An Introduction to Information Retrieval, Cambridge University Press, Christopherr D. Manning, Prabhakar Raghavan, Hinrich Schütze, Cambridge, England, 2009

REFERENCES:

1. Information Retrieval: Algorithms and Heuristics, David A. Grossman and Ophir Frieder, 2nd Edition, Springer
2. Information Retrieval Data Structures and Algorithms, Frakes, W. B., Ricardo Baeza Yates: Prentice Hall, 1992
3. Modern Information Retrieval, Baeza Yates & Ribeiro Neto, Pearson Education, 2010

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

M.Tech. I Semester

(22PC1CP01) DISTRIBUTED COMPUTING

TEACHING SCHEME		
L	T/P	C
3	0	3

EVALUATION SCHEME				
SE	CA	ELA	SEE	TOTAL
30	5	5	60	100

COURSE PRE-REQUISITES: Basic knowledge on basic networking concepts, Advanced Programming (Good knowledge in C and C++), Data Structures and Algorithms, Basic OS concepts (e.g., processes, threads, synchronization, file systems, scheduling etc.)

COURSE OBJECTIVES:

- To provide students with contemporary knowledge in distributed systems
- To equip students with skills to analyze and design distributed applications
- To provide master skills to measure the performance of distributed synchronization algorithms

COURSE OUTCOMES: After completion of the course, the student should be able to

CO-1: Demonstrate knowledge of the basic elements and concepts related to distributed system technologies

CO-2: Illustrate the middleware technologies that support distributed applications such as RPC, RMI and Object based middleware

CO-3: Analyze the various techniques used for clock synchronization and mutual exclusion

CO-4: Demonstrate the concepts of Resource and Process management and synchronization algorithms

CO-5: Demonstrate the concepts of Consistency and Apply the knowledge of Distributed File System to analyze various file systems like NFS, AFS and the experience in building large-scale distributed applications

COURSE ARTICULATION MATRIX:

*(Define Correlation of Course Outcomes with Program Outcomes and Program Specific Outcomes using **mapping levels 1 = Slight, 2 = Moderate and 3 = Substantial**)*

CO	PROGRAM OUTCOMES (PO)					
	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6
CO-1	2	1	2	-	1	-
CO-2	1	2	2	-	-	1
CO-3	1	2	2	-	-	-
CO-4	1	1	3	-	-	1
CO-5	1	1	2	-	1	-

UNIT–I:

Introduction to Distributed Systems:

Characterization of Distributed Systems: Issues, Goals, and Types of distributed systems, Distributed System Models, Hardware concepts, Software Concept.

Middleware: Models of Middleware, Services offered by middleware, Client Server model.

UNIT–II:

Communication: Layered Protocols, Interprocess communication (IPC): MPI, Remote Procedure Call (RPC), Remote Object Invocation, Remote Method Invocation (RMI), Message Oriented Communication, Stream Oriented Communication, Group Communication

UNIT–III:

Synchronization: Clock Synchronization, Logical Clocks, Election Algorithms, Mutual Exclusion, Distributed Mutual Exclusion-Classification of mutual Exclusion Algorithm, Requirements of Mutual Exclusion Algorithms, Performance measure.

Non-Token Based Algorithms: Lamport Algorithm, Ricart–Agrawala's Algorithm, Maekawa's Algorithm , Token Based Algorithms: Suzuki-Kasami's Broadcast Algorithms, Singhal's Heuristic Algorithm, Raymond's Tree based Algorithm, Comparative Performance Analysis.

UNIT–IV:

Resource and Process Management: Desirable Features of global Scheduling algorithm, Task assignment approach, Load balancing approach, load sharing approach, Introduction to process management, process migration, Threads, Virtualization, Clients, Servers, Code Migration

UNIT–V:

Consistency Models and Distributed File system: Datacentric and Client, Centric Consistency Models, Replica Management

Distributed File Systems: Caching Schemes, File Introduction and features of DFS, File models, File Accessing models, File Replication, Case Study: Distributed File Systems (DFS), Network File System (NFS), Andrew File System (AFS)

TEXT BOOKS:

1. Distributed Systems: Principles and Paradigms, Andrew S. Tanenbaum and Maarten Van Steen, 2nd Edition, Pearson Education
2. Distributed Systems: Concepts and Design, George Coulouris, Jean Dollimore, Tim Kindberg, 4th Edition, Pearson Education, 2005

REFERENCES:

1. Distributed Systems: Principles and Paradigms, A. S. Tanenbaum and M. V. Steen, Second Edition, Prentice Hall, 2006
2. Distributed Computing Principles and ApplicationsⅡ, M. L. Liu, Pearson Addison Wesley, 2004

ONLINE RESOURCES:

1. https://nptel.ac.in/courses/106106107
2. https://onlinecourses.nptel.ac.in/noc21_cs87/preview

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

M.Tech. I Semester

(22PE1SE04) FORMAL METHODS IN SOFTWARE ENGINEERING

TEACHING SCHEME		
L	T/P	C
3	0	3

EVALUATION SCHEME				
SE	CA	ELA	SEE	TOTAL
30	5	5	60	100

COURSE PRE-REQUISITES: Basic knowledge on Software Engineering

COURSE OBJECTIVES:

- To develop an appreciation of the strengths of formal methods for engineering secure software systems
- To build up a solid background for the application of formal methods to various tasks of the Software development process using Z
- To gain a basic level of competence in using formal methods to model software systems and verify software system properties
- To construct formal methods of software engineering through Z

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Understand the role of formal methods in Software engineering and glimpse of Z
CO-2: Develop Schemas and Schema Calculus for an application using Z
CO-3: Apply formal methods to system applications through Z
CO-4: Evaluate features of Z and build methods in construction of Software systems
CO-5: Understand the Refinement strategies to explore Formal Semantics and Tools

COURSE ARTICULATION MATRIX:
*(Define Correlation of Course Outcomes with Program Outcomes and Program Specific Outcomes using **mapping levels 1 = Slight, 2 = Moderate and 3 = Substantial**)*

CO	PROGRAM OUTCOMES (PO)					
	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6
CO-1	2	3	2	3	2	1
CO-2	2	2	2	3	3	2
CO-3	2	2	3	2	3	2
CO-4	2	3	3	2	3	2
CO-5	2	3	3	2	3	2

UNIT-I:
Foundations of Z: Understanding formal methods – motivation for formal methods – informal requirements to Formal specifications – validating formal specifications – Overview of Z specification – basic Elements of Z – sets and types – declarations – variables – expressions – operators – Predicates and equations.

UNIT-II:
Structures in Z: Tuples and records – relations, tables, databases – pairs and binary relations – functions –Sequences – propositional logic in Z – predicate logic in Z – Z and

Boolean types – set Comprehension – lambda calculus in Z – simple formal specifications – modeling systems and Change.

UNIT-III:

Z Schemas and Schema Calculus: Z schemas – schema calculus – schema conjunction and disjunction – other schema calculus Operators – schema types and bindings – generic definitions – free types – formal reasoning Checking specifications – precondition calculation– machine-checked proofs.

UNIT-IV:

Z Case Studies: Case Study: Text processing system – Case Study: Eight Queens – Case Study: Graphical User Interface – Case Study: Safety critical protection system – Case Study: Concurrency and Real time systems.

Z Refinement: Refinement of Z specification – generalizing refinements – refinement strategies

UNIT-V:

Refinement Strategies: program Derivation and verification – refinement calculus – data structures – state schemas – functions and relations – operation schemas – schema expressions – refinement case study.

Formal Semantics and Tools: Operational Semantics – Denotation Semantics – Axiomatic Semantics Proof Editors – Proof Analyser – Symbolic Simulators.

TEXTBOKS:

1. The Way of Z: Practical Programming with Formal Methods, Jonathan Jacky, Cambridge University Press, 1996.
2. Z: An introduction to Formal Methods, Antony Diller, 2nd Edition, Wiley, 1994.

REFERENCES:

1. Using Z – Specification, Refinement, and Proof, Jim Woodcock and Jim Davies, Prentice Hall, 1996
2. The Z Notation: A Reference Manual, J. M. Spivey, 2nd Edition, Prentice Hall, 1992
3. Mathematical Logic for Computer Science, M. Ben-Ari, 2nd Edition, Springer, 2003
4. Logic in Computer Science – Modelling and Reasoning about Systems, M. Huth and M. Ryan, 2nd Edition, Cambridge University Press, 2004

ONLINE RESOURCES:

1. https://archive.nptel.ac.in/courses/106/101/106101061/
2. https://nptel.ac.in/courses/106105087

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

M.Tech. I Semester

(22PE1CP06) SCRIPTING LANGUAGES

TEACHING SCHEME		
L	T/P	C
3	0	3

EVALUATION SCHEME				
SE	CA	ELA	SEE	TOTAL
30	5	5	60	100

COURSE PRE-REQUISITES:
- Knowledge of HTML5, CSS3, PHP, SQL, Bootstrap5, and MySQL
- Have the XAMP server installed on your PC

COURSE OBJECTIVES:
- To appreciate the nature of scripting and the role of scripting languages
- To design and implement Perl and Python software solutions that accommodate specified requirements and constraints
- To evaluate modern, representative programming languages critically
- To design and implement PHP and MySQL software solutions that accommodate specified requirements and constraints, based on analysis or modelling or requirements specification

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Understand the differences between typical scripting languages and traditional programming languages
CO-2: Illustrate the concept of Data Structure Arrays used in PHP for effective programming
CO-3: Apply the syntax and semantics of languages using PHP and MySQL for effective scripting
CO-4: Develop Web applications for businesses platforms
CO-5: Propose the appropriate software solutions using Scripting Languages, PHP and MySQL

COURSE ARTICULATION MATRIX:
*(Define Correlation of Course Outcomes with Program Outcomes and Program Specific Outcomes using **mapping levels 1 = Slight, 2 = Moderate and 3 = Substantial**)*

CO	PROGRAM OUTCOMES (PO)					
	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6
CO-1	3	2	3	2	2	3
CO-2	3	3	3	2	2	2
CO-3	3	3	3	3	3	3
CO-4	3	2	3	3	3	3
CO-5	3	3	3	3	3	3

UNIT-I:
Scripts & Programs: Origin of Scripting, Characteristics of scripting languages. PHP Basics- Features, Embedding PHP Code in Web pages, Outputting the data to the browser, Data types, Variables, Constants, expressions, string interpolation, control structures, Function, Creating a Function, Function Libraries.

UNIT-II:
PHP Arrays: Creating an Array, Adding and Removing Array Elements, Locating Array Elements, Traversing Arrays, Determining Array Size and Uniqueness, Sorting Arrays. Strings and Regular Expressions.

UNIT-III:
PHP and Web Forms: Files, PHP authentication methodologies- Hard-coded, File-Based, Database based and IP based. Uploading Files with PHP, Sending Email using PHP, PHP's Encryption Functions, the MCrypt package.

UNIT-IV:
Introducing MySQL: What Makes MySQL so popular, The Evaluation of MySQL, Installing and Configuring MySQL, MySQL Storage Engines and Data types: Storage Engines, Data types and Attributes, Working with Databases and Tables, Securing MySQL.

UNIT-V:
PHP with MySQL: Handling Installation Prerequisites, Using the mysqli Extension, Interacting with the Database, Executing Database Transactions. MySQL Triggers, MySQL Views, Indexes and Searching: Database Indexing, Form – Based Searches.

TEXT BOOKS:
1. Beginning PHP and MySQL, Jason Gilmore, 3rd Edition, Dreamtech
2. The World of Scripting Languages, David Barren, Wiley Publications

REFERENCES:
1. Open Source Web Development with LAMP using Linux, Apache, MySQL, Perl and PHP, J. Lee and B. Ware, Pearson Education/Addison Wesley
2. Programming Python, M. Lutz, SPD
3. PHP 6 Fast and Easy Web Development, Julie Meloni and Matt Telles, Cengage Learning
4. Core Python Programming, Chun, Pearson Education

ONLINE RESOURCES:
1. XAMPP in Windows - English – YouTube
2. https://www.w3schools.com/php/php_mysql_intro.asp
3. https://www.tutorialspoint.com/php/php_and_mysql.htm

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

M.Tech. I Semester

(22PE1SE05) DIGITAL FORENSICS

TEACHING SCHEME		
L	T/P	C
3	0	3

EVALUATION SCHEME				
SE	CA	ELA	SEE	TOTAL
30	5	5	60	100

COURSE PRE-REQUISITES: Minimal concept of Computer Networks, Cybercrime and Information Warfare, Computer Networks, Different types of algorithms used in Network Security & Cryptography, Cyber Security, minimal knowledge of Information Security Management

COURSE OBJECTIVES:

- To provide an in-depth study of the rapidly changing and fascinating field of computer forensics
- To Combine both the technical expertise and the knowledge required to investigate, detect and prevent digital crimes
- To introduce the Knowledge on digital forensics legislations, digital crime, forensics processes and procedures, data acquisition and validation, e-discovery tools
- To Identify the E-evidence collection and preservation, investigating operating systems and file systems, network forensics, art of steganography and mobile device forensics
- To learn the legal Issues of digital forensics

COURSE OUTCOMES: After completion of the course, the student should be able to

CO-1: Understand relevant legislation and codes of ethics

CO-2: Analyze computer forensics and digital detective and various processes, policies and procedures

CO-3: Demonstrate the knowledge of E-discovery, E-evidence, tools and environment for cyber crime analysis

CO-4: Employ the appropriate computer, network, mobile & digital forensics tools and techniques

CO-5: Understand the legal Issues of digital forensics

COURSE ARTICULATION MATRIX:

*(Define Correlation of Course Outcomes with Program Outcomes and Program Specific Outcomes using **mapping levels 1 = Slight, 2 = Moderate and 3 = Substantial**)*

CO	PROGRAM OUTCOMES (PO)					
	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6
CO-1	3	3	2	1	2	2
CO-2	3	3	2	2	2	2
CO-3	3	3	2	2	2	3
CO-4	3	3	2	1	2	2
CO-5	3	2	1	2	1	2

UNIT–I:
Digital Forensics Science: Forensics science, computer forensics, and digital forensics. Computer Crime: Criminalistics as it relates to the investigative process, analysis of cyber criminalistics area, holistic approach to cyber-forensics

UNIT–II:
Cyber Crime Scene Analysis: Discuss the various court orders etc., methods to search and seizure electronic evidence, retrieved and un-retrieved communications, Discuss the importance of understanding what court documents would be required for a criminal investigation.

UNIT–III:
Evidence Management & Presentation: Create and manage shared folders using operating system, importance of the forensic mindset, define the workload of law enforcement, Explain what the normal case would look like, Define who should be notified of a crime, parts of gathering evidence, Define and apply probable cause.

UNIT–IV:
Computer Forensics: Prepare a case, Begin an investigation, Understand computer forensics workstations and software, Conduct an investigation, Complete a case, Critique a case, Network Forensics: open-source security tools for network forensic analysis, requirements for preservation of network data.

UNIT–V:
Mobile Forensics: mobile forensics techniques, mobile forensics tools. Legal Aspects of Digital Forensics: IT Act 2000, amendment of IT Act 2008. Recent trends in mobile forensic technique and methods to search and seizure electronic evidence

TEXT BOOKS:
1. The Basics of Digital Forensics, John Sammons, Elsevier
2. Computer Forensics: Computer Crime Scene Investigation, John Vacca, Laxmi Publications

REFERENCES:
1. Learn Computer Forensics: A Beginner's Guide to Searching, Analyzing, and Securing Digital Evidence, William Oettinger, 1st Edition, Packt Publishing, 2020
2. Cybercrime and Digital Forensics: An Introduction, Thomas J. Holt, Adam M. Bossler, Kathryn C. Seigfried-Spellar, Routledge

ONLINE RESOURCES:
1. https://onlinecourses.swayam2.ac.in/cec20_lb06/preview
2. https://www.edx.org/learn/computer-forensics
3. Learn Digital Forensics Course Online or In-Person: Identify, Track and Prosecute the Cyber Criminal (hackerschool.in)
4. https://www.udemy.com/topic/digital-forensics/

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

M.Tech. I Semester

(22PC2SE01) SOFTWARE TESTING AND CASE TOOLS LABORATORY

TEACHING SCHEME		
L	T/P	C
0	2	1

EVALUATION SCHEME					
D-D	PE	LR	CP	SEE	TOTAL
10	10	10	10	60	100

COURSE PRE-REQUISITES: Basic knowledge on Programming, Algorithms

COURSE OBJECTIVES:

- To define the process of test documentation
- To identify the usage of automated testing tools
- To understand different software testing tools and their features
- To implement automated testing tools
- To apply test cases for a software project using different testing and tracking tools

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Generate various test documents
CO-2: Understand and analyze different testing tools and their mechanisms
CO-3: Identify and apply appropriate automated testing tool
CO-4: Analyze different testing tools like Selenium, Unified Functional Testing and Bugzilla for web testing and bug tracking
CO-5: Apply testing tools techniques on project applications

COURSE ARTICULATION MATRIX:
*(Define Correlation of Course Outcomes with Program Outcomes and Program Specific Outcomes using **mapping levels 1 = Slight, 2 = Moderate and 3 = Substantial**)*

CO	PROGRAM OUTCOMES (PO)					
	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6
CO-1	3	3	3	2	2	2
CO-2	3	3	3	2	2	2
CO-3	3	2	3	3	3	2
CO-4	3	3	3	3	3	3
CO-5	3	3	3	3	3	3

LIST OF PROGRAMS / EXPERIMENTS / EXERCISES:

1. Take any system (e.g. ATM system) and study its system specifications and report the various bugs
2. Write the test cases for any known application (e.g. Banking application)
3. Create a test plan document for any application (e.g. Library Management System)
4. Study of any testing tool (e.g. QTP/UFT)
5. Study of any web testing tool (e.g. Selenium)
6. Study of any bug tracking tool (e.g. Bugzilla)
7. Study of any test management tool (e.g. Quality Centre/ALM)

8. Take a mini project (e.g. University admission, Placement Portal) and execute it. During the Life cycle of the mini project create the various testing documents* and final test report document.

TEXT BOOKS:

1. The Art of Software Testing, Glenford Myers et al., 2nd Edition, 2004
2. Test Automation Using HP Unified Functional Testing - Explore Latest Version of Qtp, Garg, M. R. Navneesh

REFERENCES:

1. How to Break Software: A Practical Guide to Testing, James Whittaker, 2002
2. Effective Methods for Software Testing, William E. Perry, 3rd Edition, 2006
3. Software Automation Testing Tools for Beginners, Rahul Shedye
4. A Practitioner's Guide to Software Test Design, Lee Copeland, 2003

ONLINE RESOURCES:

1. https://onlinecourses.nptel.ac.in/noc20_cs19/preview
2. https://www.udemy.com/courses/development/software-testing/

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

M.Tech. I Semester

(22PC2CP01) ADVANCED PROBLEM SOLVING LABORATORY

TEACHING SCHEME		
L	T/P	C
0	2	1

EVALUATION SCHEME					
D-D	PE	LR	CP	SEE	TOTAL
10	10	10	10	60	100

COURSE PRE-REQUISITES: Basic knowledge on Algorithm Design and Analysis

COURSE OBJECTIVES:

- To familiarize with the advanced methods of designing and analysing algorithms
- To choose appropriate algorithms and use it for a specific problem
- To train basic paradigms and data structures used to solve advanced algorithmic problems
- To understand different classes of problems concerning their computation difficulties

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Analyze the complexity/performance of different classes of problems
CO-2: Identify appropriate data structure and algorithms design technique and use it for a specific problem solving
CO-3: Design efficient algorithms for solving the problems
CO-4: Implement the different advanced problem solving algorithms
CO-5: Apply advanced problem-solving skills in various domains

COURSE ARTICULATION MATRIX:
*(Define Correlation of Course Outcomes with Program Outcomes and Program Specific Outcomes using **mapping levels 1 = Slight, 2 = Moderate and 3 = Substantial**)*

CO	PROGRAM OUTCOMES (PO)					
	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6
CO-1	3	2	3	2	2	1
CO-2	3	2	3	3	2	1
CO-3	3	2	3	3	3	2
CO-4	3	2	3	3	3	2
CO-5	3	2	3	3	3	2

LIST OF PROGRAMS:

1. Write a program to implement Linear Probing and Separate Chaining.
2. Write a program to implement Min/Max Heap.
3. Write a program to implement Fibonacci Heap.
4. Write a program to implement AVL tree, Red-Blac tree operations.
5. Write a program to implement Boyer-Moore and KMP pattern matching algorithm.
6. Write a program to implement LCS algorithm.
7. Write a program to implement Topological sorting.
8. Write a program to compute shortest path by BFS.
9. Write a program to implement Dijkasra's Algorithm.

10. Write a program to implement Bellman-Ford Algorithm
11. Write a program to implements Ford-Fulkerson algorithm to compute maximum flow.
12. Write a program to implement strassen's algorithm.
13. Write a program to implement LUP-decomposition of a matrix.
14. Write a program to implement Floyd-Warshall Algorithm.
15. Write a program to implement Polynomial addition and multiplication.
16. Write a program to implement Simplex algorithm.

TEXT BOOKS:

1. Data Structures and Algorithm Analysis in C++, Mark Allen Weiss, 2nd Edition, Pearson, 2004
2. Introduction to Algorithms, Cormen, Leiserson, Rivest, Stein

REFERENCES:

1. Fundamentals of Computer Algorithms, E Horrowitz, S. salmi, S. Rajasekaran, 2nd Edition, University Press, 2007
2. Algorithm Design – Foundations, Analysis, and Internet Algorithms, M. T. Goodrich, R. Tomassia, John Wiley & Sons, 2002

ONLINE RESOURCES:

1. http://cs161.stanford.edu
2. https://www.ics.uci.edu/~eppstein/161/960312.html
3. https://www.cmi.ac.in/~madhavan/teaching.html

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

M.Tech. I Semester

(22SD5HS01) COMMUNICATION SKILLS FOR ACADEMIC AND RESEARCH WRITING

TEACHING SCHEME		
L	T/P	C
0	2	1

EVALUATION SCHEME					
D-D	PE	LR	CP	SEE	TOTAL
10	10	10	10	60	100

COURSE OBJECTIVES:

- To equip the students with an understanding of the mechanics and conventions of academic and research writing including cohesion and coherence to produce texts that demonstrate precision and clarity
- To enable students to present focused, logical arguments that support a thesis
- To empower the students to find, analyze, evaluate, summarize and synthesize appropriate source material for literature review
- To enable students to use appropriate language to analyze and interpret the data, and prepare an outline
- To enable students to become adept in the requirements and specifications of standard writing to produce academic and research papers

COURSE OUTCOMES: After completion of the course, the student should be able to

CO-1: Apply knowledge of academic language features, and text structure and ensure cohesion and coherence as connected to various text types

CO-2: Demonstrate the use of writing process strategies through outlining, reviewing, composing, and revising

CO-3: Evaluate sources and use summary, analysis, synthesis, and integration to construct a literature review on a topic chosen by the student

CO-4: Prepare an outline for Research Articles and Thesis

CO-5: Apply standard documentation style to produce academic and research papers that meet the demands of specific genres, purposes, and audiences

COURSE ARTICULATION MATRIX:

*(Define Correlation of Course Outcomes with Program Outcomes and Program Specific Outcomes using **mapping levels 1 = Slight, 2 = Moderate and 3 = Substantial**)*

CO	PROGRAM OUTCOMES (PO)					
	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6
CO-1	3	3	2	1	1	2
CO-2	3	3	3	2	1	2
CO-3	2	3	2	2	1	2
CO-4	2	3	2	1	1	2
CO-5	3	3	3	3	1	3

UNIT-I:

a) Factors Influencing Effective Writing: Mechanics of Writing, Purpose of Writing, Audience/reader, Organisation- Cohesion, and Coherence

b) Features of Academic Writing: Introduction, Complexity, Formality, Precision, Objectivity, Explicitness, Accuracy and Appropriacy, Relevance, Hedging

UNIT-II:

1. Academic Writing Forms:

a) Analysing arguments; Building an argument
b) Making a Counter Argument- Managing tone, and tenor

2. Types of Research: Primary and Secondary Research;
3. Research Design: Statement of the Problem, Survey of relevant literature, Writing Hypotheses, Developing Objectives; Research Tools

UNIT-III:

a) Criteria of Good Research- Avoiding Plagiarism
b) Data Interpretation
c) Preparing an outline for Research Articles & Research Reports

UNIT-IV:

a) Reference Skills -Paraphrasing (Change of parts of speech, word order, synonyms, using the passive form), -Summarizing (Steps in summarising)
b) Documentation Format: APA style
c) Documentation Format: MLA style

UNIT-V:

a) Writing Article Reviews
b) Report Writing: a) Writing Technical Reports b) Writing Proposals

TEXT BOOKS:

1. A Course in Academic Writing, Gupta R., Orient Black Swan, 2010
2. Academic Writing: Exploring Processes and Strategies, Leki I., CUP, 1998
3. Writing-up Research: Experimental Research Report Writing for Students of English, Weissberg R., & Buker S., Englewood Cliffs, Prentice Hall, 1990

REFERENCES:

1. English Academic Writing for Students and Researchers. Yakhontova T., 2003
2. Inside Track: Successful Academic Writing, Gillett A., Hammond A., Martala M., Pearson Education, 2009
3. English for Academic Research: Writing Exercises, Wallwork, Springer, 2013
4. The MLA Handbook for Writers of Research Papers, 7th Edition, Modern Language Association
5. Academic Writing for Graduate Students: A Course for Non-native Speakers of English, Swales J. M., & Feak C. B., University of Michigan Press, 1994

ONLINE RESOURCES:

1. https://www.coventry.ac.uk/study-at-coventry/student-support/academic-support/centre-for-academic-writing/support-for-students/academic-writing-resources/
2. https://www.biz-e-training.com/resources-for-learners/academic-writing-online-resources/

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

M.Tech. I Semester

(22MN6HS01) REASEARCH METHODOLOGY AND IPR

TEACHING SCHEME		
L	T/P	C
2	0	0

EVALUATION SCHEME			
SE-I	SE-II	SEE	TOTAL
50	50	-	100

COURSE OBJECTIVES:

- To understand the research problem
- To know the literature studies, plagiarism and ethics
- To get the knowledge about technical writing
- To analyze the nature of intellectual property rights and new developments
- To know the patent rights

COURSE OUTCOMES: After completion of the course, the student should be able to

CO-1: Understand research problem formulation

CO-2: Analyze research related information & follow research ethics

CO-3: Understand that today's world is controlled by Computer, Information Technology, but tomorrow world will be ruled by ideas, concept, and creativity

CO-4: Understanding that when IPR would take such important place in growth of individuals & nation, it is needless to emphasis the need of information about Intellectual Property Right to be promoted among students in general & engineering in particular

CO-5: Understand that IPR protection provides an incentive to inventors for further research work and investment in R & D, which leads to creation of new and better products, and in turn brings about, economic growth and social benefits

COURSE ARTICULATION MATRIX:

*(Define Correlation of Course Outcomes with Program Outcomes and Program Specific Outcomes using **mapping levels 1 = Slight, 2 = Moderate and 3 = Substantial**)*

CO	PROGRAM OUTCOMES (PO)					
	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6
CO-1	3	3	2	1	2	1
CO-2	3	3	2	2	2	2
CO-3	3	3	2	1	2	2
CO-4	3	3	2	1	2	2
CO-5	3	3	2	1	2	1

UNIT–I:

Meaning of research problem, Sources of research problem, Criteria Characteristics of a good research problem, Errors in selecting a research problem, Scope and objectives of research problem.

Approaches of investigation of solutions for research problem, data collection, analysis, interpretation, Necessary instrumentations

UNIT–II:

Effective literature studies approaches, analysis, Plagiarism, Research ethics

UNIT–III:
Effective technical writing, how to write report, Paper Developing a Research Proposal, Format of research proposal, a presentation and assessment by a review committee

UNIT–IV:
Nature of Intellectual Property: Patents, Designs, Trade and Copyright. Process of Patenting and Development: technological research, innovation, patenting, development. International Scenario: International cooperation on Intellectual Property. Procedure for grants of patents, Patenting under PCT.

UNIT–V:
Patent Rights: Scope of Patent Rights. Licensing and transfer of technology. Patent information and databases. Geographical Indications. New Developments in IPR: Administration of Patent System.
New developments in IPR; IPR of Biological Systems, Computer Software etc. Traditional knowledge Case Studies, IPR and IITs

TEXT BOOKS:

1. Research Methodology: An Introduction for Science & Engineering Students, Stuart Melville and Wayne Goddard
2. Research Methodology: An Introduction, Wayne Goddard and Stuart Melville
3. Research Methodology: A Step by Step Guide for beginners, Ranjit Kumar, 2nd Edition

REFERENCES:

1. Resisting Intellectual Property, Halbert, Taylor & Francis Ltd., 2007
2. Industrial Design, Mayall, McGraw Hill, 1992
3. Product Design, Niebel, McGraw Hill, 1974
4. Intellectual Property in New Technological Age, Robert P. Merges, Peter S. Menell, Mark A. Lemley, 2016
5. Intellectual Property Rights Under WTO, T. Ramappa, S. Chand, 2008

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

M.Tech. II Semester

(22PC1SE02) SOFTWARE REQUIREMENTS AND ESTIMATION

TEACHING SCHEME		
L	T/P	C
3	0	3

EVALUATION SCHEME				
SE	CA	ELA	SEE	TOTAL
30	5	5	60	100

COURSE PRE-REQUISITES: Basic knowledge on Software Engineering

COURSE OBJECTIVES:
- To learn the concepts of software requirements and management process
- To understand the stages of requirements engineering
- To know the techniques used for requirements development and modeling
- To study and analyze the estimation methods

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Identify and classify the software requirements
CO-2: Select appropriate elicitation techniques for a software system
CO-3: Develop software requirement models
CO-4: Understand Estimation methods
CO-5: Estimate the software development cost

COURSE ARTICULATION MATRIX:
*(Define Correlation of Course Outcomes with Program Outcomes and Program Specific Outcomes using **mapping levels 1 = Slight, 2 = Moderate and 3 = Substantial**)*

CO	PROGRAM OUTCOMES (PO)					
	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6
CO-1	3	2	-	2	3	3
CO-2	3	2	2	1	-	2
CO-3	2	1	1	2	3	1
CO-4	3	-	-	-	3	2
CO-5	3	3	3	2	2	2

UNIT-I:
Software Requirements: What and Why: Essentials of Software requirement Good practices for requirements engineering, Improving requirements processes, Software requirements and risk management.

UNIT-II:
Software Requirements Engineering: Requirements elicitation, requirements analysis documentation, review, elicitation techniques, analysis models, Software quality attributes, risk reduction through prototyping, setting requirements priorities, verifying requirements quality.
Software Requirements Modeling: Use Case Modeling, Analysis Models, Dataflow diagram, state transition diagram, class diagrams, Object analysis.

UNIT-III:

Software Requirements Management: Requirements management Principles and practices, Requirements attributes, Change Management Process, Requirements Traceability Matrix.

Requirements Management Tools: Benefits of using a requirements management tool, commercial requirements management tool, Rational Requisite pro, Caliber – RM.

UNIT-IV:

Software Estimation: Components of Software Estimations, Estimation methods, Problems associated with estimation, Key project factors that influence estimation.

Size Estimation: Two views of sizing, Function Point Analysis, Mark II FPA, Full Function Points, LOC Estimation.

UNIT-V:

Effort, Schedule and Cost Estimation: Productivity, Estimation Factors, Approaches to Effort and Schedule Estimation, COCOMO II.

Software Estimation Tools: Desirable features in Software estimation tools, IFPUG, SLIM (Software Life Cycle Management) Tools.

TEXT BOOKS:

1. Software Requirements, Karl E. Weigers, Microsoft Press
2. Software Requirements and Estimation, Rajesh Naik and Swapna Kishore, Tata McGraw Hill

REFERENCES:

1. Managing Software Requirements, Dean Leffingwell & Don Widrig, Pearson Education, 2003
2. Mastering the Requirements Process, Suzanne Robertson & James Robertson, Second Edition, Pearson Education, 2006
3. Estimating Software Costs, Capers Jones, 2nd Edition, Tata McGraw Hill, 2007
4. Practical Software Estimation, M.A. Parthasarathy, Pearson Education, 2007
5. Measuring the Software Process, William A. Florac & Anita D. Carleton, Pearson Education, 1999

ONLINE RESOURCES:

1. https://nptel.ac.in/courses/106105218
2. https://www.udemy.com/course/estimates-in-agile-software-development/
3. https://www.udemy.com/course/estimating-and-costing/

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

M.Tech. II Semester

(22PC1CP04) CRYPTOGRAPHY AND NETWORK SECURITY

TEACHING SCHEME		
L	T/P	C
3	0	3

EVALUATION SCHEME				
SE	CA	ELA	SEE	TOTAL
30	5	5	60	100

COUSE PRE-REQUISITES: Basic knowledge on Computer Networks, Mathematics

COURSE OBJECTIVES:

- To understand the fundamentals of cryptography
- To understand various key distribution and management schemes
- To understand how to deploy encryption techniques to secure data in transit across data networks
- To apply algorithms used for secure transactions in real world applications

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Understand the basic concepts of cryptography, network security
CO-2: Apply the concepts of public key cryptography and key management
CO-3: Familiarize with the concepts of authentication and email security
CO-4: Understand IP and web security concepts and mechanisms
CO-5: Identify and investigate vulnerabilities, viruses and security threats and mechanisms to counter them

COURSE ARTICULATION MATRIX:
*(Define Correlation of Course Outcomes with Program Outcomes and Program Specific Outcomes using **mapping levels 1 = Slight, 2 = Moderate and 3 = Substantial**)*

CO	PROGRAM OUTCOMES (PO)					
	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6
CO-1	3	1	3	3	3	3
CO-2	3	1	3	3	2	2
CO-3	3	2	2	3	3	3
CO-4	2	1	3	2	3	2
CO-5	3	2	3	2	3	3

UNIT–I:
Security Attacks, Security Services and Mechanisms, A model for Internetwork security. Classical Encryption Techniques, DES, Strength of DES, Differential and Linear Cryptanalysis, Block Cipher Design Principles and Modes of operation, RC4, Blowfish, Placement of Encryption Function, Traffic Confidentiality.

UNIT–II:
Public key Cryptography Principles, RSA algorithm, Key Management, Diffie-Hellman Key Exchange, Elliptic Curve Cryptography. Message authentication and Hash Functions, Authentication Requirements and Functions, Message Authentication, Hash Functions and MACs Hash and MAC Algorithms SHA-512, HMAC.

UNIT–III:
Digital Signatures, Authentication Protocols, Digital signature Standard, Authentication Applications, Kerberos, X.509 Directory Authentication Service. Email Security: Pretty Good Privacy (PGP) and S/MIME.

UNIT–IV:
IP Security: Overview, IP Security Architecture, Authentication Header, Encapsulating Security Payload, Combining Security Associations and Key Management.
Web Security: Web Security Requirements, Secure Socket Layer (SSL) and Transport Layer Security (TLS), Secure Electronic Transaction (SET).

UNIT–V:
Intruders, Viruses and Worms Intruders, Viruses and related threats Firewalls: Firewall Design Principles, Trusted Systems, Intrusion Detection Systems.

TEXT BOOK:
1. Cryptography and Network Security (Principles and Approaches), William Stallings, 4th Edition, Pearson Education

REFERENCES:
1. Network Security Essentials (Applications and Standards), William Stallings, Pearson Education
2. Principles of Information Security, Whitman, Thomson

ONLINE RESOURCES:
1. https://www.mooclab.club/tags/network-security/
2. https://in.coursera.org/lecture/managing-network-cybersecurity/cryptography-and-network-security-w9SuJ

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

M.Tech. II Semester

(22PC1CP06) BIG DATA ANALYTICS

TEACHING SCHEME		
L	T/P	C
3	0	3

EVALUATION SCHEME				
SE	CA	ELA	SEE	TOTAL
30	5	5	60	100

COURSE PRE-REQUISITES: Basic knowledge on Data Analytics, Statistical Analysis

COURSE OBJECTIVES:
- To explore the fundamental concepts of big data analytics
- To learn to analyze the data analysis techniques
- To explore the techniques related to mining streams
- To understand, explore big data technology and its associated database techniques

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Work with big data platform and analyze the big data analytic techniques for useful business applications
CO-2: Design efficient algorithms for mining the data from large volumes
CO-3: Learn to use various techniques for mining data stream
CO-4: Analyze the Hadoop and Map Reduce technologies and related database techniques associated with big data analytics
CO-5: Explore Hadoop framework & visualization Techniques

COURSE ARTICULATION MATRIX:
*(Define Correlation of Course Outcomes with Program Outcomes and Program Specific Outcomes using **mapping levels 1 = Slight, 2 = Moderate and 3 = Substantial**)*

CO	PROGRAM OUTCOMES (PO)					
	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6
CO-1	3	2	3	2	3	2
CO-2	3	2	3	2	3	2
CO-3	3	2	3	2	3	2
CO-4	2	2	3	2	3	2
CO-5	2	2	3	2	3	2

UNIT-I:
Big Data and Data Analysis: Introduction to Big Data Platform, Challenges of Conventional Systems, Web Data, Evolution of Analytic Scalability, Analytic Processes and Tools, Analysis vs Reporting, Modern Data Analytic Tools. Statistical Concepts: Sampling Distributions, Re- Sampling, Statistical Inference - Prediction Error, Regression Modelling, Multivariate Analysis.

UNIT-II:
Classification and Clustering:
Classification: Rule Based Classifier, Nearest neighbour classifiers, Artificial Neural Network, Support Vector Machine.

Cluster Analysis: Overview, K-Means, Agglomerative, Hierarchical Clustering, Prototype based clustering.

UNIT-III:

Mining Data Streams: Introduction to Streams Concepts, Stream Data Model and Architecture, Stream Computing, Sampling Data in a Stream, Filtering Streams.
Mining Frequent Item Sets: Mining Frequent Item-sets, Market Based Model, A-Priori Algorithm, Handling Large Data Sets in Main Memory, Limited Pass Algorithms, Counting Frequent Item- sets in a Stream.

UNIT-IV:

Hadoop: Meet Hadoop, Comparison with other systems, A brief history of Hadoop and the Hadoop ecosystem, Hadoop Distributed File System, Components of Hadoop, Analyzing the Data with Hadoop, Scaling Out- Hadoop Streaming- Design of HDFS-Java interfaces to HDFS Basics- Developing a Map Reduce Application-How Map Reduce Works-Anatomy of a Map Reduce Job run-Failures-Job Scheduling-Shuffle and Sort – Task execution - Map Reduce Types and Formats- Map Reduce Features

UNIT-V:

Frameworks and Visualization: Applications on Big Data Using Pig and Hive – Data processing operators in Pig – Hive services –HiveQL – Querying Data in Hive - fundamentals of HBase and ZooKeeper.

TEXT BOOKS:

1. Taming the Big Data Tidal Wave: Finding Opportunities in Huge Data Stream with Advanced Analytics, Bill Franks, John Wiley & Sons, 2012
2. Introduction to Data Mining, Pang-Ning Tan, Vipin Kumar Michael Steinbach, Pearson
3. Mining of Massive Datasets, Anand Rajaraman and Jeffrey David Ullman, Cambridge University Press, 2012

REFERENCES:

1. Making Sense of Data, Glenn J. Myatt, John Wiley & Sons, 2007
2. Big Data Glossary, Pete Warden, O'Reilly, 2011
3. Data Mining Concepts and Techniques, Jiawei Han, Micheline Kamber, 2nd Edition, Elsevier, Reprinted 2008
4. Hadoop: The Definitive Guide, Tom White, 3rd Edition, O'Reilly Media, 2012

ONLINE RESOURCES:

1. https://nptel.ac.in/courses/106104189
2. Data Engineering Certification Courses Online - Purdue University Program (simplilearn.com)
3. Learn Big Data with Online Courses, Classes, & Lessons | edX

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

M.Tech. II Semester

(22PE1CP09) CLOUD COMPUTING

TEACHING SCHEME		
L	T/P	C
3	0	3

EVALUATION SCHEME				
SE	CA	ELA	SEE	TOTAL
30	5	5	60	100

COURSE PRE-REQUISITES: Basic knowledge on Computer Systems, Programming

COURSE OBJECTIVES:

- To understand cloud computing paradigm, recognize its various forms
- To get a clear understanding of cloud computing fundamentals and its importance to various organizations
- To master the concepts of IaaS, PaaS, SaaS, public and private clouds
- To understand the security issues and storage mechanism for the cloud

COURSE OUTCOMES: After completion of the course, the student should be able to

CO-1: Articulate the main concepts of distributed system models, key technologies, need of virtualization of clusters, data centres

CO-2: Identify the architecture and infrastructure of cloud computing, including SaaS, PaaS, IaaS, different types of cloud

CO-3: Explain the core issues of cloud computing such as security, privacy, and interoperability, understanding the cloud services and the workflow of the cloud

CO-4: Articulate the scientific applications and SLA management in cloud computing

CO-5: Identifying the legal issues of cloud computing and organizational readiness in the cloud

COURSE ARTICULATION MATRIX:

*(Define Correlation of Course Outcomes with Program Outcomes and Program Specific Outcomes using **mapping levels 1 = Slight, 2 = Moderate and 3 = Substantial**)*

CO	PROGRAM OUTCOMES (PO)					
	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6
CO-1	2	3	1	2	1	3
CO-2	3	3	2	3	2	2
CO-3	3	3	2	3	2	3
CO-4	3	3	3	3	3	3
CO-5	3	3	1	2	3	3

UNIT-I:

Systems Modelling, Clustering and Virtualization: Distributed System Models and Enabling Technologies, Computer Clusters for Scalable Parallel Computing, Virtual Machines and Virtualization of Clusters and Data centres.

UNIT-II:

Foundations: Introduction to Cloud Computing, migrating into a Cloud, Enriching the 'Integration as a Service' Paradigm for the Cloud Era. Infrastructure as a Service (IAAS) & Platform and Software as a Service (PAAS / SAAS)

UNIT-III:

Virtual machines provisioning and Migration services, Enhancing Cloud Computing Environments using a cluster as a Service, Secure Distributed Data, Storage in Cloud Computing. Aneka, Comet Cloud, T- Systems', Workflow Engine for Clouds

UNIT-IV:

Understanding Scientific Applications for Cloud Environments. An Architecture for Federated Cloud Computing. SLA Management in Cloud Computing, Performance Prediction for HPC on Clouds.

UNIT-V:

Legal Issues in Cloud computing, Achieving Production Readiness for Cloud Services. Building Content Delivery networks using Clouds, Organizational Readiness and Change management in the Cloud age.

TEXT BOOKS:

1. Cloud Computing: Principles and Paradigms, Rajkumar Buyya, James Broberg and Andrzej M. Goscinski, Wiley, 2011
2. Distributed and Cloud Computing, Kai Hwang, Geoffery C. Fox, Jack J. Dongarra, Elsevier, 2012
3. Cloud Computing: A Practical Approach, Anthony T. Velte, Toby J. Velte, Robert Elsenpeter, Tata McGraw Hill, 2011

REFERENCES:

1. Cloud Computing: A Practical Approach, Anthony T. Velte, Toby J. Velte, Robert Elsen peter, Tata McGraw Hill, 2011
2. Enterprise Cloud Computing, Gautam Shroff, Cambridge University Press, 2010
3. Cloud Computing: Implementation, Management and Security, John W. Rittinghouse, James F. Ransome, CRC Press, 2012
4. Cloud Application Architectures: Building Applications and Infrastructure in the Cloud, George Reese, O'Reilly, SPD, 2011
5. Cloud Security and Privacy: An Enterprise Perspective on Risks and Compliance, Tim Mather, Subra Kumaraswamy, Shahed Latif, O'Reilly, SPD, 2011

ONLINE RESOURCES:

1. https://onlinecourses.nptel.ac.in/noc21_cs14/preview

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

M.Tech. II Semester

(22PE1CP10) SOFT COMPUTING

TEACHING SCHEME		
L	T/P	C
3	0	3

EVALUATION SCHEME				
SE	CA	ELA	SEE	TOTAL
30	5	5	60	100

COURSE PRE-REQUISITES: Basic knowledge on Mathematics, Machine Learning, Deep Learning

COURSE OBJECTIVES:

- To introduce soft computing concepts and techniques and foster their abilities in designing appropriate technique for a given scenario
- To implement soft computing based solutions for real-world problems
- To give students knowledge of non-traditional technologies and fundamentals of artificial neural networks, fuzzy sets, fuzzy logic, genetic algorithms
- To provide student a hands-on experience on MATLAB to implement various strategies
- To understand recent trends in various soft computing constituents

COURSE OUTCOMES: After completion of the course, the student should be able to

CO-1: Explain various soft computing techniques and their roles in building intelligent machines

CO-2: Analyze the problems which can be solved using fuzzy logic, genetic algorithms and neural networks

CO-3: Apply soft computing techniques to solve engineering problems

CO-4: Implement various soft computing approaches for a given problem using MAT Lab or Python

CO-5: Understand recent case studies or trends in various constituents of soft computing

COURSE ARTICULATION MATRIX:

*(Define Correlation of Course Outcomes with Program Outcomes and Program Specific Outcomes using **mapping levels 1 = Slight, 2 = Moderate and 3 = Substantial**)*

CO	PROGRAM OUTCOMES (PO)					
	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6
CO-1	2	-	3	3	2	-
CO-2	2	-	3	3	3	1
CO-3	3	1	3	3	3	-
CO-4	1	2	3	3	3	-
CO-5	3	3	3	2	2	2

UNIT-I:

Introduction to Soft Computing: Evolution of Computing: Soft Computing Constituents, From Conventional AI to Computational Intelligence: Machine Learning Basics.

UNIT-II:

Fuzzy Logic: Fuzzy Sets, Operations on Fuzzy Sets, Fuzzy Relations, Membership Functions: Fuzzy Rules and Fuzzy Reasoning, Fuzzy Inference Systems, Fuzzy Expert Systems, Fuzzy Decision Making.

UNIT-III:

Neural Networks: Machine Learning Using Neural Network, Adaptive Networks, Feed forward Networks, Supervised Learning Neural Networks,

Radial Basis Function Networks: Reinforcement Learning, Unsupervised Learning Neural Networks, Adaptive Resonance architectures, Advances in Neural networks.

UNIT-IV:

Genetic Algorithms: Introduction to Genetic Algorithms (GA)- GA Operators, Applications of GA in Machine Learning: Machine Learning Approach to Knowledge Acquisition.

UNIT-V:

Matlab/Python Lib: Introduction to MATLAB /Python, Arrays and array operations, Functions and Files, Study of neural network toolbox and fuzzy logic toolbox, Simple implementation of Artificial Neural Network and Fuzzy Logic.

Recent Trends in Fuzzy logic, neural networks and genetic algorithm, Implementation of recently proposed soft computing techniques.

TEXT BOOKS:

1. Neuro-Fuzzy and Soft Computing, J. S. R. Jang, C. T. Sun and E. Mizutani, PHI / Pearson Education, 2004
2. Principles of Soft Computing, S. N. Sivanandam and S. N. Deepa, Wiley India, 2011

REFERENCES:

1. Fuzzy Sets and Fuzzy Logic: Theory and Applications, George J. Klir and Bo Yuan, Prentice Hall, 1995
2. An Introduction to Genetic Algorithm, Melanic Mitchell, MIT Press, 1996
3. Fuzzy Logic with Engineering Applications, Timothy J. Ross, Wiley, 2010
4. Neural Networks, Fuzzy Logic and Genetic Algorithms, S. Rajasekaran and G. A. V. Pai, 1st Edition, PHI, 2003

ONLINE RESOURCES:

1. https://youtu.be/K9gjuXjJeEM
2. https://youtu.be/5lM6uYXqFEU

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

M.Tech. II Semester

(22PE1CP11) ADVANCED OPERATING SYSTEMS

TEACHING SCHEME		
L	T/P	C
3	0	3

EVALUATION SCHEME				
SE	CA	ELA	SEE	TOTAL
30	5	5	60	100

COURSE PRE-REQUISITES: Basic knowledge of Operating System, Functions, Scheduling, Memory Management

COURSE OBJECTIVES:

- To understand main components of real time operating system and their working
- To know about distributed system and its functioning
- To learn about centralized system and its working
- To explore on network operating system
- To know about kernel, concept of threading, multi-tasking Vs multi-programming

COURSE OUTCOMES: After completion of the course, the student should be able to

CO-1: Describe and demonstrate about real-time operating system (RTOS), its functioning, usage, and its applications

CO-2: Compare and contrast distributed vs centralized design principles and features

CO-3: Describes network operating system features and design principles

CO-4: Exemplify and hypothesize kernel Issues and development principles

COURSE ARTICULATION MATRIX:

*(Define Correlation of Course Outcomes with Program Outcomes and Program Specific Outcomes using **mapping levels 1 = Slight, 2 = Moderate and 3 = Substantial**)*

CO	PROGRAM OUTCOMES (PO)					
	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6
CO-1	3	2	3	3	2	2
CO-2	3	3	2	3	2	3
CO-3	2	3	3	2	3	2
CO-4	3	2	2	3	2	3
CO-5	3	3	2	3	2	3

UNIT-I:

Real-Time Operating Systems: Introduction to Real-Time Operating Systems, Definitions, Important Terminology and Concepts with examples, Role of an OS in Real Time Systems,

UNIT-II:

Real-Time Applications: How Real-Time OSs Differ from General-Purpose OSs, Design issues, principles, and case study.

UNIT-III:

Distributed Operating System: Introduction to Distributed Systems, Definitions, Goals, Advantages of Distributed Systems over Centralized Systems, Advantages of

Distributed Systems over Independent PCs, Disadvantages of Distributed Systems Design issues, features and principles of working, case study.

UNIT-IV:

Network Operating System: Introduction to Network operating system, Definitions, Different types of network operating systems, Function of Network operating systems, Design issues, working principles and characteristic features, case study.

UNIT-V:

Kernel Development and Secure Concerns: Introduction, Overview, Issues and development principles, case study. Protection, privacy, access control and security issues, solutions.

TEXT BOOKS:

1. Distributed Operating Systems, Andrew S. Tanenbaum, PHI
2. Modern Operating Systems, Andrew S. Tanenbaum, 3rd Edition, PE
3. Operating System Principles, Lubemir F. Bic and Alan C. Shaw, Pearson Education, 2003

REFERENCES:

1. Operating Systems: Internal and Design Principles, Stallings, 6th Edition, PE
2. UNIX Network Programming, W. Richard Stevens, 1998, PHI
3. UNIX User Guide, Ritchie & Yates
4. Operating System Principles, Abraham Silberchatz, Peter B. Galvin, Greg Gagne, 7th Edition, John Wiley & SonsS

ONLINE RESOURCES:

1. https://youtube.com/playlist?list=PLBlnK6fEyqRiVhbXDGLXDk_OQAeuVcp2O

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

M.Tech. II Semester

(22PE1SE06) SOFTWARE ARCHITECTURE AND DESIGN PATTERNS

TEACHING SCHEME		
L	T/P	C
3	0	3

EVALUATION SCHEME				
SE	CA	ELA	SEE	TOTAL
30	5	5	60	100

COURSE PRE-REQUISITES: Basic knowledge on Software Engineering

COURSE OBJECTIVES:

- To outline the fundamentals of software architecture and quality requirements of a software system
- To define the fundamental principles and guidelines for software architecture design, architectural styles, patterns, and frameworks
- To identify the methods, techniques, and tools for software architecture and document different software product lines
- To relate various design patterns for software architecture system

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Design suitable software architecture for small software systems
CO-2: Analyze software architectural styles, design patterns, and frameworks
CO-3: Elaborate software architecture using documentation approaches and architectural description languages
CO-4: Understand behavioral patterns
CO-5: Demonstrate fundamental patterns and principles of software architectural styles and design a case study

COURSE ARTICULATION MATRIX:
*(Define Correlation of Course Outcomes with Program Outcomes and Program Specific Outcomes using **mapping levels 1 = Slight, 2 = Moderate and 3 = Substantial**)*

CO	PROGRAM OUTCOMES (PO)					
	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6
CO-1	3	2	-	-	3	3
CO-2	3	-	1	1	3	2
CO-3	2	1	-	1	-	-
CO-4	2	3	2	2	3	1
CO-5	3	3	3	2	2	2

UNIT-I:

Envisioning Architecture: The Architecture Business Cycle, What is Software Architecture, Architectural patterns, reference models, Reference architectures, architectural structures and views.

Creating an Architecture, Quality Attributes, Achieving qualities. Architectural styles and patterns, designing the Architecture, Documenting Software architectures, Reconstructing Software Architecture.

UNIT-II:

Analyzing Architectures: Architecture Evaluation, Architecture design decision making, ATAM, CBAM.

Moving from one system to many, Software Product Lines, Building systems from off the shelf components, Software architecture in future.

UNIT-III:

Patterns: Pattern Description, Organizing catalogs, role in solving design problems. Selection and usage.

Creational and Structural Patterns: Abstract factory, builder, factory method, prototype, singleton, adapter, bridge, composite, facade, flyweight Proxy.

UNIT-IV:

Behavioral Patterns: Chain of responsibility, command. Interpreter, iterator, mediator, memento, observer, state, strategy, template method, visitor.

UNIT-V:

Case Studies: A-7E -A case study in utilizing architectural structures, The World Wide Web - a case study in interoperability. Air Traffic Control - a case study in designing for high availability, Celsius Tech - a case study in product line development.

TEXT BOOKS:

1. Software Architecture in Practice, Len Bass, Paul Clements & RickKa, 2nd Edition, Pearson Publication, 2003
2. Design Patterns, Erich Gamma, Pearson Education, 1995

REFERENCES:

1. Beyond Software Architecture, Luke I-Iohmann, Addison Wesley, 2003
2. Software Architecture, David M. Dikel, David Kane and James R. Wilson, Prentice Hall PTR, 2001
3. Pattern Oriented Software Architecture, F. Buschmann, John Wiley & Sons
4. Head First Design Patterns, Eric Freeman & Elisabeth Freeman, O'Reilly, 2007
5. Design Patterns in Java, Steven John Metsker & William C. Wake

ONLINE RESOURCES:

1. https://in.coursera.org/learn/design-patterns

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

M.Tech. II Semester

(22PC1CP05) INTERNET OF THINGS

TEACHING SCHEME		
L	T/P	C
3	0	3

EVALUATION SCHEME				
SE	CA	ELA	SEE	TOTAL
30	5	5	60	100

COURSE OBJECTIVES:

- To introduce the terminology, technology, concept of M2M (machine to machine) and its applications
- To introduce the Python scripting language which issued in many IoT devices
- To introduce the IOT in different domains, system management with NETCONF-YANG
- To introduce the hardware and working principles of various sensors used for IoT
- To introduce the Raspberry PI platform, design and implementation of web application Frame work used in IoT applications

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Understand the physical and logical design of the Internet of Things, IoT & M2M
CO-2: Analyze various applications of Internet of Things in various domain, NETCONF-YANG
CO-3: Create logical design of IoT Systems using Python
CO4: Understand the hardware and working principles of various sensors used for IoT,
CO5: Create Web application framework design using Raspberry PI platform and RESTful web API

COURSE ARTICULATION MATRIX:

*(Define Correlation of Course Outcomes with Program Outcomes and Program Specific Outcomes using **mapping levels 1 = Slight, 2 = Moderate and 3 = Substantial**)*

CO	PROGRAM OUTCOMES (PO)					
	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6
CO-1	2	2	1	2	2	3
CO-2	3	1	2	2	3	3
CO-3	1	1	2	2	2	3
CO-4	2	2	2	2	2	2
CO-5	1	2	3	3	2	2

UNIT–I:

Introduction to Internet of Things –Definition and Characteristics of IoT, Physical Design of IoT –IoT Protocols, IoT communication models, IoT Communication APIs, IoT enabled Technologies –Wireless Sensor Networks, Cloud Computing, Bigdata analytics, Communication protocols, Embedded Systems, IoT Levels and Templates.
IOT and M2M: Introduction, M2M, Difference between IOT and M2M, SDN and NFV for IOT

UNIT–II:

Domain Specific IoTs: Home, City, Environment, Energy, Retail, Logistics, Agriculture, Industry, health and Lifestyle

System Management with NETCONF-YANG: Software defined Networking, Network Function Virtualization, Need for IOT Systems Management, Simple Network Management Protocol, Limitations of SNMP, Network Operator Requirements, NETCONF, YANG, IOT Systems management with NETCONF-YANG

UNIT–III:

Introduction To Python: Language features of Python, Data types, data structures, Control of flow, functions, modules, packaging, file handling, data/time operations, classes, Exception handling Python packages -JSON,XML, HTTPLib, URLLib, SMTPLib

UNIT-IV:

IoT Physical Devices and Endpoints: Introduction to Raspberry Pi- Installation, Interfaces (serial, SPI, I2C), and Programming – Python program with Raspberry PI with focus on interfacing external gadgets, controlling output, reading input from pins. IoT Physical Servers and Cloud Offerings – Introduction to Cloud Storage models and communication APIs Webserver – Web server for IoT, Cloud for IoT, Python web application framework designing a RESTful web API

UNIT-V:

Controlling Hardware: Connecting LED, Buzzer, Switching High Power devices with transistors, Controlling AC Power devices with Relays, Controlling servo motor, speed control of DC Motor, Using unipolar and bipolar Stepper motors

Digital input- Sensing push switch, pull-up and pull-down resistors, Rotary encoder, Using keypad, Using RTC Sensors: Light sensor, temperature sensor with thermistor, voltage sensor, ADC and ADC, Temperature and Humidity Sensor DHT11, Read Switch, Distance Measurement with ultrasound sensor

TEXT BOOKS:

1. Internet of Things - A Hands-on Approach, Arshdeep Bahga and Vijay Madisetti, Universities Press, 2015
2. Getting Started with Raspberry Pi, Matt Richardson & Shawn Wallace, O'Reilly (SPD), 2014
3. Raspberry Pi Cookbook, Software and Hardware Problems and solutions, Simon Monk, O'Reilly (SPD), 2016

REFERENCES:

1. Designing the Internet of Things, Adrian McEwen, Hakim Cassimally, Wiley, 2014
2. The Internet of Things, Samuel Greengard, MIT Press, Cambridge, 2015
3. Internet of Things: Principles and Paradigms, Rajkumar Buyya, Amir Vahid Dastjerdi, Morgan Kaufman, 2016

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

M.Tech. II Semester

(22PE1SE07) ADVANCED SOFTWARE ENGINEERING PRINCIPLES AND PRACTICES

TEACHING SCHEME		
L	T/P	C
3	0	3

EVALUATION SCHEME				
SE	CA	ELA	SEE	TOTAL
30	5	5	60	100

COURSE PRE-REQUISITES: Basic knowledge on Software Engineering

COURSE OBJECTIVES:

- To understand the importance of software engineering principles in software development
- To develop the necessary skills to handle software projects in a principled way
- To understand the basics of testing, debugging and errors
- To understand the best practices in software engineering

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Apply software engineering principles to major projects
CO-2: Implement design principles to design a real time project
CO-3: Understand the Architectural Design Process
CO-4: Apply the design principles to implement real time software design
CO-5: Implement user interface design using component based approach to evaluate a real time project

COURSE ARTICULATION MATRIX:
*(Define Correlation of Course Outcomes with Program Outcomes and Program Specific Outcomes using **mapping levels 1 = Slight, 2 = Moderate and 3 = Substantial**)*

CO	PROGRAM OUTCOMES (PO)					
	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6
CO-1	3	3	2	3	2	2
CO-2	3	2	3	3	3	2
CO-3	2	2	3	2	3	2
CO-4	3	3	3	2	3	2
CO-5	2	3	3	2	3	2

UNIT-I:
System Engineering: System Engineering: Computer based systems, system engineering hierarchy, Information engineering, Information strategy planning, business area analysis, product engineering, modelling the system architecture, system modelling and simulation, system specification.
Computer Based System Engineering: Emergent system properties, systems and their environment, system modelling, system engineering process, system procurement.

UNIT-II:
Modern Design Concept and Principles: Design Concepts: Mapping of analysis model to design model, design process, design principles, design concepts, effective modular design, design model, design heuristics, design specification.

UNIT-III:

Architectural Design Process: Transform mapping and transaction mapping, design post processing, interface design, Human computer interface design, and interface design guidelines, procedural design.

UNIT-IV:

Real Time Software Design: Real–time systems, definition, System consideration, Real time system analysis, stimulation / Response systems, Real–time System model, system elements, Real – time programming, system design, Real-time system modelling, RTOS, process priority, process management, scheduling strategy, RT-Systems, design process, monitoring and control system, Generic architecture, data acquisitions systems.

UNIT-V:

User Interface Design: The golden rules, user interface analysis and design, interface analysis, interface design steps, WebApp interface design, Design evaluation.

Component Based Development CBSE: Component based Software engineering, components and component models; Component based Software engineering process, Component Composition.

TEXT BOOKS:

1. Software Engineering – A Practitioner's Approach, Roger S. Pressman, 4th Edition, McGraw Hill
2. Software Engineering, Ian Sommerville, 6th / 7th Edition, Pearson Education
3. Software Engineering Theory and Practices, Shari Lawarence, 2nd Edition, Pfleeger

REFERENCES:

1. System Analysis and Design in Changing World, John W. Satzinger, Robert B. Jackson, Stephen D. Burd, Thomson Course Technology
2. Intelligent Software Agents, Richard Murch, Tony Johnson, Prentice Hall

ONLINE RESOURCES:

1. https://archive.nptel.ac.in/courses/106/105/106105182/

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

M.Tech. II Semester

(22PE1CP14) DEEP LEARNING AND ITS APPLICATIONS

TEACHING SCHEME		
L	T/P	C
3	0	3

EVALUATION SCHEME				
SE	CA	ELA	SEE	TOTAL
30	5	5	60	100

COURSE PRE-REQUISITES: Programming in Python and knowledge on Algorithms and Basic Mathematics

COURSE OBJECTIVES:
- To understand characteristics of neural networks
- To identify methods to train and minimization of errors of neural networks
- To analyze different architectures of deep learning
- To build CNN and RNN models and evaluate the performance
- To study importance of deep learning models in various applications

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Understand basic characteristics of neural networks
CO-2: identify methods to minimize the error of neural networks
CO-3: Analyze different architectures of deep learning
CO-4: Build CNN and RNN models
CO-5: Apply deep learning models on various applications

COURSE ARTICULATION MATRIX:
*(Define Correlation of Course Outcomes with Program Outcomes and Program Specific Outcomes using **mapping levels 1 = Slight, 2 = Moderate and 3 = Substantial**)*

CO	PROGRAM OUTCOMES (PO)					
	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6
CO-1	3	2	3	3	2	2
CO-2	3	2	3	3	3	2
CO-3	3	3	3	3	3	3
CO-4	3	3	2	2	3	2
CO-5	3	3	3	3	3	3

UNIT-I:
Introduction to Neural Networks: Characteristics of neural networks, Historical development of neural networks principles, Artificial neural networks: Terminology, Models of neuron, Topology, Basic learning laws.

UNIT-II:
Training Neural Networks: Risk minimization, loss functions, back propagation, regularization, model selection, optimization.

UNIT-III:
Deep Learning Architectures: Introduction to deep learning, Machine Learning and Deep Learning, Representation Learning, Activation Functions: RELU, LRELU, ERELU,

Unsupervised Training of Neural Networks, Restricted Boltzmann Machines, Auto Encoders, Deep Learning Applications.

UNIT-IV:

Convolutional Neural Networks: Architectural Overview, Motivation, Layers, Filters, Parameter sharing, Regularization, Popular CNN Architectures: ResNet, AlexNet– Applications.

UNIT-V:

Sequence Modelling – Recurrent and Recursive Nets: Recurrent Neural Networks, Bidirectional RNNs, Encoder-decoder sequence to sequence architectures, LSTM, CNN training on computer vision data, Sentiment analysis using RNN, Time series data analysis using RNN, Feature extraction in NLP.

TEXT BOOKS:

1. Deep Learning, Ian Good fellow, Yoshua Bengio and Aaron Courville, MIT Press
2. The Elements of Statistical Learning, T. Hastie, R. Tibshirani, and J. Friedman, Springer
3. Machine Learning in Data Science using Python, Dr. R. Nageswara Rao, Dreamtech, 2022

REFERENCES:

1. Probabilistic Graphical Models, Koller, and N. Friedman, MIT Press
2. Pattern Recognition and Machine Learning, Bishop C. M., Springer, 2006
3. Artificial Neural Networks, Yegnanarayana B., PHI Learning, 2009
4. Deep Learning: A Practitioners Approach, Josh Patterson, Adam Gibson
5. Neural Networks and Deep Learning, Michael Nielsen, Determination Press, 2015

ONLINE RESOURCES:

1. https://nptel.ac.in/courses/106106184
2. Why deep learning is becoming so popular? | Deep Learning Tutorial 2 (Tensorflow2.0, Keras & Python) – YouTube

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

M.Tech. II Semester

(22PE1SE08) SOFTWARE DEFINED NETWORKS

TEACHING SCHEME		
L	T/P	C
3	0	3

EVALUATION SCHEME				
SE	CA	ELA	SEE	TOTAL
30	5	5	60	100

COURSE PRE-REQUISITES: General understanding of Machine Learning Algorithms for Security Data and an intermediate level of Python Coding ability

COURSE OBJECTIVES:

- To explore how software defined networking has aided the success in virtualization
- To analyze SDN design and operations in implementing
- To observe modern programmatic interfaces for controlling network
- To identify WAN utilization techniques and controller designs for scalibility
- To familiarize with the SDN implementation, deployment and management

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Understand the modern notions in software defined networks and virtualization
CO-2: Apply SDN design techniques and various operations to solve real-world problems
CO-3: Learn how to use SDN controllers for managing the Interface and network programming
CO-4: Be capable of confidently addressing scalability and design issues
CO-5: Handle implementation challenges using G-scale network

COURSE ARTICULATION MATRIX:

*(Define Correlation of Course Outcomes with Program Outcomes and Program Specific Outcomes using **mapping levels 1 = Slight, 2 = Moderate and 3 = Substantial**)*

CO	PROGRAM OUTCOMES (PO)					
	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6
CO-1	2	2	2	2	3	1
CO-2	2	2	2	2	3	1
CO-3	2	2	2	2	3	1
CO-4	2	2	2	2	3	1
CO-5	2	2	2	2	3	1

UNIT-I:

Introduction to Software Defined Networking: Virtualization, Virtual Memory, Virtual Memory Operation, Virtual and Physical Memory Mapping, Server Virtualization, Network Function virtualization, Software Defined Networking, Network Limitations.

UNIT-II:

SDN Implementation: Introduction, SDN Implementation, SDN Design, Separation of the Control and Data Planes, Edge-Oriented Networking, SDN Operation, Service Providers and SDN, Benefits of SDN.

UNIT-III:

SDN Controllers: Network Programmability, The Management Interface, The Application-Network Divide Modern Programmatic Interfaces, Virtualization and Data Plane I/O, Services Engineered Path, Service Locations and Chaining.

UNIT-IV:

SDN and Enterprise Networks: SDN and Optical Transport Networks, Increasing WAN Utilization with SDN, SDN Scalability Issues, Controller Designs for Scalability, Potential SDN Scalability Issues such as controller placement issue.

UNIT-V:

SDN Management: Load Adaptation, Google and SDN, Google's G-Scale Network, Google's G-Scale Network Hardware, Google SDN Deployment, Implementation Challenges

TEXT BOOKS:

1. Software Defined Networking: Design and Deployment, Patricia A. Morreale and James M. Anderson, 1st Edition, CRC Press
2. SDN: Software Defined Networks, Thomas D. Nadeau and Ken Gray, Orielly Media

REFERENCES:

1. Software Defined Networking with Open Flow, Siamak Azodolmolky, Wiley
2. Software Defined Networks: A Comprehensive Approach, Paul Goransson, Chuck Black, Morgan Kaufmann

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

M.Tech. II Semester

(22PE1SE09) WEB SERVICES AND SERVICE ORIENTED ARCHITECTURE

TEACHING SCHEME		
L	T/P	C
3	0	3

EVALUATION SCHEME				
SE	CA	ELA	SEE	TOTAL
30	5	5	60	100

COURSE PRE-REQUISITES: Basic knowledge on Web Technologies

COURSE OBJECTIVES:

- To define and design applications as combinations of services, and be able to discuss the emergent properties of those compositions
- To understand service oriented architecture and web services and their importance
- To analyze security solutions in web services and to introduce security standards for web services
- To interpret contemporary SOA features and analyze benefits
- To understand web service specifications and assess support by platforms like J2EE and .NET

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Define distributed computing evolution and web service basics
CO-2: Analyze web services framework and its importance
CO-3: Understand SOA fundamentals and build Services with WS-* Specifications
CO-4: Assess the service layer abstraction & analyze and design the building an SOA
CO-5: Examine SOA support provided by J2EE and .NET platform

COURSE ARTICULATION MATRIX:
*(Define Correlation of Course Outcomes with Program Outcomes and Program Specific Outcomes using **mapping levels 1 = Slight, 2 = Moderate and 3 = Substantial**)*

CO	PROGRAM OUTCOMES (PO)					
	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6
CO-1	3	2	2	2	2	2
CO-2	2	2	2	3	3	3
CO-3	2	2	2	2	2	2
CO-4	2	3	2	2	2	2
CO-5	2	2	3	2	3	2

UNIT-I:

Evolution of Distributed Computing: Core distributed computing technologies-client/server, CORBA, JAVA RMI, Microsoft DCOM, MOM, Challenges in Distributed Computing Introduction to Web Services: The definition of web services, basic operational model of webservices, Core Web Service Standards, benefits and challenges of using web services

UNIT-II:

SOA and Web Services Fundamentals:

Introducing SOA: Fundamental SOA, Common Characteristics of Contemporary SOA, Common tangible benefits of SOA, Common pitfalls of adopting SOA.

The Evolution of SOA: An SOA timeline, The continuing evolution of SOA, The roots of SOA.

Web Services and Primitive SOA: The Web Services frame work, Services, Service Descriptions, and Messaging.

UNIT-III:

SOA and WS-* Extensions:

Web Services and Contemporary SOA (Part-I): Message Exchange Patterns, Service Activity Coordination, Atomic transactions, Business Activities, Orchestration, and Choreography. Web Services and Contemporary SOA (Part-II): Addressing, Reliable Messaging, Correlation, Policies, Metadata Exchange, Security, Notification and Eventing.

UNIT-IV:

SOA and Services – Orientation: Principles of Service-Orientation: Service - Orientation and the Enterprise, Anatomy of SOA, Common Principles of Service – Orientation, Interrelation between Principles of Service-Orientation

Service Layers: Service-Orientation and contemporary SOA, Service Layer abstraction, Application Service Layer, Business Service Layer, Orchestration Service Layer, Agnostic Services, Service Layer Configuration Scenarios.

UNIT-V:

Building SOA (Planning and Analysis):

SOA Delivery Strategies: SOA delivery lifecycle phases, the top-down strategy, the bottom up strategy, the agile strategy.

Service-Oriented Analysis (Part I-Introduction): Introduction to Service Oriented Analysis, Benefits of a Business-Centric SOA, Deriving Business Services.

SOA Platforms: SOA platform basics, SOA support in J2EE and .NET, Integration considerations.

TEXT BOOKS:

1. Service-Oriented Architecture: Concepts, Technology & Design, Thomas Erl, Pearson Edu
2. Developing Java Web Services, R. Nagappan, R. Skoczylas, R. P. Sriganesh, Wiley India

REFERENCES:

1. Web Services & SOA Principles and Technology, Michael P. Papazoglou, 2nd Edition
2. The Definitive Guide to SOA, Jeff Davies & Others, Apress, Dreamtech
3. Understanding SOA with Web Services, Eric Newcomer, Greg Lomowand, Pearson Education
4. Java SOA Cook Book, E. Hewitt, SPD
5. SOA in Practice, N. M. Josuttis, SPD

ONLINE RESOURCES:

1. https://in.coursera.org/learn/service-oriented-architecture

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

M.Tech. II Semester

(22PE1CP15) NATURAL LANGUAGE PROCESSING

TEACHING SCHEME		
L	T/P	C
3	0	3

EVALUATION SCHEME				
SE	CA	ELA	SEE	TOTAL
30	5	5	60	100

COURSE PRE-REQUISITES: students should have knowledge on Data Structures, Finite Automata and Probability Theory

COURSE OBJECTIVES:

- To understand the algorithms available for the processing of linguistic information of natural languages
- To conceive basic knowledge on various syntactic and semantics of NLP tasks
- To familiarize various NLP software libraries and data sets publicly available
- To apply the NLP techniques for language modelling

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Understand morphological models and familiarize with issues and challenges
CO-2: Describe the concepts of syntax and evaluate parsing algorithms
CO-3: Analyze the semantics and pragmatics of a statement written in a natural language
CO-4: Extract information using predicate argument structure in a corpus
CO-5: Design and implement different language modeling techniques

COURSE ARTICULATION MATRIX:
*(Define Correlation of Course Outcomes with Program Outcomes and Program Specific Outcomes using **mapping levels 1 = Slight, 2 = Moderate and 3 = Substantial**)*

CO	PROGRAM OUTCOMES (PO)					
	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6
CO-1	3	3	3	3	3	3
CO-2	3	3	3	3	3	3
CO-3	3	3	3	3	3	2
CO-4	3	2	2	2	3	2
CO-5	3	3	2	2	3	2

UNIT–I:
Finding the Structure of Words: Words and Their Components, Issues and Challenges, Morphological Models. Finding the Structure of Documents: Introduction, Methods, Complexity of the Approaches, Performances of the Approaches

UNIT–II:
Syntax Analysis: Parsing Natural Language, Treebanks: A Data-Driven Approach to Syntax, Representation of Syntactic Structure, Parsing Algorithms, Models for Ambiguity Resolution in Parsing, Multilingual Issues.

UNIT–III:
Semantic Parsing: Introduction, Semantic Interpretation, System Paradigms, Word Sense Systems, Software.

UNIT–IV:
Predicate-Argument Structure, Meaning Representation Systems, Software.

UNIT–V:
Discourse Processing: Cohesion, Reference Resolution, Discourse Cohesion and Structure Language Modeling: Introduction, N-Gram Models, Language Model Evaluation, Parameter Estimation, Language Model Adaptation, Types of Language Models, Language-Specific Modeling Problems, Multilingual and Cross Lingual Language Modeling.

TEXT BOOKS:

1. Multilingual natural Language Processing Applications: From Theory to Practice – Daniel M. Bikel and Imed Zitouni, Pearson Publication
2. Natural Language Processing and Information Retrieval: Tanvier Siddiqui, U. S. Tiwary
3. Foundations of Statistical Natural Language Processing, Christopher D. Manning and Hinrich Schutze, MIT Press, 1999

REFERENCES:

1. Speech and Natural Language Processing, Daniel Jurafsky & James H. Martin, Pearson Publication
2. Practical Text Analytics: Interpreting Text and Unstructured Data for Business ntelligence, Steven Struhl, Kogan Page, 2015
3. Handbook of Natural Language Processing, Nitin Indurkhya and Fred J. Damerau, Second Edition, Chapman and Hall/CRC Press, 2010

ONLINE RESOURCES:
1. Applied Natural Language Processing - Course (nptel.ac.in)
2. Natural Language Processing - Course (nptel.ac.in)
3. Natural Language Processing | Coursera
4. Top Nlp Courses - Learn Nlp Online | Coursera

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

M.Tech. II Semester

(22PC2CP03) BIG DATA ANALYTICS LABORATORY

TEACHING SCHEME		
L	T/P	C
0	2	1

EVALUATION SCHEME					
D-D	PE	LR	CP	SEE	TOTAL
10	10	10	10	60	100

COURSE PRE-REQUISITES: Basic knowledge in LINUX, SQL, JAVA

COURSE OBJECTIVES:

- To discuss the overview of data analytics and interpret the data analytics life cycle
- To illustrate the various data analytic methods using R
- To design Programs using Data Analytics Techniques
- To identify the usage of Hadoop Ecosystem

COURSE OUTCOMES: After completion of the course, the student should be able to

CO-1: Understand the importance of data analytics in real life through life cycle and explore the features of R and R Studio environment

CO-2: Explore the data types and programming constructs of R with examples

CO-3: Develop analysis model using various datasets

CO-4: Analyze the data for cluster analysis, time series analysis and other mining techniques

CO-5: Learn the different tools in Hadoop Framework

COURSE ARTICULATION MATRIX:

*(Define Correlation of Course Outcomes with Program Outcomes and Program Specific Outcomes using **mapping levels 1 = Slight, 2 = Moderate and 3 = Substantial**)*

CO	PROGRAM OUTCOMES (PO)					
	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6
CO-1	3	2	3	2	3	3
CO-2	3	2	3	2	3	2
CO-3	3	2	3	2	3	2
CO-4	2	2	3	2	3	3
CO-5	2	2	3	2	3	2

LIST OF EXPERIMENTS:

1. Data Analytics Life Cycle
2. Basic Data Analytic methods using R and R Studio environment. Explore the features
3. Explore the data types of R and demonstrate the basic operations of data types
4. Explore the control structures of R and demonstrate with one example under each case
5. Importing & exporting the data from I) CSV file ii) Excel File
6. Data Visualization through I) Histogram ii) Pie Chart iii) Box Plot iv) Density Plots
7. Conduct Hypothesis Test on „mtcars" dataset
8. Demonstrate regression analysis

9. Demonstrate „Association Rule Mining" using „groceries" dataset
10. Demonstrate clustering technique using „iris" dataset
11. Demonstrate the time series analysis and develop the prediction model using "airpassengers" dataset
12. Hadoop Storage File system
    i. Write a command to create the directory structure in HDFS.
    ii. Write a Command to move file from local unix/linux machine to HDFS cluster.
13. Viewing Data Contents, Files and Directory
    i. Write HDFS command Look at the HDFS files and directory of under your Hadoop cluster.
    ii. Write HDFS command to see contents of files which are present in Hadoop cluster.
14. Getting Files data from the Hadoop Cluster to Local Disk.:
    i. Find out HDFS command to take file from HDFS to local file system.
    ii. If we want process any data first should move into Hadoop cluster using HDFS commands. All files storage in Haddoop cluster will be using HDFS
15. Map Reduce Programming (Processing data) – Word Count
    i. Develop the word count map-reduce program to count the words with given input file. Before you start, execute the prepare step, to load the data into HDFS.
    ii. Most Frequent Words Count
    iii. Use the output from the previous program to list the most frequent words with their counts.

TEXT BOOKS:

1. R-The statistical Programming Language, Mark Gardener, Wiley India
2. Hadoop: The Definitive Guide, Tom White, 3rd Edition, O'Reilly Media, 2012

REFERENCES:

1. R Programming, A. K. Verma, Cengage
2. Big Data Glossary, Pete Warden, O'Reilly, 2011

ONLINE RESOURCES:

1. Big Data Course - Online Hadoop Certification Training (intellipaat.com)
2. Hadoop Developer In Real World: Learn Hadoop for Big Data | Udemy

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

M.Tech. II Semester

(22PC2CP04) CRYPTOGRAPHY AND NETWORK SECURITY LABORATORY

TEACHING SCHEME		
L	T/P	C
0	2	1

EVALUATION SCHEME					
D-D	PE	LR	CP	SEE	TOTAL
10	10	10	10	60	100

COURSE PRE-REQUISITES: Knowledge on Computer Networks, Mathematics and any programming language

COURSE OBJECTIVES:
- To implement the cryptographic algorithms
- To implement the security algorithms
- To implement cryptographic, digital signatures algorithms

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: To implement the Block and Stream encryption algorithms
CO-2: To implement the secret key and public key security algorithms
CO-3: To implement authentication, digital signatures algorithms
CO-4: To implement key management algorithms
CO-5: To implement firewalls and secure web transactions

COURSE ARTICULATION MATRIX:
*(Define Correlation of Course Outcomes with Program Outcomes and Program Specific Outcomes using **mapping levels 1 = Slight, 2 = Moderate and 3 = Substantial**)*

CO	PROGRAM OUTCOMES (PO)					
	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6
CO-1	3	1	3	3	3	3
CO-2	2	1	3	3	2	3
CO-3	3	2	2	3	3	3
CO-4	3	1	3	2	3	2
CO-5	3	2	3	3	3	3

LIST OF EXPERIMENTS:

1. Implementation of symmetric cipher algorithm (AES and RC4)
2. Random number generation using a subset of digits and alphabets.
3. Implementation of RSA based signature system
4. Implementation of Subset sum
5. Authenticating the given signature using MD5 hash algorithm.
6. Implementation of Diffie-Hellman algorithm
7. Implementation ElGAMAL cryptosystem.
8. Implementation of Rabin Cryptosystem. (Optional).
9. Implementation of Kerberos cryptosystem
10. Firewall implementation and testing.
11. Implementation of a trusted secure web transaction.
12. Digital Certificates and Hybrid (ASSY/SY) encryption, PKI.

13. Message Authentication Codes.
14. Elliptic Curve cryptosystems (Optional)

ONLINE RESOURCES:

1. https://www.mooclab.club/tags/network-security/
2. https://crypto.stanford.edu/~dabo/courses/OnlineCrypto/

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

M.Tech. II Semester

(22PW4SE02) MINI-PROJECT

TEACHING SCHEME

L	T/P	C
0	4	2

CIE	SEE	TOTAL
40	60	100

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Understand the formulated industry / technical / societal problems
CO-2: Analyze and / or develop models for providing solution to industry / technical / societal problems
CO-3: Interpret and arrive at conclusions from the project carried out
CO-4: Demonstrate effective communication skills through oral presentation
CO-5: Engage in effective written communication through project report

COURSE OUTLINE:

- A student shall undergo a mini-project during II semester of the M.Tech. programme.
- A student, under the supervision of a faculty member, shall collect literature on an allotted project topic of his / her choice, critically review the literature, carry out the project work, submit it to the department in a prescribed report form and shall make an oral presentation before the departmental Project Review Committee.
- Evaluation of the mini-project shall consist of CIE and SEE and shall be done by a Project Review Committee (PRC) consisting of the Head of the Department, faculty supervisor and a senior faculty member of the specialization / department.
- CIE shall be carried out for 40 marks on the basis of review presentation as per the calendar dates and evaluation format.
- SEE shall be carried out at the end of semester fpr 60 marks on the basis of oral presentation and submission of mini-project report.
- Prior to the submission of mini-project report to the PRC, its soft copy shall be submitted to the PG Coordinator for PLAGIARISM check.
- The mini-project report shall be accepted for submission to the PRC only upon meeting the prescribed similarity index of less than 25%.

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

M.Tech. II Semester

(22MN6HS02) ANCIENT WISDOM

TEACHING SCHEME

L	T/P	C
2	0	0

EVALUATION SCHEME

SE-I	SE-II	SEE	TOTAL
50	50	-	100

COURSE OBJECTIVES:

- To introduce the contribution from ancient Indian system & tradition to modern science & Technology
- To trace, identify and develop the ancient knowledge systems
- To introduce the sense of responsibility, duties and participation of individual for establishment of fearless society

COURSE OUTCOMES: After completion of the course, the student should be able to

CO-1: Familiarize learners with major sequential development in Indian science, engineering and technology

CO-2: Understand eco-friendly, robust and scientific planning and architecture system of ancient India

CO-3: Trace, identify, practice and develop the significant Indian mathematic and astronomical knowledge

CO-4: Understand the importance of Indian aesthetics in individual realization of the truth arises by realizing the harmony within

UNIT-I:

Indian Science & Technology: Indian S & T Heritage, sixty-four art forms and occupational skills (64 Kalas)

Ancient Architecture:

Scientific Achievements though Ancient Architect: Musical Pillars of Vitthal temple, Sundial of konark temple, construction of eight shiva temple in straight line from Kedarnath to rameshwaram at longitude 79oE 41'54, Veerbhadra temple with 70 hanging pillars

UNIT-II:

Foundation Concept for Science and Technology: The Introduction to Ancient Mathematics & Astronomy Introduction to Brief introduction of inception of Mathematics & Astronomy from vedic periods. Details of different authors who has given mathematical & astronomical sutra (e.g. arytabhatta, bhaskara, brahmagupta, varamahira, budhyana, yajanvlkya, panini, pingala, 22 bharat muni, sripati, mahaviracharya, madhava, Nilakantha somyaji, jyeshthadeva, bhaskara-II, shridhara Number System and Units of Measurement, concept of zero and its importance, Large numbers & their representation, Place Value of Numerals, Decimal System, Measurements for time, distance and weight, Unique approaches to represent numbers (Bhūta Saṃkhya System, Kaṭapayādi System), Pingala and the Binary system, Knowledge Pyramid

Indian Mathematics, Great Mathematicians and their contributions, Arithmetic Operations, Geometry (Sulba Sutras, Aryabhatiya-bhasya), value of π, Trigonometry, Algebra, Chandah Sastra of Pingala, Indian Astronomy, celestial coordinate system,

Elements of the Indian Calendar Aryabhatiya and the Siddhantic Tradition Pancanga – The Indian Calendar System

UNIT-III:

Humanities & Social Sciences: Health, Wellness & Psychology, Ayurveda Sleep and Food, Role of water in wellbeing Yoga way of life Indian approach to Psychology, the Triguṇa System Body-Mind-IntellectConsciousness Complex. Governance, Public Administration & Management reference to ramayana, Artha Sastra, Kauṭilyan State

UNIT-IV:

Aspiration and Purpose of Individual and Human Society: Aims of Human life; at individual level and societal level. At societal level; Four purusarthas Dharma, Artha, Kama, Moksha.

Individual Level:

Program for Ensuring Human Purpose:

Fundamental Concept of Nitishastra: Satyanishtha Aur Abhiruchi (Ethics, Integrity & aptitude). The true nature of self; Shiksha Valli, Bhrigu Valli (concept of Atman-Brahman (self, soul).

The True Constitution of Human: Ananda Valli (Annamaya Kosha, Pranamaya Kosha, Manomaya Kosha, Vijnanamaya Kosha, Anandamaya Kosha). The four states of consciousness (Waking state, Dreaming state, Deep Sleep State, Turiya the fourth state), Consciousness (seven limbs and nineteen mouths), Prajna, Awarness. The Life Force Prana (Praana-Apaana-Vyaana-Udaana- Samaana

Ancient Indian Science (Ayurveda & Yoga)

Ayurveda for Life, Health and Well-being: Introduction to Ayurveda: understanding Human body and Pancha maha bhuta, the communication between body & mind, health

Introduction to Yoga: Definition, Meaning and objectives of Yoga, Relevance of yoga in modern age. the six cleansing procedures of Yoga, understanding of Indian psychological concept, consciousness, tridosha & triguna.

UNIT-V:

Five Important Slokas for Enlightenment

Gayatri Mantram, Santi Mantram: Asatoma Sadgamaya, Geeta (Yada Yadahi Dharmasya, Glanirbhavati Bharata), Amanitwam Adambitwam.., Karmanyevadikarastu… Maa phaleshukadachana

TEXT BOOKS:

1. Textbook on Indian Knowledge Systems, Prof. B Mahadevan, IIM Bengaluru
2. Indian Knowledge Systems, Kapur K. and Singh A. K., 2005

REFERENCES:

1. Tatvabodh of Sankaracharya, Central Chinmay Mission Trust, Bombay, 1995
2. Value and Distribution System in India, B. L. Gupta, Gyan Publication House
3. Ancient Indian Culture and Civilization, Reshmi Ramdhoni, Star Publication, 2018
4. Ancient Indian Society, Maharaj Swami Chidatmanjee, Anmol Publication
5. Ancient Indian Classical Music, Lalita Ramkrishna, Shubhi Publications

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

M.Tech. III Semester

(22PE1CP21) BLOCK CHAIN TECHNOLOGY

TEACHING SCHEME		
L	T/P	C
3	0	3

EVALUATION SCHEME				
SE	CA	ELA	SEE	TOTAL
30	5	5	60	100

COURSE OBJECTIVES:
- To familiarize the functional/operational aspects of cryptocurrency ecosystem
- To understand blockchain technology architecture and components
- To smart contracts and bitcoins
- To understand blockchain and other technologies

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Understand blockchain technology
CO-2: Understanding the concept of distributed transactions and bitcoin
CO-3: Remembering the concept of fault tolerant mechanisms
CO-4: Applying various security algorithms
CO-5: Understanding blockchain and machine learning

COURSE ARTICULATION MATRIX:
*(Define Correlation of Course Outcomes with Program Outcomes and Program Specific Outcomes using **mapping levels 1 = Slight, 2 = Moderate and 3 = Substantial**)*

CO	PROGRAM OUTCOMES (PO)					
	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6
CO-1	3	3	2	2	1	1
CO-2	3	3	2	2	2	2
CO-3	3	2	2	3	2	2
CO-4	3	2	3	1	1	2
CO-5	2	2	1	1	2	1

UNIT-I:
Basics of Blockchain: Introduction, Concept of Blockchain, History, Definition of Blockchain, Fundamentals of Blockchain, P2P Network, Characteristics of Blockchain, Consensus in Trust-Building Exercise, Public, Private, and Hybrid Blockchains, Distributed Ledger Technologies, DLT Decentralized Applications and Databases, Architecture of Blockchain, Transactions, Chaining Blocks, Value Proposition of Blockchain Technology

UNIT-II:
Architecture of Blockchain: Architecture of Blockchain, Transactions, Chaining Blocks, Value Proposition of Blockchain Technology, Consensus: Introduction, Consensus Approach, Consensus Algorithms, Byzantine Agreement Methods

UNIT-III:

Bitcoins: Introduction, Working of Bitcoin, Merkle Trees, Bitcoin Block Structure, Bitcoin Address, Bitcoin Transactions, Bitcoin Network, Bitcoin Wallets, Bitcoin Payments, Bitcoin Clients, Bitcoin supply.

UNIT-IV:

Blockchain Components: Introduction, Ethereum, History, Ethereum Virtual Machine, Working of Ethereum, Ethereum Clients, Ethereum Key Pairs, Ethereum Addresses, Ethereum Wallets, Ethereum Transactions, Ethereum Languages, Ethereum Development Tools

Smart Contracts: Introduction, Smart Contracts, Absolute and Immutable, Contractual Confidentiality, Law Implementation and Settlement, Characteristics, Internet of Things

UNIT-V:

Blockchain and Allied Technologies: Blockchain and Cloud Computing, Characteristics of Blockchain Cloud, Blockchain and Artificial Intelligence, Blockchain and IoT, Blockchain and Machine Learning, Blockchain and Robotic Process Automation.

TEXT BOOKS:

1. Blockchain Technology: Concepts and Applications. Kumar Saurabh, Ashutosh Saxena, Wiley
2. Mastering Bitcoin: Unlocking Digital Cryptocurrencies, Andreas Antonopoulos, O'Reilly, 2014

REFERENCES:

1. Blockchain Technology, Chandramouli Subramanian, Asha A. George, Abhilash K. A and Meena Karthikeyan, Universities Press, 2020
2. Blockchain Basics: ANon-Technical Introduction in 25 Steps, Daniel Drescher, Apress, 2017
3. The Basics of Bitcoins and Blockchains, Antony Lewis, Coral Gables, 2018

ONLINE RESOURCES:

1. J. A. Garay et al., The Bitcoin Backbone Protocol - Analysis and Applications EUROCRYPT2015LNCSVOl9057,(VOLII),pp281310.(Alsoavailableateprint.iacr.org/2016/1048).(Serious beginning of discussions related to formal models for bitcoin protocols)

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

M.Tech. III Semester

(22PE1CN08) ARTIFICIAL INTELLIGENCE

TEACHING SCHEME		
L	T/P	C
3	0	3

EVALUATION SCHEME				
SE	CA	ELA	SEE	TOTAL
30	5	5	60	100

COURSE OUTCOMES:

- To learn the different nature of environments and problem solving agents
- To understand the knowledge and reasoning techniques
- To learn different learning techniques and natural language processing applications
- To understand the natural language processing and its applications
- To learn functions of robotics and AI based programming tools

COURSE OBJECTIVES: After completion of the course, the student should be able to
CO-1: To familiarize to the concepts of Artificial Intelligence
CO-2: To learn about knowledge representation AI and reasoning
CO-3: To understand various types of learning
CO-4: To understand the importance of natural language processing in the real world
CO-5: To learn about AI based programming tools

COURSE ARTICULATION MATRIX:

*(Define Correlation of Course Outcomes with Program Outcomes and Program Specific Outcomes using **mapping levels 1 = Slight, 2 = Moderate and 3 = Substantial**)*

CO	PROGRAM OUTCOMES (PO)					
	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6
CO-1	3	2	1	1	1	1
CO-2	2	1	2	1	2	2
CO-3	3	1	2	2	-	-
CO-4	3	-	2	1	2	2
CO-5	2	-	2	2	3	3

UNIT–I:

Introduction: AI definition, Foundations of AI, History of AI, Agents and environments, Thenature of the Environment, Problem solving Agents, Problem Formulation, Search Strategies

UNIT–II:

Knowledge and Reasoning: Knowledge-based Agents, Representation, Reasoning and Logic, Prepositional logic, First-order logic, Using First-order logic, Inference in First-order logic, forward and Backward Chaining

UNIT–III:

Learning: Learning from observations, Forms of Learning, Inductive Learning, Learning decision trees, why learning works, Learning in Neural and Belief networks

UNIT–IV:

Practical Natural Language Processing: Practical applications, Efficient parsing, Scaling up the lexicon, Scaling up the Grammar, Ambiguity, Perception. Image formation, Image processing operations for Early vision, Speech recognition and Speech Synthesis

UNIT–V:

Robotics: Introduction, Tasks, parts, effectors, Sensors, Architectures, Configuration spaces, Navigation and motion planning, Introduction to AI based programming Tools

TEXT BOOKS:

1. Artificial Intelligence: A Modern Approach, Stuart Russell, Peter Norvig, 2nd Edition, Pearson Education, 2007
2. Artificial Neural Networks B. Yagna Narayana, PHI

REFERENCES:

1. Artificial Intelligence, E. Rich and K. Knight, 2ndEdition, TMH
2. Artificial Intelligence and Expert Systems, Patterson, PHI
3. Expert Systems: Principles and Programming, 4th Edition, Giarrantana / Riley, Thomson
4. PROLOG Programming for Artificial Intelligence, Ivan Bratka, 3rd Edition, Pearson Education
5. Neural Networks, Simon Haykin, PHI

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

M.Tech. III Semester

(22PE1CP23) QUANTUM COMPUTING

TEACHING SCHEME		
L	T/P	C
3	0	3

EVALUATION SCHEME				
SE	CA	ELA	SEE	TOTAL
30	5	5	60	100

COURSE PRE-REQUISITES: Basic knowledge on Linear Algebra, Theory of Computation

COURSE OBJECTIVES:

- To provide an insight of basics of quantum physics from a computer scientist's perspective
- To describe reality and understand the philosophical implications of quantum computing

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Demonstrate vector spaces, matrices, quantum state
CO-2: Illustrate density operator and quantum measurement theory
CO-3: Understand commutator algebra
CO-4: Analyze tensor products
CO-5: Understand quantum measurement theory

COURSE ARTICULATION MATRIX:
*(Define Correlation of Course Outcomes with Program Outcomes and Program Specific Outcomes using **mapping levels 1 = Slight, 2 = Moderate and 3 = Substantial**)*

CO	PROGRAM OUTCOMES (PO)					
	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6
CO-1	3	2	-	-	-	1
CO-2	3	2	-	2	2	1
CO-3	3	-	2	-	2	1
CO-4	3	2	-	-	2	1
CO-5	3	-	2	-	-	1

UNIT-I:
Qubit & Quantum States: The Qubit, Vector Spaces. Linear Combination Of Vectors, Uniqueness of a spanning set, basis & dimensions, inner Products, orthonormality, gram-schmidt orthogonalization, bra-ket formalism, the Cauchyschwarez and triangle Inequalities

UNIT-II:
Matrices & Operators: Observables, The Pauli Operators, Outer Products, The Closure Relation, Representation of operators using matrices, outer products &matrix representation, matrix representation of operators in two dimensional spaces, Pauli Matrix, Hermitian unitary and normal operator, Eigen values &Eigen Vectors, Spectral Decomposition, Trace of an operator, important properties of Trace, Expectation Value of Operator, Projection Operator,
Positive Operators.

UNIT-III:
Commutator Algebra, Heisenberg uncertainty principle, polar decomposition &singular values, Postulates of Quantum Mechanics.

UNIT-IV:
Tensor Products: Representing Composite States in Quantum Mechanics,Computing inner products, Tensor products of column vectors, operators and tensor products of Matrices.
Density Operator: Density Operator of Pure & Mix state, Key Properties, Characterizing Mixed State, Practical Trace & Reduce Density Operator, Density Operator & Bloch Vector.

UNIT-V:
Quantum Measurement Theory: Distinguishing Quantum states & Measures, Projective Measurements, Measurement on Composite systems, Generalized, Measurements, Positive Operator- Valued Measures.

TEXT BOOKS:
1. Quantum Computing without Magic, Zdzislaw Meglicki
2. Quantum Computing Explained, David McMahon

REFERENCES:
1. Quantum Computer Science, Marco Lanzagorta, Jeffrey Uhlmann
2. An Introduction to Quantum Computing, Phillip Kaye, Raymond Laflamme, Michele Mosca

ONLINE RESOURCES:
1. https://nptel.ac.in/courses/106106232

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

M.Tech. III Semester

(22PE1SE10) SOFTWARE CONCEPTUAL DESIGN

TEACHING SCHEME		
L	T/P	C
3	0	3

EVALUATION SCHEME				
SE	CA	ELA	SEE	TOTAL
30	5	5	60	100

COURSE PRE-REQUISITES: Basic knowledge on programming in any language, and should be familiar with basic programming constructs

COURSE OBJECTIVES:
- To think of software in terms of sub-systems, and understand what issues have to be considered in order to design these sub-systems
- To create a software conceptual design for a given design problem, and model them using Unified Modeling Language (UML) diagrams
- To evaluate their designs for functional and non-functional quality attributes

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Understand software subsystems
CO-2: Demonstrate issues to be considered in order to design these sub-systems
CO-3: Create a software conceptual design for a given design problem
CO-4: Model subsystem using Unified Modeling Language (UML) diagrams
CO-5: Evaluate their designs for functional and non-functional quality attributes

COURSE ARTICULATION MATRIX:
*(Define Correlation of Course Outcomes with Program Outcomes and Program Specific Outcomes using **mapping levels 1 = Slight, 2 = Moderate and 3 = Substantial**)*

CO	PROGRAM OUTCOMES (PO)					
	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6
CO-1	2	-	-	-	1	-
CO-2	-	2	-	-	2	1
CO-3	2	2	2	-	2	1
CO-4	2	-	-	-	2	1
CO-5	2	2	-	2	-	-

UNIT-I:
Deconstructing the software design process: Deconstructing a software system, Thinking of software in terms of components, Requirement specification, Software design and development, Software testing and maintenance, Software development models, Comparing and contrasting software development.

UNIT-II:
Designing Software using the FBS Framework: Creating a software conceptual design, How to start creating a software conceptual design, Using FBS (Function-Structure-Behavior) design framework, Creating software conceptual design using think & link.

UNIT-III:

Comprehending and Evaluating Software Designs: Comprehending and evaluating software designs (Brief Introduction), Software modelling, Unified modelling language (UML).

UNIT-IV:

Software Design Comprehension, VeriSIM: A learning environment for comprehending software design, Software design quality perspective.

UNIT-V:

The Next Steps - Where Does One Go From Here: Tying it all together, Software development process recap, Mapping Function-Behavior-Structure to software development process. Abstractions in modelling.

TEXT BOOK:

1. Software Engineering: A Precise Approach, Dr. Pankaj Jalote, Wiley

REFERENCES:

1. Cooperative Software Development, Dr. Amy Ko

ONLINE RESOURCES:

1. https://nptel.ac.in/courses/106101235

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

M.Tech. III Semester

(22PE1LI03) DIGITAL IMAGE PROCESSING

TEACHING SCHEME		
L	T/P	C
3	0	3

EVALUATION SCHEME				
SE	CA	ELA	SEE	TOTAL
30	5	5	60	100

COURSE OBJECTIVES:

- To introduce fundamentals of digital image processing and study image transforms
- To learn enhancement & restoration techniques in spatial and frequency domains
- To study and compare various image compression image segmentation and morphological algorithms
- To understand image analysis methods

COURSE OUTCOMES: After completion of the course, the student should be able to

CO-1: Understand the basic principles of digital image processing and perform image transforms

CO-2: Understand and perform basic image processing methods such as Image filtering operations, Image enhancement and restoration

CO-3: Analyze and compare various image compression image segmentation and Morphological techniques and their applications

CO-4: Design and implement various algorithms for image analysis

COURSE ARTICULATION MATRIX:

*(Define Correlation of Course Outcomes with Program Outcomes and Program Specific Outcomes using **mapping levels 1 = Slight, 2 = Moderate and 3 = Substantial**)*

CO	PROGRAM OUTCOMES (PO)					
	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6
CO-1	2	1	-	2	2	2
CO-2	2	1	-	2	2	2
CO-3	3	1	-	3	3	2
CO-4	3	1	-	3	3	3

UNIT–I:

Fundamentals of Image Processing: Digital Image Fundamentals, Basic steps of Image Processing System, Sampling and Quantization of an image, relationship between pixels, Imaging Geometry.

Image Transforms: 2 D-Discrete Fourier Transform, Discrete Cosine Transform (DCT), Haar Transform, Hadmard Transform, Hotelling Transform and slant transform.

UNIT–II:

Image Enhancement: Spatial domain methods: Histogram processing, Fundamentals of Spatial filtering, Smoothing spatial filters, Sharpening spatial filters.

Frequency Domain Methods: Basics of filtering in frequency domain, Image smoothing, Image sharpening, Selective filtering.

UNIT–III:

Image Segmentation: Segmentation concepts, Point, Line and Edge Detection, Edge Linking using Hough Transform, Thresholding, Region Based segmentation.

Wavelet Based Image Processing: Introduction to wavelet Transform, Continuous wavelet Transform, Discrete wavelet Transform, Filter banks, Wavelet based image segmentation.

UNIT–IV:

Image Compression: Image compression fundamentals - Coding Redundancy, Spatial and Temporal redundancy, Compression models - Lossy and Lossless, Huffman coding, Arithmetic coding, LZW coding, Run length coding, Bit plane coding, Transform coding, Predictive coding, JPEG Standards.

Image Restoration: Image Restoration Degradation model, Algebraic approach to restoration, Inverse Filtering, Least Mean square filters.

UNIT–V:

Morphological Image Processing: Dilation and Erosion, Opening and closing, The Hit or Miss Transformation, Morphological algorithms.

Representation and Description: Boundary following, chain codes, polygonal approximation using minimum - perimeter polygons, boundary segments, skeleton, simple boundary descriptors, shape number, simple regional descriptors.

TEXT BOOKS:

1. Digital Image Processing, Rafael C. Gonzalez and Richard E. Woods, 4th Edition, Pearson, 2018
2. Digital Image Processing, S. Jayaraman, S. Esakkirajan, T. Veerakumar, 5th Edition, TMH, 2015

REFERENCES:

1. Digital Image Processing, William K. Pratt, 3rd Edition, John Willey, 2007
2. Fundamentals of Digital Image Processing, A. K. Jain, 3rd Edition, PHI, 1989
3. Digital Image Processing using MATLAB, Rafael C. Gonzalez, Richard E. Woods and Steven L. Edding, 2nd Edition, TMH, 2010
4. Digital Image Processing and Computer Vision, Sonka, Hlavac, Boyl, Cengage Learning, 2008
5. Introduction to Image Processing and Analysis, John C. Russ, J. Christian Russ, CRC Press, 2008

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

M.Tech. III Semester

(22OE1CN01) BUSINESS ANALYTICS

TEACHING SCHEME		
L	T/P	C
3	0	3

EVALUATION SCHEME				
SE	CA	ELA	SEE	TOTAL
30	5	5	60	100

COURSE OBJECTIVES:

- To understand the role of business analytics within an organization and to analyze data using statistical and data mining techniques and understand relationships between the underlying business processes of an organization
- To gain an understanding of how managers use business analytics to formulate and solve business problems and to support managerial decision making and to become familiar with processes needed to develop, report, and analyze business data
- To use decision-making tools/Operations research techniques and to manage business process using analytical and management tools
- To analyze and solve problems from different industries such as manufacturing, service, retail, software, banking and finance, sports, pharmaceutical, aerospace etc.

COURSE OUTCOMES: After completion of the course, the student should be able to

CO-1: Apply knowledge of data analytics

CO-2: Think critically in making decisions based on data and deep analytics

CO-3: Use technical skills in predicative and prescriptive modeling to support business decision-making

CO-4: Translate data into clear, actionable insights

COURSE ARTICULATION MATRIX:

*(Define Correlation of Course Outcomes with Program Outcomes and Program Specific Outcomes using **mapping levels 1 = Slight, 2 = Moderate and 3 = Substantial**)*

CO	PROGRAM OUTCOMES (PO)					
	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6
CO-1	2	-	1	-	1	1
CO-2	3	-	2	-	1	2
CO-3	2	1	1	-	1	1
CO-4	1	2	1	-	1	1

UNIT-I:

Business Analytics: Overview of Business analytics, Scope of Business analytics, Business Analytics Process, Relationship of Business Analytics Process and organization, competitive advantages of Business Analytics.

Statistical Tools: Statistical Notation, Descriptive Statistical methods, Review of probability distribution and data modelling, sampling and estimation methods overview.

UNIT-II:

Trendiness and Regression Analysis: Modelling Relationships and Trends in Data, simple Linear Regression. Important Resources, Business Analytics Personnel, Data and models for Business analytics, problem solving, Visualizing and Exploring Data Business Analytics Technology.

UNIT-III:

Organization Structures of Business analytics, Team management, Management Issues, Designing Information Policy, Outsourcing, Ensuring Data Quality, Measuring contribution of Business analytics, Managing Changes.

Descriptive Analytics, predictive analytics, predicative Modelling, Predictive analytics analysis, Data Mining, Data Mining Methodologies, Prescriptive analytics and its step in the business analytics Process, Prescriptive Modelling, nonlinear Optimization.

UNIT-IV:

Forecasting Techniques: Qualitative and Judgmental Forecasting, Statistical Forecasting Models, Forecasting Models for Stationary Time Series, Forecasting Models for Time Series with a Linear Trend, Forecasting Time Series with Seasonality, Regression Forecasting with Casual Variables, Selecting Appropriate Forecasting Models.

Monte Carlo Simulation and Risk Analysis: Monte Carle Simulation Using Analytic Solver Platform, New-Product Development Model, Newsvendor Model, Overbooking Model, Cash Budget Model.

UNIT-V:

Decision Analysis: Formulating Decision Problems, Decision Strategies without Outcome Probabilities, Decision Trees, The Value of Information, Utility and Decision Making.

Recent trends in Embedded and collaborative business intelligence, Visual data recovery, Data Storytelling and Data journalism.

TEXT BOOKS:

1. Business Analytics-Principles, Concepts, and Applications, Marc J. Schniederjans, Dara G. Schniederjans, Christopher M. Starkey, Pearson
2. Business Analytics, James Evans, Pearson Education
3. Business Analytics, Purba Halady Rao, PHI, 2013

REFERENCES:

1. Business Analytics for Managers: Taking Business Intelligence Beyond Reporting, Gert H. N. Laursen, Jesper Thorlund, 2nd Edition, Wiley Publications
2. Business Analytics: Data Analysis & Decision Making, S. Christian Albright, Wayne L. Winston, 5th Edition, 2015
3. Business Intelligence Guidebook: From Data Integration to Analytics, Rick Sherman Elsevier, 2014

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

M.Tech. III Semester

(22OE1AM01) INDUSTRIAL SAFETY

TEACHING SCHEME		
L	T/P	C
3	0	3

EVALUATION SCHEME				
SE	CA	ELA	SEE	TOTAL
30	5	5	60	100

COURSE PRE-REQUISITES: Elements of Mechanical, Civil, Electrical and Industrial Engineering

COURSE OBJECTIVES:

- To achieve an understanding of principles, various functions and activities of safety management
- To communicate effectively information on Health safety and environment facilitating collaboration with experts across various disciplines so as to create and execute safe methodology in complex engineering activities
- To anticipate, recognize, and evaluate hazardous conditions and practices affecting people, property and the environment, develop and evaluate appropriate strategies designed to mitigate risk
- To develop professional and ethical attitude with awareness of current legal issues by rendering expertise to wide range of industries

COURSE OUTCOMES: After completion of the course, the student should be able to

CO-1: Apply risk management principles to anticipate, identify, evaluate and control physical, chemical, biological and psychosocial hazards

CO-2: Communicate effectively on health and safety matters among the employees and with society at large

CO-3: Demonstrate the use of state of the art occupational health and safety practices in controlling risks of complex engineering activities and understand their limitations

CO-4: Interpret and apply legislative / legal requirements, industry standards, and best practices in accident prevention programmes in a variety of workplaces

COURSE ARTICULATION MATRIX:

*(Define Correlation of Course Outcomes with Program Outcomes and Program Specific Outcomes using **mapping levels 1 = Slight, 2 = Moderate and 3 = Substantial**)*

CO	PROGRAM OUTCOMES (PO)					
	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6
CO-1	3	3	2	2	3	1
CO-2	-	-	-	-	2	3
CO-3	3	1	2	1	-	-
CO-4	-	2	-	1	-	2

UNIT-I:

Safety Management: Evaluation of modern safety concepts – Safety management functions – safety organization, safety department – safety committee, safety audit -

performance measurements and motivation – employee participation in safety and productivity.

UNIT-II:

Operational Safety: Hot metal Operation – Boiler, pressure vessels – heat treatment shop - gas furnace operation-electroplating-hot bending pipes – Safety in welding and cutting. Cold-metal Operation- Safety in Machine shop- metal cutting – shot blasting, grinding, painting – power press and other machines.

Safe Handling and Storage: Material Handling, Compressed Gas Cylinders, Corrosive Substances, Hydrocarbons, Waste Drums and Containers

UNIT-III:

Safety Measures: Layout design and material handling - Use of electricity – Management of toxic gases and chemicals – Industrial fires and prevention – Road safety– Safety of sewage disposal and cleaning – Control of environmental pollution – Managing emergencies in industrial hazards.

UNIT-IV:

Accident Prevention: Human side of safety – personal protective equipment – Causes and cost of accidents. Accident prevention programmes - Specific hazard control strategies - HAZOP – Training and development of employees – First Aid – Fire fighting devices – Accident reporting investigation.

UNIT-V:

Safety, Health, Welfare & Laws: Safety and health standards – Industrial hygiene – occupational diseases prevention - Welfare facilities – History of legislations related to safety–pressure vessel act- Indian boiler act- The environmental protection act – Electricity act - Explosive act.

TEXT BOOKS:

1. Safety Management, John V. Grimaldi and Rollin H. Simonds, All India Travellers Bookseller, 1989
2. Safety Management in Industry, Krishnan N. V., Jaico Publishing House, 1996

REFERENCES:

1. Occupational Safety Manual, BHEL
2. Industrial Safety and The Law, P. M. C. Nair Publishers
3. Managing Emergencies in Industries, Loss Prevention of India Ltd., Proceedings, 1999
4. Safety Security and Risk Management, U. K. Singh & J. M. Dewan, A. P. H. Publishing Company, 1996
5. Industrial Safety Management: Hazard Identification and Risk Control, L. M. Deshmukh, McGraw Hill, 2005

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

M.Tech. III Semester

(22OE1AM02) OPERATIONS RESEARCH

TEACHING SCHEME		
L	T/P	C
3	0	3

EVALUATION SCHEME				
SE	CA	ELA	SEE	TOTAL
30	5	5	60	100

COURSE OBJECTIVES:

- To analyze linear programming models in practical and their practical use
- To apply the transportation, assignment and sequencing models and their solution methodology for solving problems
- To apply inventory and queuing, inventory models and their solution methodology for solving problems
- To evaluate the simulation models

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Evaluate the problems using linear programming
CO-2: Analyze assignment, transportation problems
CO-3: Apply inventory and queuing problems for real time problems
CO-4: Model the real-world problem and simulate it

COURSE ARTICULATION MATRIX:
*(Define Correlation of Course Outcomes with Program Outcomes and Program Specific Outcomes using **mapping levels 1 = Slight, 2 = Moderate and 3 = Substantial**)*

CO	PROGRAM OUTCOMES (PO)					
	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6
CO-1	1	3	3	2	-	-
CO-2	1	3	3	3	-	-
CO-3	1	3	3	3	-	-
CO-4	1	3	3	3	-	-

UNIT-I:

Introduction to Operations Research: Definitions of OR, Characteristics of OR, Scope of OR, Classification of Optimization Techniques, models in OR, General L.P Formulation, Graphical solution, Simplex Techniques.

Allocation: Linear Programming Problem Formulation- Graphical solution-Simplex method-Artificial variables technique-Two phase method, Big-M Method-Duality Principle.

UNIT-II:

Transportation Problem: Formulation-Optimal solution-unbalanced transportation problem-Degeneracy. Assignment problem-Formulation-Optimal solution-Variations of Assignment Problem-Travelling Salesman Problem.

Sequencing: Introduction-Flow Shop sequencing-n jobs through two machines-n jobs through three machines-Job shop sequencing-two jobs through m machines.

UNIT-III:

Waiting Lines: Introduction-Single channel-Poisson arrivals-exponential service times-with infinite population and finite population models-Multichannel-Poisson arrivals-exponential service times with infinite population single channel Poisson arrivals.

UNIT-IV:

Inventory Models: Deterministic inventory, models - Probabilistic inventory control models

UNIT-V:

Simulation: Definition-Types of simulation models-phases of simulation-applications of simulation Inventory and Queuing problems-Advantages and Disadvantages-Brief Introduction of Simulation Languages.

TEXT BOOKS:

1. Operations Research, S. D. Sharma, Kedarnath Ramnath, Meerut
2. Engineering Optimization, S. S. Rao, New Age International, 2014
3. Introduction to Genetic Algorithms, S. N. Sivanandam, Springer

REFERENCES:

1. Operations Research-An Introduction, H. A. Taha, PHI, 2008
2. Principles of Operations Research, H. M. Wagner, PHI, 1982
3. Introduction to Optimization: Operations Research, J. C. Pant, Jain Brothers, 2008

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

M.Tech. III Semester

(22OE1AM03) ENTREPRENEURSHIP AND START-UPS

TEACHING SCHEME		
L	T/P	C
3	0	3

EVALUATION SCHEME				
SE	CA	ELA	SEE	TOTAL
30	5	5	60	100

COURSE OBJECTIVES:

- To motivate the engineers to inculcate the skills thereof in any professional role and to consider intrapreneurship or entrepreneurship as career choices for personal and societal growth
- To understand different Theories of Entrepreneurship and their Classification
- To create Feasibility Reports, Business, Project Plans and resolve Operational problems
- To understand the roles of Family, non-family entrepreneurs and learning about Startups' Opportunities, Corporate Legal and Intellectual Property related issues

COURSE OUTCOMES: After completion of the course, the student should be able to

CO-1: Understand the role of an entrepreneur in the economic development and discover societal problems as entrepreneurial opportunities and ideate to develop solutions through systematic and creative approaches to innovation and business strategy

CO-2: Learn different Theories of entrepreneurship, the role of Family and Non-Family entrepreneurs and problem-solving skills

CO-3: Create Marketing, Financial Plans and evaluate Structural, Financial and Managerial Problems

CO-4: Apply lean methodology to startup ideas using Business Model Canvas and be able to create Business Plans through establishing business incubators. Understand Corporate Legal and Intellectual Property related matters

COURSE ARTICULATION MATRIX:

*(Define Correlation of Course Outcomes with Program Outcomes and Program Specific Outcomes using **mapping levels 1 = Slight, 2 = Moderate and 3 = Substantial**)*

CO	PROGRAM OUTCOMES (PO)					
	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6
CO-1	2	1	3	2	-	3
CO-2	1	-	-	-	-	2
CO-3	1	-	-	-	-	2
CO-4	-	-	-	1	-	-

UNIT-I:

Entrepreneurship: Definition of Entrepreneur, Entrepreneurial motivation and barriers; Internal and external factors; Types of entrepreneurs, Personality and Skill Set of an Entrepreneur, Entrepreneurship as a career for engineers, scientists, and technologists.

UNIT-II:

Theories of Entrepreneurship: Classification of entrepreneurship. Creativity and Innovation: Creative Problems Solving, Creative Thinking, Lateral Thinking, Views of De Bono, Khandwala and others, Creative Performance in terms of motivation and skills.

Family and Non-Family Entrepreneurs: Role of Professionals, Professionalism vs. family entrepreneurs, Role of Woman entrepreneur, Sick industries, Reasons for Sickness, Remedies for Sickness, Role of BIFR in revival, Bank Syndications.

UNIT-III:

Creativity and Entrepreneurial Plan: Idea Generation, Screening and Project Identification, Creative Performance, Feasibility Analysis: Economic, Marketing, Financial and Technical; Project Planning, Evaluation, Monitoring and Control, segmentation, Targeting and positioning of Product, Role of SIDBI in Project Management.

UNIT-IV:

Operation Problems: Incubation and Take-off, Problems encountered Structural, Financial and Managerial Problems, Types of Uncertainty. Institutional support for new ventures: Supporting organizations; Incentives and facilities; Financial Institutions and Small-scale Industries, Govt. Policies for SSIs.

UNIT-V:

Startups' Opportunity Assessment, Business Models, Entrepreneur talk, Clinical/ Regulatory, Sector Specific Group Briefing by Advisory Committee, Corporate Legal and Intellectual Property, Pitching, Payers and Reimbursement, Pitch practice, Investors, Mistakes I Won't Repeat, Business Development and Exits, Finance, Budgeting, Team Building, Opportunities in Telangana State and India – incubators, schemes, accelerators.

TEXT BOOKS:

1. Understanding Enterprise: Entrepreneurship and Small Business, Bridge S. et al., Palgrave, 2003
2. Holt- Entrepreneurship: New Venture Creation, Prentice Hall, 1998
3. Entrepreneurship Development, Robert D. Hisrich, Michael P. Peters, Tata McGraw Hill

REFERENCES:

1. New Venture Creation: An Innovator's Guide to Entrepreneurship, Marc H. Meyer and Frederick G. Crane, 2nd Edition, Sage Publications
2. Technology Ventures: From Idea to Enterprise, Byers, Dorf, Nelson
3. Venture Deals: Be Smarter Than Your Lawyer and Venture Capitalist - Feld, Mendelson, Costolo
4. Breakthrough Entrepreneurship, Burgstone and Murphy
5. Business Model Generation, Alexander Osterwalder

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

M.Tech. III Semester

(22OE1PL01) WASTE TO ENERGY

TEACHING SCHEME		
L	T/P	C
3	0	3

EVALUATION SCHEME				
SE	CA	ELA	SEE	TOTAL
30	5	5	60	100

COURSE OBJECTIVES:
- To create awareness in students of energy conservation
- To identify the use of different types of Bio waste energy resources
- To understand different types of bio waste energy conservations
- To detect different waste conversion into different forms of energy

COURSE OUTCOMES: After completion of the course, the student should be able to
CO-1: Find different types of energy from waste to produce electrical power
CO-2: Estimate the use of bio waste to produce electrical energy
CO-3: Understanding different types of bio waste and its energy conversions
CO-4: Analyze the bio waste utilization and to avoid the environmental pollution

COURSE ARTICULATION MATRIX:
*(Define Correlation of Course Outcomes with Program Outcomes and Program Specific Outcomes using **mapping levels 1 = Slight, 2 = Moderate and 3 = Substantial**)*

CO	PROGRAM OUTCOMES (PO)					
	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6
CO-1	3	2	3	1	2	1
CO-2	3	3	3	3	2	3
CO-3	3	2	3	2	2	3
CO-4	3	3	3	3	2	3

UNIT-I:
Introduction to Energy From Waste: Classification of waste as fuel, Agro based, Forest residue, Industrial waste, MSW (Municipal solid waste) – Conversion devices – Incinerators, Gasifiers, Digestors. Urban waste to energy conversion, Biomass energy Programme in India.

UNIT-II:
Biomass Pyrolysis: Pyrolysis – Types, slow fast – Manufacture of charcoal – Methods - Yields and application – Manufacture of pyrolytic oils and gases, yields and applications.

UNIT-III:
Biomass Gasification: Gasifiers – Fixed bed system – Downdraft and updraft gasifiers – Fluidized bed gasifiers – Design, construction and operation – Gasifier burner arrangement for thermal heating – Gasifier engine arrangement and electrical power.

UNIT-IV:

Biomass Combustion: Biomass stoves – Improved chullahs, types, some exotic designs, Fixed bed combustors, Types, inclined grate combustors, Fluidized bed combustors, Design, construction and operation - Operation of all the above biomass combustors.

UNIT-V:

Biogas: Properties of biogas (Calorific value and composition) - Biogas plant technology and status - Bio energy system - Design and constructional features - Biomass resources and their classification - Biomass conversion processes - Thermo chemical conversion - Direct combustion - biomass gasification - pyrolysis and liquefaction - biochemical conversion - anaerobic digestion.

Types of biogas Plants – Applications - Alcohol production from biomass - Bio diesel production - Urban waste to energy conversion - Biomass energy programme in India.

TEXT BOOKS:

1. Biogas Technology-Transfer and Diffusion, M. M. EL-Halwagi, Elsevier Applied Science Publisher, 1984
2. Introduction to Biomass Energy Conversions, Sergio Capareda

REFERENCES:

1. Non-Conventional Energy, Desai Ashok V., Wiley Eastern Ltd., 1990
2. Biogas Technology - A Practical Hand Book, Khandelwal K. C. and Mahdi S. S., Vol. I & II, Tata McGraw Hill, 1983
3. Food, Feed and Fuel from Biomass, Challal D. S., IBH Publishing, 1991
4. Biomass Conversion and Technology, C. Y. WereKo-Brobby and E. B. Hagan, John Wiley & Sons, 1996