R18

M.Tech. (COMPUTER SCIENCE AND ENGINEERING)

M.Tech. R18 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 127 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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VISION OF THE INSTITUTE

To be a World Class University providing value-based education, conducting interdisciplinary research in cutting edge technologies leading to sustainable development of the nation

MISSION OF THE INSTITUTE

- To produce technically competent and socially responsible engineers, managers and entrepreneurs, who will be future ready.
- To involve students and faculty in innovative research projects linked with industry, academic and research institutions in India and abroad.
- To use modern pedagogy for improving the teaching-learning process.

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.

(COMPUTER SCIENCE AND ENGINEERING)

M.TECH. (CSE)

PROGRAM EDUCATIONAL OBJECTIVES

PEO-I: To provide students with sound foundations in Basic Sciences and fundamentals in Engineering Sciences.

PEO-II: To instill strong problem-solving skills through the courses of CSE.

PEO-III: To prepare students with hands on experience in implementing various software development concepts.

PEO-IV: To afford graduates with both fundamental and advanced knowledge of computer science and engineering that prepares them for excellence, leadership roles along diverse career paths, and integrate ethical behaviour.

PEO-V: To deliver graduates to design and implement solutions for rapidly changing computing problems and information system environments and lifelong learning to adapt innovation.

M.TECH. (CSE)

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: An ability to demonstrate a degree of mastery over the area as per the specialization of the program.

PO-4: An ability to apply the knowledge of engineering principles to develop software systems, products and processes thus to solve real world multifaceted problems.

PO-5: An ability to design and conduct experiments, procedures and technical skills necessary for engineering exploration to solve societal problems and environmental contexts for sustainable development.

PO-6: An ability to recognize the need to engage in self-governing and life-long learning by making use of professional and ethical principles.

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

(COMPUTER SCIENCE AND ENGINEERING)

I SEMESTER **R18**

Course Type	Course Code	Name of the Course	L	T	P	Credits
Professional Core-I	18PC1CP01	Mathematical Foundations of Computer Science	3	0	0	3
Professional Core-II	18PC1CP02	Advanced Data Structures	3	0	0	3
Professional Core-III	18PC1CP03	Machine Learning	3	0	0	3
Professional Elective-I	18PE1CP01	Distributed Computing	3	0	0	3
	18PE1SE03	Android Application Development				
	18PE1SE07	Scripting Languages				
Professional Elective -II	18PE1CP02	Data Science	3	0	0	3
	18PE1ES02	Internet of Things				
	18PE1CP03	Ethical Hacking and Computer Forensics				
Professional Core Lab-I	18PC2CP01	Advanced Data Structures Laboratory	0	0	3	1.5
Professional Core Lab-II	18PC2CP02	Machine Learning Laboratory	0	0	3	1.5
Project	18PW4CP01	Technical Seminar	0	0	4	2
Audit	18AU5CS01	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

(COMPUTER SCIENCE AND ENGINEERING)

II SEMESTER **R18**

Course Type	Course Code	Name of the Course	L	T	P	Credits
Professional Core-IV	18PC1CP04	Advanced Algorithms	3	0	0	3
Professional Core-V	18PC1CP05	Soft Computing	3	0	0	3
Professional Core-VI	18PC1CP06	Big Data Analytics	3	0	0	3
Professional Elective-III	18PE1CP04	Cloud Computing	3	0	0	3
	18PE1CP05	Advanced Network Programming				
	18PE1CP06	Network Security				
Professional Elective -IV	18PE1CP07	Advanced Operating Systems	3	0	0	3
	18PE1CP08	Dynamic Computer Networks				
	18PE1SE06	Web Services and Service Oriented Architecture				
Professional Core Lab-III	18PC2CP03	Advanced Algorithms Laboratory	0	0	3	1.5
Professional Core Lab-IV	18PC2CP04	Big Data Analytics Laboratory	0	0	3	1.5
Project	18PW4CP02	Mini-Project	0	0	4	2
Audit	18AU5EN01	English for Academic and Research Writing	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

(COMPUTER SCIENCE AND ENGINEERING)

III SEMESTER **R18**

Course Type	Course Code	Name of the Course	L	T	P	Credits
Professional Elective-V	18PE1CP09	Database Security	3	0	0	3
	18PE1CP10	Software Design and Engineering				
	18PE1CP11	Blockchain Technology				
Open Elective	18OE1CN01	Business Analytics	3	0	0	3
	18OE1AM01	Industrial Safety				
	18OE1AM02	Operations Research				
	18OE1AM03	Composite Materials				
	18OE1PS01	Waste to Energy				
Project	18PW4CP03	Project Part - I	0	0	16	8
Total			**6**	**0**	**16**	**14**

IV SEMESTER **R18**

Course Type	Course Code	Name of the Course	L	T	P	Credits
Project	18PW4CP04	Project Part - II	0	0	28	14
Total			**0**	**0**	**28**	**14**

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

M.Tech. I Semester (CSE)	**L**	**T/P**	**C**
	3	**0**	**3**

(18PC1CP01) MATHEMATICAL FOUNDATIONS OF COMPUTER SCIENCE

COURSE PRE-REQUISITES: Discrete Mathematics

COURSE OBJECTIVES:

- To understand the mathematical fundamentals that is prerequisites for a variety of courses like Data mining, Network protocols, analysis of Web traffic, Computer security, Software engineering, Computer architecture, operating systems, distributed systems, Bioinformatics, Machine learning
- To develop the understanding of the mathematical and logical basis to many modern techniques in information technology like machine learning, programming language design, and concurrency
- To study various sampling and classification problems.
- To construct various kinds of graphs

COURSE OUTCOMES: After completion of the course, students should be able to
CO-1: Understand the basic notions of discrete and continuous probability
CO-2: Understand the methods of statistical inference, and the role that sampling distributions play in those methods
CO-3: Able to perform correct and meaningful statistical analyses of simple to moderate complexity
CO-4: Analyze the techniques and applications of graph theory

UNIT-I:
Probability mass, density, and cumulative distribution functions, Parametric families of distributions, Expected value, variance, conditional expectation, Applications of the univariate and Central Limit Theorem, Probabilistic inequalities, Markov chains.

UNIT-II:
Random samples, sampling distributions of estimators, Methods of Moments and Maximum Likelihood.

UNIT-III:
Statistical inference, Introduction to multivariate statistical models: regression and classification problems, principal components analysis, The problem of overfitting model assessment.

UNIT-IV:
Graph Theory: Isomorphism, Planar graphs, graph colouring, Hamilton circuits and Euler cycles. Permutations and Combinations with and without repetition. Specialized techniques to solve combinatorial enumeration problems.

UNIT-V:
Computer science and engineering applications Data mining, Network protocols, analysis of Web traffic, Computer security, Software engineering, Computer architecture, operating systems, distributed systems, Bioinformatics, Machine learning.

UNIT-VI:
Recent Trends in various distribution functions in mathematical field of computer science for varying fields like bioinformatics, soft computing, and computer vision.

TEXT BOOKS:

1. Foundation Mathematics for Computer Science, John Vince, Springer
2. Probability and Statistics with Reliability, Queuing, and Computer Science Applications, K. Trivedi, Wiley

REFERENCES:

1. Probability and Computing: Randomized Algorithms and Probabilistic Analysis, M. Mitzenmacher and E. Upfal
2. Applied Combinatorics, Aln Tucker, Wiley

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M.Tech. I Semester (CSE)	**L**	**T/P**	**C**
	3	**0**	**3**

(18PC1CP02) ADVANCED DATA STRUCTURES

COURSE PRE-REQUISITES: Data Structures

COURSE OBJECTIVES:
- To choose appropriate data structures, understand the ADT/libraries, and use it to design algorithms for a specific problem
- To understand the necessary mathematical abstraction to solve problems
- To familiarize students with advanced paradigms and data structure used to solve algorithmic problems
- To come up with analysis of efficiency and proofs of correctness

COURSE OUTCOMES: After completion of the course, students should be able to
CO-1: Understand the implementation of symbol table using hashing techniques
CO-2: Develop and analyse algorithms for red-black trees, B-trees and Splay trees
CO-3: Develop algorithms for text processing applications
CO-4: Identify suitable data structures and develop algorithms for computational geometry problems

UNIT-I:
Algorithms, Performance analysis- time complexity and space complexity, Complexity Analysis Examples. Data structures-Linear and nonlinear data structures, ADT concept, Linear List ADT, Array representation, Linked representation, singly linked lists -insertion, deletion, search operations, doubly linked lists-insertion, deletion operations,

UNIT-II:
Dictionaries: Definition, Dictionary Abstract Data Type, Implementation of Dictionaries, Hashing: Review of Hashing, Hash Function, Collision Resolution Techniques in Hashing, Separate Chaining, Open Addressing, Linear Probing, Quadratic Probing, Double Hashing, Rehashing, Extendible Hashing.
Searching (linear and binary with and without recursion), counting and radix sorting techniques.

UNIT-III:
Trees: Binary Search Trees, AVL Trees, Red Black Trees, 2-3 Trees, B-Trees, Splay Trees.

UNIT-IV:
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.

UNIT-V:
Computational Geometry: One Dimensional Range Searching, Two Dimensional Range Searching, Introduction to Convex Hull, finding the convex hull and Graham scan approach.

UNIT-VI:
Recent Trends in Hashing (Introduction of tries), Tries, and various computational geometry methods for efficiently solving the new evolving problem (k-D trees)

TEXT BOOKS:

1. Data Structures and Algorithm Analysis in C++, Mark Allen Weiss, 2nd Edition, Pearson, 2004
2. Algorithm Design, M T Goodrich, Roberto Tamassia, John Wiley, 2002

REFERENCES:

1. The Design and Analysis of Computer Algorithms, Aho, Hopcroft, Ullman
2. Algorithm Design, Kleinberg and Tardos
3. Introduction to Algorithms, Cormen, Leiserson, Rivest, Stein

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M.Tech. I Semester (CSE)	**L**	**T/P**	**C**
	3	**0**	**3**

(18PC1CP03) MACHINE LEARNING

COURSE PRE-REQUISITES: Statistics and Linear Algebra

COURSE OBJECTIVES:
- To learn the concept of how to learn patterns and concepts from data without being explicitly programmed in various IOT nodes
- To design and analyze various machine learning algorithms and techniques with a modern outlook focusing on recent advances
- To explore supervised and unsupervised learning paradigms of machine learning
- To explore Deep learning technique and various feature extraction strategies

COURSE OUTCOMES: After completion of the course, students should be able to
CO-1: Understand wide variety of learning algorithms
CO-2: Compare and contrast pros and cons of various machine learning techniques and to get an insight of when to apply a particular machine learning approach
CO-3: Mathematically analyse various machine learning approaches and paradigms
CO-4: Apply machine learning algorithms to solve problems of moderate complexity

UNIT-I:
Introduction: Basic definitions, types of learning, hypothesis space and inductive bias, evaluation, cross-validation, Over fitting and Under fitting.

UNIT-II:
Supervised Learning (Regression/Classification):
- Basic methods: Distance-based methods, Nearest-Neighbours, Decision Trees, Bayes Rule & Naive Bayes
- Linear models: Linear Regression, Logistic Regression
- Support Vector Machines, Nonlinearity and Kernel Methods

UNIT-III:
Unsupervised Learning:
- Clustering: K-means, adaptive hierarchical clustering
- Generative Model: Gaussian Mixture Model
- Dimensionality Reduction: PCA and kernel PCA

UNIT-IV:
Evaluating Machine Learning algorithms and Model Selection, Introduction to Statistical Learning Theory, Ensemble Methods (Boosting, Bagging, Random Forests)

UNIT-V:
Sparse Modelling and Estimation, Modelling Sequence/Time-Series Data, Deep Learning and Feature Representation Learning

UNIT-VI:
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. The Elements of Statistical Learning, Trevor Hastie, Robert Tibshirani, Jerome Friedman
3. Pattern Recognition and Machine Learning, Christopher Bishop, Springer, 2007

REFERENCES:

1. Machine Learning, Tom Mitchell, First Edition, McGraw- Hill, 1997
2. Introduction to Machine Learning, Ethem Alpaydin, Second Edition, MIT Press, 2010

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M.Tech. I Semester (CSE)	**L**	**T/P**	**C**
	3	**0**	**3**

(18PE1CP01) DISTRIBUTED COMPUTING

COURSE PRE-REQUISITES: None

COURSE OBJECTIVES:
- To know exclusion algorithms, Deadlock detection algorithms and agreement protocols
- To gain insight on to the distributed resource management components viz. the algorithms
- To implement atomic transactions, recovery and commit protocols
- To know the components and management aspects of grid computing and cluster computing

COURSE OUTCOMES: After completion of the course, students should be able to
CO-1: Discuss the various synchronization, scheduling and memory management issues
CO-2: Demonstrate the Mutual exclusion, Deadlock detection and agreement protocols of Distributed operating system
CO-3: Discuss the various resource management techniques for distributed computing
CO-4: Identify the different features of grid computing and cluster computing

UNIT-I:
Introduction: The different forms of computing - Monolith Distributed, Parallel and cooperative computing, the meaning of Distributed computing, Examples of Distributed systems, the strengths and weaknesses of Distributed computing operating system concepts relevant to distributed computing, the architecture of distributed applications.

UNIT-II:
Distributed Computing Paradigms: Paradigms for Distributed Applications - Message Passing Paradigm, The Client-Server Paradigm (Java Socket API), The peer-to-peer Paradigm, Message system (or MOM) Paradigm - the point-to-point message model and the publish/subscribe message model, RPC model, The Distributed Objects Paradigms - RMI ORB, the object space Paradigm, The Mobile Agent Paradigm.

UNIT-III:
Distributed Objects Paradigm (RMI): Message passing versus Distributed Objects, An Archetypal Distributed Object Architecture, Distributed Object Systems, RPC, RMI, The Java RMI Architecture, Java RMI API, A sample RMI Application, steps for building an RMJ application, testing and debugging, comparison of RMI and socket API

UNIT-IV:
Distributed Object Paradigm (CORBA): The basic Architecture, The CORBA object interface, Inter-ORB protocols, object servers and object clients CORBA object references, CORBA Naming Service and the Interoperable Naming Service, CORBA object services, object Adapters, Java IDL, An example CORBA application.

UNIT-V:
Mutual Exclusion: A centralized algorithm, distributed algorithm, token ring algorithm, election algorithms, the bully algorithm, a ring algorithm, **Atomic Transactions**: Introduction, transaction model, transaction primitives, Properties of transactions, nested transactions, two-phase commit protocol **Concurrency Control**: Locking, optimistic concurrency control, timestamps,
Deadlocks in Distributed Systems: Distributed deadlock detection, centralized deadlock detection, distributed deadlock prevention

UNIT-VI:

Grid Computing: Definition of grid, grid types - computational grid, data grid, grid benefits and applications, drawbacks of grid computing, grid components, grid architecture and its relation to various Distributed Technologies.

Cluster Computing: Parallel computing overview, cluster computing - Introduction, Cluster Architecture, parallel programming models and Paradigms, Applications of Clusters.

TEXT BOOKS:

1. Distributed Computing, Principles and Applications, M. L. Liu, Pearson Education
2. Distributed Systems, Principles and Paradigms, A. S. Tanenbaum and M. V. Steen, Pearson Education
3. Client/Server Programming with Java and CORBA, R. Orfali & Dan I. larkey, Second Edition, John Wiley & Sons

REFERENCES:

1. A Networking Approach to Grid Computing, D. Minoli, Wiley & Sons
2. Grid Computing: A Practical Guide to Technology and Applications, A. Abbas, Firewall Media
3. Grid Computing, J. Joseph & C. Fellenstcin, Pearson Education
4. Distributed Systems, Concepts and Design, G. Coulouris, J. Dollimore and Tim Kindbirg, 3rd Edition, Pearson Education
5. High Performance Cluster Computing, Rajkumar Buyya, Pearson Education

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M.Tech. I Semester (CSE)	**L**	**T/P**	**C**
	3	**0**	**3**

(18PE1SE03) ANDROID APPLICATION DEVELOPMENT

COURSE OBJECTIVES:

- To understand the differences between android development environments and other public development environments
- To design and develop useful android applications with compiling user interfaces by using extending and creating own layouts and views by menus
- To demonstrate the advantage of android's API's for data storage, retrieval, user preferences, files, databases and content providers
- To design location based services and create rich map based applications

COURSE OUTCOMES: After completion of the course, students should be able to
CO-1: Appreciate the Mobility landscape
CO-2: Familiarize with Mobile apps development aspects
CO-3: Design and develop mobile apps, using Android as development platform, with key focus on user experience design, native data handling and background tasks and notifications
CO-4: Perform testing, signing, packaging and distribution of mobile apps

UNIT-I:
Introduction to Android: History of Mobile Software Development, The Open Handset Alliance, The Android Platform, Android SDK, Android Studio Installation, Building a Sample Android application.

UNIT-II:
Android Application Design Essentials: Anatomy of an Android applications, Android terminologies, Application Context, Activities, Intents, Receiving and Broadcasting Intents, User Interface Screen elements, Designing User Interfaces with Layouts, Fragments, Menus.

UNIT-III:
Working with Android Resources: Android Manifest File and its common settings, Using Intent Filter, Permissions, Working with different types of resources.

UNIT-IV:
Android Services: Android Service, Android Service API, Android Started Service, Android Bound Service, Android Service Life Cycle, Android Service Example.

UNIT-V:
Using Common Android APIs: Using Android Data and Storage APIs, Shared Preferences, Sharing Data between Applications with Content Providers, Managing data using SQLite.

UNIT-VI:
Device Connectivity: Bluetooth Tutorial, List Paired Devices, Working with WiFi , Working with Camera
Android Google Map: Android Map V2 API, Adding Map, Customizing Map, Google Map class, Android Google Map Application.

TEXT BOOKS:
1. J2ME: The Complete Reference, James Keogh, Tata McGraw Hill
2. Android Wireless Application Development, Lauren Darcey and Shane Conder, Pearson Education, 2nd Ed., 2011

REFERENCES:

1. Professional Android 2 Application Development, Reto Meier, Wiley India Pvt. Ltd.
2. Beginning Android, Mark L. Murphy, Wiley India Pvt. Ltd.
3. Pro Android, Sayed Y. Hashimi and Satya Komatineni, Wiley India Pvt. Ltd.
4. devloper.android.com (web)
5. Android Application Development All in one for Dummies, Barry Burd, 1st Edition

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

M.Tech. I Semester (CSE)	**L**	**T/P**	**C**
	3	**0**	**3**

(18PE1SE07) SCRIPTING LANGUAGES

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 PYTHON software solutions that accommodate specified requirements and constraints, based on analysis or modeling or requirements specification

COURSE OUTCOMES: After completion of the course, students should be able to
CO-1: Explain the differences between typical scripting languages and typical system and application programming languages
CO-2: Apply the syntax and semantics of languages such as PHP and PYTHON for effective scripting
CO-3: Create software systems using scripting languages, including Perl and Python
CO-4: Design and implement the appropriate software solutions using Scripting Languages

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.

UNIT-VI:
Introduction to Python language, Python-syntax, statements, functions, Built-in-functions and Methods, Modules in python, Exception Handling, Web Application Framework, Applications of Python programming.

TEXT BOOKS:

1. Beginning PHP and MySQL, Jason Gilmore, 3rd Edition, Dreamtech
2. Python Web Programming, Steve Holden and David Beazley, New Riders 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 Publication
4. Core Python Programming, Chun, Pearson Education

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M.Tech. I Semester (CSE)	**L**	**T/P**	**C**
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(18PE1CP02) DATA SCIENCE

COURSE PRE-REQUISITES: None

COURSE OBJECTIVES:
- To provide the knowledge and expertise to become a proficient data scientist
- To demonstrate an understanding of statistics and machine learning concepts that are vital for data science
- To produce Python code to statistically analyse a dataset
- To critically evaluate data visualizations based on their design and use for communicating stories from data

COURSE OUTCOMES: After completion of the course, students should be able to
CO-1: Explain how data is collected, managed and stored for data science
CO-2: Understand the key concepts in data science, including their real-world applications
CO-3: The toolkit used by data scientists
CO-4: Implement data collection and management scripts using MongoDB

UNIT-I:
Introduction to Core Concepts and Technologies: Introduction, Terminology, data science process, data science toolkit, Types of data, Example applications. Data Science Venn Diagram, Spawner recruit model, structured and unstructured data.

UNIT-II:
Data Collection and Management: Introduction, Sources of data, Data collection and APIs, Exploring and fixing data, Data storage and management, Using multiple data sources. Basic Mathematics: Symbols, Terminology, Vector and matrices, summation, proposition, set theory, basic linear algebra.

UNIT-III:
Data Analysis: Introduction, Terminology and concepts, Introduction to statistics, Central tendencies and distributions, Variance, Distribution properties and arithmetic, Samples/CLT, Basic machine learning algorithms, Linear regression, SVM, Naive Bayes .

UNIT-IV:
Data Visualisation: Introduction, Types of data visualisation, Data for visualisation: Data types, Data encodings, Retinal variables, Mapping variables to encodings, Visual encodings.

UNIT-V:
Applications of Data Science, Technologies for visualisation, Bokeh (Python)

UNIT-VI:
Recent Trends in various data collection and analysis techniques, various visualization techniques, application development methods of used in data science. Financial Modelling.

TEXT BOOKS:
1. Doing Data Science, Straight Talk From The Frontline, Cathy O'Neil and Rachel Schutt, O'Reilly
2. Mining of Massive Datasets, Jure Leskovek, Anand Rajaraman and Jeffrey Ullman, v2.1, Cambridge University Press

REFERENCES:

1. The Data Science Handbook, Field Cady, Wiley
2. Principles of Data Science, Sinan Ozdemir, Packt

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M.Tech. I Semester (CSE)	**L**	**T/P**	**C**
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(18PE1ES02) INTERNET OF THINGS

COURSE PRE-REQUISITES: Concepts of Programming in Java, C/C++, Embedded C, Concepts of Wireless Communication and Networking

COURSE OBJECTIVES:

- To understand the new paradigm of objects interacting with people, information systems and with other objects
- To introduce various IoT protocols
- To understand the issues in developing specific real time systems on various IoT platforms.

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

CO-1: Identify and describe different kinds of internet-connected products developed on various IoT platforms

CO-2: Appreciate the challenges involved in establishing user-interaction with connected-objects

CO-3: Develop prototype IoT application using python

UNIT-I:

Introduction to Internet of Things: Definition and Characteristics of IoT, Physical Design of IoT – IoT Architecture, Smart Objects, Bits and Atoms, IoT enabled Technologies – Wireless Sensor Networks, Cloud Computing, Big data analytics, Communication protocols, Embedded Systems.

UNIT-II:

IoT Standards and Protocols: Infrastructure (ex: 6LowPAN, IPv4/IPv6, RPL); Identification (ex: EPC, uCode, IPv6, URIs); Comms / Transport (ex: Wifi, Bluetooth, LoRa); Discovery (ex: Physical Web, mDNS, DNS-SD); Data Protocols (ex: MQTT, CoAP, AMQP, Websocket, Node); Device Management (ex: TR-069, OMA-DM); Semantic (ex: JSON-LD, Web Thing Model); Multi-layer Frameworks (ex: Alljoyn, IoTivity, Weave, Homekit).

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-Interfaces (serial, SPI, I2C) Programming – Python program with Raspberry PI with focus of interfacing external gadgets, controlling output, and reading input from pins.

UNIT-V:

IoT Platforms: Introduction to IoT Platforms (AWS IoT, IBM Watson, ARM Mbed), Cloud Storage models and communication APIs, Python web application framework Designing a RESTful web API.

UNIT-VI:

Iot Applications and Issues: Combination scenarios, Breaking assumptions: - Home, City, Environment, Energy, Retail, Logistics, Agriculture, Industry, health and Lifestyle with Case Studies

TEXT BOOKS:

1. Internet of Things - A Hands-on Approach, Arshdeep Bahga and Vijay Madisetti, Universities Press, 2015, ISBN: 9788173719547
2. Internet of Things: Converging Technologies for Smart Environments and Integrated Ecosystems, Dr. Ovidiu Vermesan, Dr. Peter Friess, River Publishers, 2007
3. Building the Internet of Things. Sara Cordoba, WimerHazenberg, Menno Huisman. BIS Publishers. 2011

REFERENCES:

1. Designing the Internet of Things, Adrian Mcewen, Hakin Cassimally, 2015
2. The Internet of Things: Key Applications and Protocols, Olivier Hersent, David Boswarthick, Omar Elloumi, 2012
3. Getting Started with Raspberry Pi, Matt Richardson & Shawn Wallace, O'Reilly (SPD), 2014, ISBN: 9789350239759
4. Securing the Internet of Things: A Standardization Perspective, Keoh, Sye Loong, Sahoo Subhendu Kumar, and Hannes Tschofenig, Internet of Things Journal, IEEE 1.3 (2014): 265-275

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

M.Tech. I Semester (CSE)	**L**	**T/P**	**C**
	3	**0**	**3**

(18PE1CP03) ETHICAL HACKING AND COMPUTER FORENSICS

COURSE PRE-REQUISITES: None

COURSE OBJECTIVES:
- To assess and measure threats to information assets
- To evaluate where information networks are most vulnerable
- To describe the origin of computer forensics and the relationship between law enforcement and industry
- To compose electronic evidence and the computing investigation process

COURSE OUTCOMES: After completion of the course, students should be able to
CO-1: Identify and analyze the stages an ethical hacker requires to take in order to compromise a target system
CO-2: Implement security techniques and tools used to protect system and user data
CO-3: Identify, analyze, and mitigate threats to internal computer systems
CO-4: Produce various forensic tools to collect digital evidence

UNIT-I:
Introduction to Hacking: Basics of Hacking Techniques, Ethics of Hacking, Hacking techniques, Information War, Introduction to Ethical Hacking.
Password Cracking: Introduction, Password Stealing, Password Crackers

UNIT-II:
Sniffers: Introduction to Sniffers, Working of a Sniffer, Sniffer Programs, Detecting a Sniffer, Protecting Against a Sniffer.
Buffer Overflows: Introduction, Types of Buffer Overflow, Methods to Cause a Buffer Overflow,
Buffer Overflows: Detection and Prevention

UNIT-III:
Denial-of-Service Attacks: Denial-of-Service Attacks, Flood Attacks, Software Attacks, Distributed Denial-of-Service, Prevention of DoS Attacks.
Scanning Tools: Introduction, Scanners.

UNIT-IV:
Introduction to Cyber Crime: Introduction and Overview of Cyber Crime, Nature and Scope of Cyber Crime, Types of Cyber Crime: Social Engineering, Categories of Cyber Crime, Property Cyber Crime

UNIT-V:
Introduction to Computer Forensics & Investigations: Computer Forensics & Investigations as a profession, understanding computer investigations, data acquisition, processing crime and incident scenes, Network forensics, cell phone and mobile device forensics.

UNIT-VI:
Searching and Seizing Computer Related Evidence; Processing Evidence and Report Preparation
Current Computer Forensics Tools: Evaluating Computer Forensics Tool Needs, Computer Forensics Software Tools, Computer Forensics Hardware Tools, Validating and Testing Forensics Software.

TEXT BOOKS:

1. Hacking Tools & Technique for Incident Handling, NIIT, PHI Learning
2. Computer Forensics and Investigations, Nelson, Phillips Enfinger, Steuart, Cengage Learning

REFERENCES:

1. Computer Forensics and Cyber Crime: An Introduction, Marjie T. Britz, Pearson
2. Ethical Hacking and Network Defense, Michael T. Simpson, Cengage Learning

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M.Tech. I Semester (CSE)	**L**	**T/P**	**C**
	0	**3**	**1.5**

(18PC2CP01) ADVANCED DATA STRUCTURES LABORATORY

COURSE PRE-REQUISITES: None

COURSE OBJECTIVES:

- To explain the data structures and their categories
- To understand abstract data types and differentiate linear and non-linear data structures
- To advance understanding of stack, queue and their applications
- To understand searching and sorting techniques in real-world scenarios

COURSE OUTCOMES: After completion of the course, students should be able to
CO-1: Understanding and applying the Techniques in Software Development Life cycle
CO-2: Apply fundamental knowledge of Data Structures in Real time applications
CO-3: Develop a project based on Algorithms and Data Structures
CO-4: Analyze and implement graphs and trees for real time applications

Sample Problems on Data structures:

1. Write a program to implement Hash Tables with Double Hashing
2. Write a program to implement all the functions of a dictionary (ADT) using Hashing
3. Write a program to implement Hash Tables with Linear Probing
4. Write a program to implement skip list search
5. Write a program to insert a record into the skip list
6. Write a program to implement BST(binary search tree) operations
7. Write a program to implement Red black tree operations
8. Write a program to implement AVL tree operations
9. Write a program to implement B-trees operations
10. Write a program for the Boyer-Moore Algorithm
11. Write a program for the Knuth-Morris-Pratt Algorithm
12. Write a program for the Huffman Coding Algorithm
13. Write a program to implement basic Insert, Search, Delete operations on K-D Tree
14. Write a program to implement Insert, Search operations on QuadTree
15. Write a program to implement One Dimensional Range searching
16. Write a program to implement Insert, Search, Delete operations on priority Search Tree

TEXT BOOKS:

1. Data Structures and Algorithms in Java, A. Drozdek, 3rd Edition, Cengage Learning
2. Data Structures with Java, J. R. Hubbard, 2nd Edition, Schaum"s Outlines, TMH
3. Data Structures and algorithms in Java, R. Lafore, 2nd Edition, Pearson Education

REFERENCES:

1. Data Structures using Java, D. S. Malik and P. S. Nair, Cengage Learning
2. Data structures, Algorithms and Applications in Java, S. Sahani, 2nd Edition, Universities Press
3. Design and Analysis of Algorithms, P. H. Dave and H. B. Dave, Pearson Education
4. Data Structures and Java Collections Frame Work, W. J. Collins, McGraw Hill
5. Java: The Complete Reference, Herbert Schildt, 7th Editon, TMH

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M.Tech. I Semester (CSE)	**L**	**T/P**	**C**
	0	**3**	**1.5**

(18PC2CP02) MACHINE LEARNING LABORATORY

COURSE PRE-REQUISITES: None

COURSE OBJECTIVES:

- To learn the concept of how to learn patterns and concepts from data
- To design and analyze various machine learning algorithms and techniques with a modern outlook focusing on recent advances
- Explore supervised and unsupervised learning paradigms of machine learning
- To explore Deep learning technique and various feature extraction strategies

COURSE OUTCOMES: After completion of the course, students should be able to
CO-1: Understand wide variety of learning algorithms
CO-2: Compare and contrast pros and cons of various machine learning techniques and to get an insight of when to apply a particular machine learning approach
CO-3: Mathematically analyze various machine learning approaches and paradigms
CO-4: Apply machine learning algorithms to solve problems of moderate complexity

WEEK 1: Installation of R Software. Installing various packages related to Machine Learning Aspects in R Language
WEEK 2: Basic Commands in R Language, vector operations and control structures
WEEK 3: Data types, Data Structures in R
WEEK 4: Import or Export data, Data Visualization and Data shaping in R
WEEK 5: Outlier Detection, Data Cleaning in R
WEEK 6: Classification of Data using Decision Trees using R
WEEK 7: Implementing Naive Bayes Algorithm
WEEK 8: Implementation of K Nearest Neighborhood Algorithm
WEEK 9: Implementation of K Means Algorithm
WEEK 10: Implementation of Support Vector Machine (SVM) Algorithm
WEEK 11: Implementation of Ensemble Learning
WEEK 12: Implementation of collaborative filtering algorithm for recommender system

TEXT BOOKS:

1. Beginning R: The Statistical Programming Language, Mark Gardener, First Edition, Wrox Publications
2. Machine Learning With R, Brett Lantz, Second Edition, Packt Publishing, 2015

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M.Tech. I Semester (CSE)	**L**	**T/P**	**C**
	0	**4**	**2**

(18PW4CP01) TECHNICAL SEMINAR

COURSE OUTCOMES: After completion of the course, students should be able to
CO-1: Identify a research topic related to advanced/state-of-the-art technologies
CO-2: Collect the literature and comprehend/analyze critically the technological advancements
CO-3: Engage in effective oral communication through presentation of seminar
CO-4: Engage in effective written communication through report

COURSE OUTLINE:

- A student shall present a seminar on a technical topic during I semester of the M.Tech. programme.
- A student, under the supervision of a faculty member, shall collect literature on a technical topic of his / her choice, critically review the literature and submit it to the Seminar Review Committee (SRC) in a prescribed report form.
- The SRC shall consist of Head of the Department, faculty supervisor and a senior faculty member of the specialization / department.
- Student shall make an oral presentation before the SRC after clearing the plagiarism check.
- Prior to the submission of seminar report to the SRC, its soft copy shall be submitted to the PG Coordinator for PLAGIARISM check.
- The report shall be accepted for submission to the SRC only upon meeting the prescribed similarity index.

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M.Tech. I Semester (CSE)	**L**	**T/P**	**C**
	2	**0**	**0**

(18AU5CS01) RESEARCH METHODOLOGY AND IPR

COURSE PRE-REQUISITES: None

COURSE OBJECTIVES:
- To introduce the characteristics of a good research problem
- To choose appropriate approaches of investigation of solutions for research problem
- To familiarize with basic Intellectual Property Rights
- To understand different Patent Rights

COURSE OUTCOMES: After completion of the course, students should be able to
CO-1: Understand research problem formulation, analyze research related information and follow research ethics
CO-2: Realize the importance of ideas, concept, and creativity in the present-day context
CO-3: Recognize that when IPR would take such important place in growth of individuals and nation, it is needless to emphasize the need of information about IPR to be promoted among students in general and engineering in particular
CO-4: Appreciate IPR protection which leads to creation of new and better products, and in turn brings about, economic growth and social benefits

UNIT-I:
Introduction: 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:
Literature Survey: 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.

UNIT-VI:
New Developments in IPR: Administration of Patent System. New developments in IPR; IPR of Biological Systems, Computer Software etc. Traditional knowledge Case Studies, IPR.

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. Resisting Intellectual Property, Halbert, Taylor & Francis Ltd, 2007

REFERENCES:

1. Research Methodology: A Step-by-Step Guide for Beginners, Ranjit Kumar, 2nd Edition
2. Research Methodology: Methods and Techniques, C. R. Kothari and Gaurav Garg, New Age International Publishers
3. Intellectual Property in New Technological Age, Robert P. Merges, Peter S. Menell, Mark A. Lemley, 2016
4. Intellectual Property Rights Under WTO, T. Ramappa, S. Chand, 2008

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M.Tech. II Semester (CSE)	**L**	**T/P**	**C**
	3	**0**	**3**

(18PC1CP04) ADVANCED ALGORITHMS

COURSE PRE-REQUISITES: UG level course in 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, students should be able to
CO-1: Analyze the complexity/performance of different algorithms
CO-2: Determine the appropriate data structure for solving a particular set of problems
CO-3: Categorize the different problems in various classes according to their complexity
CO-4: Have an insight of recent activities in the field of the advanced data structure

UNIT-I:
Sorting: Review of various sorting algorithms, topological sorting
Graph: Definitions and Elementary Algorithms: Shortest path by BFS, shortest path in edge-weighted case (Dijkasra's), depth-first search and computation of strongly connected components, emphasis on correctness proof of the algorithm and time/space analysis, example of amortized analysis.

UNIT-II:
Matroids: Introduction to greedy paradigm, algorithm to compute a maximum weight maximal independent set. Application to MST.
Graph Matching: Algorithm to compute maximum matching. Characterization of maximum matching by augmenting paths, Edmond's Blossom algorithm to compute augmenting path.

UNIT-III:
Flow-Networks: Maxflow-mincut 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, relation between the time complexities of basic matrix operations, LUP-decomposition.

UNIT-IV:
Shortest Path in Graphs: Floyd-Warshall algorithm and introduction to dynamic programming paradigm. More examples of dynamic programming.
Modulo Representation of integers/polynomials: Chinese Remainder Theorem, Conversion between base-representation and modulo-representation. Polynomials addition and Multiplication

UNIT-V:
Linear Programming: Geometry of the feasibility region and Simplex algorithm
NP-Completeness: P and NP Examples, Non-Deterministic algorithm for search, satisfiability, proof of NP-hardness and NP-completeness

UNIT-VI:
Recent Trends in problem solving paradigms using recent searching and sorting techniques by applying recently proposed data structures.

TEXT BOOKS:

1. Introduction to Algorithms, Cormen, Leiserson, Rivest, Stein
2. Fundamentals of Computer Algorithms, E. Horrowitz, S. salmi, S. Rajasekaran, Second Edition, University Press, 2007
3. Algorithm Design – Foundations, Analysis, and Internet Algorithms, M. T. Goodrich, R. Tomassia, John Wiley, 2002

REFERENCES:

1. The Design and Analysis of Computer Algorithms, Aho, Hopcroft, Ullman
2. Algorithm Design, Kleinberg and Tardos
3. Design Analysis and Algorithms, Hari Mohan Pandy, University Science Press, 2009

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M.Tech. II Semester (CSE)	**L**	**T/P**	**C**
	3	**0**	**3**

(18PC1CP05) SOFT COMPUTING

COURSE PRE-REQUISITES: Basic knowledge of Mathematics

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 an hand-on experience on MATLAB to implement various strategies

COURSE OUTCOMES: After completion of the course, students should be able to
CO-1: Identify and describe soft computing techniques and their roles in building intelligent machines
CO-2: Analyze fuzzy logic and reasoning to handle uncertainty and solve various engineering problems
CO-3: Apply neural networks and genetic algorithms to combinatorial optimization problems
CO-4: Evaluate and compare solutions by various soft computing approaches for a given problem

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), 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.

UNIT-VI:
Recent Trends in deep learning, various classifiers, 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 Pvt. Ltd., 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 Ed., PHI, 2003

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M.Tech. II Semester (CSE)	**L**	**T/P**	**C**
	3	**0**	**3**

(18PC1CP06) BIG DATA ANALYTICS

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, students 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

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 Modeling, Multivariate Analysis.

UNIT-II:
Classification and Clustering:
Classification: Rule Based Classifier, Nearest neighbor 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, Counting Distinct Elements in a Stream, Estimating Moments, Counting Oneness in a Window, Decaying Window

UNIT-IV:
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-V:
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-VI:
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, Second Edition, Elsevier, Reprinted 2008
4. Hadoop: The Definitive Guide, Tom White, Third Edition, O'Reilly Media, 2012

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M.Tech. II Semester (CSE)	**L**	**T/P**	**C**
	3	**0**	**3**

(18PE1CP04) CLOUD COMPUTING

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 AWS and learn to develop applications in AWS

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

CO-1: Articulate the main concepts, key technologies, strengths, and limitations of cloud computing

CO-2: Identify the architecture and infrastructure of cloud computing, including SaaS, PaaS, IaaS, public cloud, private cloud, hybrid cloud, etc.

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

CO-4: Identify problems, and explain, analyze, and evaluate various cloud computing solutions

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, the Enterprise Cloud Computing Paradigm.

UNIT-III:

Infrastructure as a Service (IAAS) & Platform and Software as a Service (PAAS / SAAS)Virtual machines provisioning and Migration services, On the Management of Virtual machines for Cloud Infrastructures, Enhancing Cloud Computing Environments using a cluster as a Service.

UNIT-IV:

Secure Distributed Data Storage in Cloud Computing. Aneka, Comet Cloud, T-Systems', Workflow Engine for Clouds, Understanding Scientific Applications for Cloud Environments. An Architecture for Federated Cloud Computing.

UNIT-V:

SLA Management in Cloud Computing, Performance Prediction for HPC on Clouds, Best Practices in Architecting Cloud Applications in the AWS cloud, Building Content Delivery networks using Clouds, Resource Cloud Mashups.

UNIT-VI:

Governance and Case Studies: Organizational Readiness and Change management in theCloud age, Data Security in the Cloud, Legal Issues in Cloud computing, Achieving Production Readiness for Cloud Services.

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

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M.Tech. II Semester (CSE)	**L**	**T/P**	**C**
	3	**0**	**3**

(18PE1CP05) ADVANCED NETWORK PROGRAMMING

COURSE OBJECTIVES:

- To introduce the student to Unix/Linux kernel programming techniques and 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

COURSE OUTCOMES: After completion of the course, students 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: Develop programs to provide Inter process communication to avoid classical IPC problems

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

UNIT-IV:
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, Example applications

Shared Memory- Kernel support for shared memory, UNIX system V APIs for shared memory, client/server example.

UNIT-V:

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-VI:

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, King Ables, 3rd Edition, Pearson Education

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M.Tech. II Semester (CSE)	**L**	**T/P**	**C**
	3	**0**	**3**

(18PE1CP06) NETWORK SECURITY

COURSE OBJECTIVES:
- To outline security concepts, threats, attacks, services and mechanisms
- To describe various cryptosystems- symmetric key cryptography, public key cryptography
- To apply authentication services, mechanisms and Email security
- To discuss the concepts of IP Security, web security, viruses and firewalls

COURSE OUTCOMES: After completion of the course, students should be able to
CO-1: Illustrate security issues, services, goals and mechanism of security
CO-2: Develop a security model to prevent, detect the attacks, using various mechanisms
CO-3: Examine the authenticity of the messages, communicate securely and investigate non repudiation
CO-4: Operate IP Security, SET, firewalls and establish trusted system

UNIT-I:
Introduction: Security Attacks, Services Mechanisms, A model for Internetwork security, Classical Encryption techniques, Fiestel Cipher Structure, Data Encryption Standard, Block Cipher Design Principles and Modes of Operation, Triple DES, RC-4,

UNIT-II:
Public Key Cryptography: Evaluation criteria for AES, AES Cipher, Placement of Encryption Function, Traffic Confidentiality.
Confidentiality using Symmetric Encryption – Principles of Public key Cryptosystems, RSA algorithm, Key Management, Diffie-Hellman key Exchange, Elliptic Curve Cryptography.

UNIT-III:
Authentication and Hash Functions: Buffer overflow, TCP session hijacking, ARP attacks, route table modification, UDP hijacking and man-in-the-middle attacks. Authentication requirements, Authentication functions, Message Authentication Codes, Hash Functions, Security of Hash Functions and MACs, MD5 message Digest algorithm , Secure Hash Algorithm, HMAC.

UNIT-IV:
Network Security: Email Security: Digital Signatures, Authentication Protocols, Digital Signature Standard, Authentication Applications: Kerberos.

UNIT-V:
Web Security: X.509 Authentication Service, Electronic Mail Security – PGP/ SMIME, IP security-Architecture, Authentication Header, Encapsulating Security Payload. Key Management, Web Security- Secure Socket Layer, Transport Layer Security and Secure Electronic Transaction

UNIT-VI:
System Level Security: Intrusion detection – password management –Viruses and related Threats – Virus Counter measures – Firewall Design Principles – Trusted Systems.

TEXT BOOKS:
1. Cryptography And Network Security – Principles and Practices, William Stallings, Fourth Edition, Prentice Hall of India, 2005
2. Hack Proofing Your Network, Ryan Russell, Dan Kaminsky, Rain Forest, Puppy, Joe Grand, David Ahmad, Hal Flynn Ido Dubrawsky, Steve W. Manzuik and Ryan Permeh, Wiley

Dreamtech

REFERENCES:

1. Network Security Essentials: Applications and Standards, William Stallings, Prentice Hall, Hardcover, November 1999, ISBN 0130160938
2. Security in Computing, Charles B. Pfleeger, Shari Lawrence Pfleeger, Third Edition, Pearson Education, 2003
3. Cryptography: Theory and Practice, Douglas R. Stinson, CRC Press, 1995, ISBN 0-8493-8521-0
4. Applied Cryptography, Bruce Schneier, John Wiley & Sons Inc., 2001

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

M.Tech. II Semester (CSE)	**L**	**T/P**	**C**
	3	**0**	**3**

(18PE1CP07) ADVANCED OPERATING SYSTEMS

COURSE OBJECTIVES:
- To understand main components of Real time Operating system and their working
- To study the operations performed by OS as a resource manager
- To understand the scheduling policies of DOS
- To implement the working principles of OS

COURSE OUTCOMES: After completion of the course, students should be able to
CO-1: Explain what a real-time operating system (RTOS) is, how real-time operating systems are useful for measurement and control applications
CO-2: Understand distributed operating system design issues, features and principles of working
CO-3: Analyze functions of Network operating systems
CO-4: Understand kernel Issues and development principles

UNIT-I:
Real-time Operating Systems: Introduction to Real-Time Operating Systems, Definitions, Role of an OS in Real Time Systems, Important Terminology and Concepts Example

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: Introduction, Overview, Issues and development principles, case study.

UNIT-VI:
Protection, privacy, access control and security issues, solutions.

TEXT BOOKS:
1. Applied Operating System Concepts, A. Silberschatz, Wiley, 2000
2. Operating System Principles, Lubemir F. Bic and Alan C. Shaw, Pearson Education, 2003
3. Distributed Operating Systems, Andrew S. Tanenbaum, PHI

REFERENCES:
1. Operating Systems: Internal and Design Principles, Stallings, 6th Ed., PE
2. Modern Operating Systems, Andrew S. Tanenbaum, 3rd Ed., PE
3. Operating System Principles, Abraham Silberchatz, Peter B. Galvin, Greg Gagne, 7th Ed., John Wiley
4. UNIX User Guide, Ritchie & Yates

5. UNIX Network Programming, W. Richard Stevens, 1998, PHI

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M.Tech. II Semester (CSE)	**L**	**T/P**	**C**
	3	**0**	**3**

(18PE1CP08) DYNAMIC COMPUTER NETWORKS

COURSE OBJECTIVES:
- To provide advanced background on relevant computer networking topics to have a comprehensive and deep knowledge in computer networks

COURSE OUTCOMES: After completion of the course, students should be able to
CO-1: Understand holistic approach to computer networking
CO-2: Understand the computer networks and their application
CO-3: Design simulation concepts related to packet forwarding in networks

UNIT-I:
Review of Computer Networks, Devices and the Internet: Internet, Network edge, Network core, Access Networks and Physical media, ISPs and Internet Backbones, Delay and Loss in Packet-Switched Networks, Networking and Internet - Foundation of Networking Protocols: 5-layer TCP/IP Model, 7-Layer OSI Model, Internet Protocols and Addressing. Multiplexers, Modems and Internet Access Devices, Switching and Routing Devices, Router Structure. The Link Layer and Local Area Networks-Link Layer, Introduction and Services, Error- Detection and Error-Correction techniques, Multiple Access Protocols, Link Layer Addressing, Ethernet, Interconnections: Hubs and Switches, PPP: The Point-to-Point Protocol, Link Virtualization

UNIT-II:
Data-link Protocols: Ethernet, Token Ring and Wireless (802.11). Wireless Networks and Mobile IP: Infrastructure of Wireless Networks, Wireless LAN Technologies, IEEE 802.11 Wireless Standard, Cellular Networks, Mobile IP, Wireless Mesh Networks (WMNs), Multiple access schemes Routing and Internetworking: Network–Layer Routing, Least-Cost-Path algorithms, NonLeast-Cost-Path algorithms, Intra-domain Routing Protocols, Inter-domain Routing Protocols, Congestion Control at Network Layer.

UNIT-III:
Logical Addressing: IPv4 Addresses, IPv6 Addresses - Internet Protocol: Internetworking, IPv4, IPv6, Transition from IPv4 to IPv6 – Multicasting Techniques and Protocols: Basic Definitions and Techniques, Intra-domain Multicast Protocols, Inter-domain Multicast Protocols, Node-Level Multicast algorithms

UNIT-IV:
Transport and Application Layer Protocols: Client-Server and Peer-To-Peer Application Communication, Protocols on the transport layer, reliable communication. Routing packets through a LAN and WAN. Transport Layer, Transmission Control Protocol (TCP), User Datagram Protocol (UDP), Mobile Transport Protocols, TCP Congestion Control. Principles of Network Applications,

UNIT-V:
The Web and HTTP, File Transfer: FTP, Electronic Mail in the Internet, Domain Name System (DNS), P2P File Sharing, Socket Programming with TCP and UDP,

UNIT-VI:
Building a Simple Web Server. Creating simulated networks and passing packets through them using different routing techniques. Installing and using network monitoring tools.

TEXT BOOKS:
1. Computer Networking: A Top-Down Approach, James F. Kuros and Keith W. Ross,

Pearson, 6th Edition, 2012
2. Computer Networks and Internets, Duglas E. Comer, 6th Edition, Pearson

REFERENCES:

1. A Practical Guide to Advanced Networking, Jeffrey S. Beasley and Piyasat Nilkaew, Pearson, 3rd Edition, 2012
2. Computer Networks, Andrew S. Tanenbaum, David J. Wetherall, Prentice Hall

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M.Tech. II Semester (CSE)	**L**	**T/P**	**C**
	3	**0**	**3**

(18PE1SE06) WEB SERVICES AND SERVICE ORIENTED ARCHITECTURE

COURSE OBJECTIVES:

- To define and design applications as combinations of services, and be able to discuss the emergent properties of those compositions
- To understand concepts, technology and design of service orientation and web services analyzing and designing business based on SOA principles
- To understand web service specifications and assess support by platforms like J2EE and .NET

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

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 Orientation and Object Orientation, Native Web Services support for 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-upstrategy, the agile strategy.
Service-Oriented Analysis (Part I-Introduction): Introduction to Service Oriented Analysis, Benefits of a Business-Centric SOA, Deriving Business Services.

Service Oriented Analysis (Part-II-Service Modelling): Service Modelling, Service Modelling guidelines, Classifying Service model logic, Contrasting Service modelling Approaches.

UNIT-VI:
Building SOA (Technology and Design)
Service Oriented Design (Part I-Introduction): Introduction to Service-Oriented Design, WSDL related XML Schema language basics. WSDL language basics, SOAP language basics, Service interface design tools.
Service Oriented Design (Part II-SOA Composition Guidelines): SOA Composing steps, Considerations for choosing service layers, Considerations for positioning core SOA standards, Considerations for choosing SOA extensions.
Service Oriented Design (Part III - Service Design): Service Design overview, Entity-centric business Service Design, Application Service Design, Task-centric business Service Design, Service Design guidelines.
Service Oriented Design (Part IV-Business Process Design): WS-BPEL language basics, WS-Coordination overview, Service Oriented Business process Design.
Fundamental WS-* Extensions: WS-Addressing language basics, WS-Reliable Messaging language basics, WS-Policy language basics, WS-Metadata Exchange language basics, WS-Security language basics.
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, Second 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

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M.Tech. II Semester (CSE)	**L**	**T/P**	**C**
	0	**3**	**1.5**

(18PC2CP03) ADVANCED ALGORITHMS LABORATORY

COURSE OBJECTIVES:
- To familiarize the students to the advanced methods of designing and analyzing algorithms
- To illustrate appropriate algorithms and use it for a specific problem
- To train the 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, students should be able to
CO-1: Implement the complexity/performance of different algorithms
CO-2: Determine the appropriate data structure for solving a particular set of problems
CO-3: Categorize the different problems in various classes according to their complexity
CO-4: Obtain an insight of recent activities in the field of the advanced data structures and algorithms

LIST OF PROGRAMS:

1. Write a program for Topological sorting.
2. Write a program for Shortest path by BFS.
3. Write a program for Dijkasras's Algorithm.
4. Write a program for maximum matching using edmonds blossom algorithm.
5. Write a program to implement Maxflow-minicut theorem.
6. Write a program to implements Ford-Fulkerson algorithm to compute maximum flow.
7. Write a program to implement strassen's algorithm.
8. Write a program to implement LUP-decomposition of a matrix.
9. Write a program to implement Floyd-Warshall Algorithm.
10. Write a program to implement to perform dfs using fast Fourier transform.
11. Write a program to implement the Schonhage-Strassen algorithm for Multiplication of Two Numbers.
12. Write a program to implement Binomial Probability using randomized algorithms.
13. Write a program to compute Modular power using number theoretic algorithms.
14. Write a program to implement greedy approximation algorithm for Graph Coloring.

TEXT BOOKS:
1. Introduction to Algorithms, Cormen, Leiserson, Rivest, Stein
2. Fundamentals of Computer Algorithms, E. Horrowitz, S. salmi, S. Rajasekaran, Second Edition, University Press, 2007
3. Algorithm Design – Foundations, Analysis, and Internet Algorithms, M. T. Goodrich, R. Tomassia, John Wiley, 2002

REFERENCES:
1. The Design and Analysis of Computer Algorithms, Aho, Hopcroft, Ullman
2. Algorithm Design, Kleinberg and Tardos
3. Design aAnalysis and Algorithms, Hari Mohan Pandy, University Science Press, 2009
4. A Practical Guide to Data Structures and Algorithms using Java, S. Goldman & K. Goldman, Chapman & Hall/CRC, Taylor & Francis Group. a. (Note: Use packages like java.io, java.util, etc.

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M.Tech. II Semester (CSE)	**L**	**T/P**	**C**
	0	**3**	**1.5**

(18PC2CP04) BIG DATA ANALYTICS LABORATORY

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, students 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

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 Pvt. Ltd.
2. Hadoop: The Definitive Guide, Tom White, Third Edition, O'Reilly Media, 2012

REFERENCES:

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

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M.Tech. II Semester (CSE)	**L**	**T/P**	**C**
	0	**4**	**2**

(18PW4CP02) MINI-PROJECT

COURSE OUTCOMES: After completion of the course, students 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 mini-project, submit it to the department in a prescribed report form.
- Evaluation of the mini-project 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.
- 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.

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M.Tech. II Semester (CSE)	**L**	**T/P**	**C**
	2	**0**	**0**

(18AU5EN01) ENGLISH FOR ACADEMIC AND RESEARCH WRITING

COURSE OBJECTIVES:
- To understand the usage of appropriate vocabulary (Formal, Informal, Gender Insensitive etc.)
- To understand the features and processes of academic writing
- To identify the resources
- To understand standard documentation styles

COURSE OUTCOMES: After completion of the course, students should be able to
CO-1: Use appropriate vocabulary (Formal, Informal, Slang, Gender Insensitive etc.)
CO-2: Employ processes of academic writing
CO-3: Identify the resources
CO-4: Understand standard documentation styles

UNIT- I:
Introduction to Research:
i. Identifying the topic
ii. Identifying Sources; Finding Sources
iii. Defining the broad area; Defining the specific area; Difference between a broad area and specific area
iv. Choosing a topic
v. Mechanics of Writing – Language, Tone, Style, Ethics

UNIT-II:
Referencing & Library Skills:
i. Literature Survey
ii. Writing Objectives
iii. Hypothesis
iv. Methodology
v. Prospects for Future Research

UNIT-III:
Academic Writing Skills:
i. Paraphrasing
ii. Summarizing
iii. Quoting
iv. Rewriting
v. Expansion

UNIT-IV:
Kinds of Academic Writing:
i. Essays
ii. Reports
iii. Reviews
iv. SOPs
v. Abstracts
vi. Proposals

UNIT-V:
Research Process:
i. Selection of Topic

ii. Formulation of Hypothesis
iii. Collection of Data
iv. Analysis of Data
v. Interpretation of Data
vi. Presentation of Data

UNIT-VI:

i. Title
ii. Abstract
iii. Introduction
iv. Literature Survey
v. Methodology
vi. Discussion
vii. Findings/Results
viii. Conclusion
ix. Documenting Sources

TEXT BOOKS:

1. Writing for Science, Goldbort R., Yale University Press (available on Google Books), 2006
2. Handbook of Writing for the Mathematical Sciences, Highman N., SIAM. Highman's Book, 1998

REFERENCES:

1. How to Write and Publish a Scientific Paper, Day R., Cambridge University Press, 2006
2. English for Writing Research Papers, Adrian Wall Work, Springer New York Dordrecht Heidelberg London, 2011
3. MLA Handbook for Research

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M.Tech. III Semester (CSE)	**L**	**T/P**	**C**
	3	**0**	**3**

(18PE1CP09) DATABASE SECURITY

COURSE OBJECTIVES:
- To understand the key issues associated with protecting database assets
- To analyze the levels of protection and response to security incidents
- To synthesize a consistent, reasonable database security system

COURSE OUTCOMES: After completion of the course, students should be able to
CO-1: Build a risk analysis model for a large database
CO-2: Implement identification and authentication procedures, fine-grained access control and data encryption techniques
CO-3: Plan Audit accounts and the database system
CO-4: Formulate methods for Back-up and Restore a database

UNIT-I:
Introduction to database security, Security in Information Technology, importance of data database review, identity theft
Levels of Security: Human level, Corrupt/careless User, Network/User Interface, Database application program, Database system, Operating System, Physical level.
Authentication and Authorization: Passwords, Profiles, Privileges and Roles Authentication: operating system authentication, database authentication, Network or third-party authentication, Database vector password policies, Authorization: User Account authorization

UNIT-II:
Database Vulnerabilities: Application Vulnerabilities, Application Security, OWASP Top 10 Web Security Vulnerabilities, non-validated input, Broken access control, Broken account/session management, Cross-site scripting (XSS) flaws, Buffer overflows.
SQL Injection flaws, Improper error handling, Insecure storage, Denial-ofservice, Insecure configuration management, Databases Security Controls
Security Models: Access Matrix Mode, Take-Grant Mode, Security Model for Distributed databases, Bell and LaPadula's Model Biba's Mode, The Lattice Model for the Flow Control conclusion.

UNIT-III:
Security Mechanisms: Introduction User Identification/Authentication Memory Protection Resource Protection Control Flow Mechanisms Isolation Security Functionalities in Some Operating Systems Trusted Computer System Evaluation Criteria
Security Software Design: Introduction A Methodological Approach to Security Software Design Secure Operating System Design Secure DBMS Design Security Packages Database Security Design

UNIT-IV:
Statistical Database Protection & Intrusion Detection Systems: Introduction Statistics Concepts and Definition, Types of Attacks Inference Controls evaluation Criteria for Control Comparison. Introduction IDES System RETISS System ASES System Discovery.
Securing Database to Database Communications: Monitor and limit outbound communications – secure database links – protect link usernames and passwords – monitor usage of database links – secure replication mechanisms - map and secure all data sources and sinks. Trojans – four types of database Trojans.

UNIT-V:

Models for the Protection of New Generation Database Systems-1: Introduction, A Model for the Protection of Frame Based Systems A Model for the Protection of Object-Oriented Systems SORION Model for the Protection of Object-Oriented Databases

Models for the Protection of New Generation Database Systems-2: A Model for the Protection of New Generation Database Systems: the Orion Model Jajodia and Kogan's Model A Model for the Protection of Active Databases Conclusions.

UNIT-VI:

Encrypting and Auditing the Data: Encrypting data in transit, encrypting data at rest, auditing architectures, audit trail, architectures of external audit systems, archive auditing information, secure auditing information, audit the audit system.

TEXT BOOKS:

1. Database Security and Auditing, Hassan A. Afyouni, India Edition, CENGAGE Learning, 2009
2. Database Security, *Castano,* Second Edition, Pearson Education
3. Ron Ben-Natan, Implementing Database Security and Auditing: A Guide for DBAs, Information Security Administrators and Auditors", Published by Elsevier, 2005

REFERENCES:

1. Database Security, Alfred Basta, Melissa Z. Gola, Cengage Learning
2. Web Application Security Scanners, http: // www. Window security.com/ software/Web- Application-Security/
3. SQL Injection, http://www.cgisecurity.com/development/sql.shtml

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M.Tech. III Semester (CSE)	**L**	**T/P**	**C**
	3	**0**	**3**

(18PE1CP10) SOFTWARE DESIGN AND ENGINEERING

COURSE OBJECTIVES:

- To develop in students the knowledge, understanding, skills and values to solve problems through the creation of software solutions
- To design and experiment with software prototypes
- To elicit, analyze and specify software requirements through a productive working relationship with project stakeholders
- To build solutions using different technologies, architectures and life-cycle approaches

COURSE OUTCOMES: After completion of the course, students should be able to
CO-1: Understanding of the historical developments that have led to current practices in software design and development, and of emerging trends and technologies in this field
CO-2: Acquiring and applying the skills in designing and developing software solutions
CO-3: Acquiring and using the skills required to schedule a software project
CO-4: Demonstrate an understanding of and apply current theories, models, and techniques that provide a basis for the software lifecycle

UNIT-I:
Introduction to Software Engineering: The evolving role of software, Changing Nature of Software, legacy software, Software myths.
A Generic View of Process: Software engineering- A layered technology, a process framework, The Capability Maturity Model Integration (CMMI), Process patterns, process assessment, personal and team process models.
Process Models: The waterfall model, Incremental process models, Evolutionary process models, Specialized process models, The Unified process.
Software Requirements: Functional and non-functional requirements, User requirements, System requirements, Interface specification, the software requirements document.
Requirements engineering process: Feasibility studies, Requirements elicitation and analysis, Requirements validation, Requirements management.

UNIT-II:
Software Design: The nature of the design process, transferring design knowledge, constraints upon the design process and product, recording design decisions, designing with others, context for design, economic factors, assessing design qualities, quality attributes of the design product, assessing the design process. Representing abstract ideas, design view points, the architecture concept, design methods, design patterns, design representations, rationale for design methods.
Design Processes and Strategies: The role of strategy in design methods, describing the design process – The D – Matrix, design by top-down decomposition, design by composition, organizational influences upon design.

UNIT-III:
Designing with Objects and Components: Designing with objects: Design practices for object-oriented paradigm, Object-oriented paradigm, Object-oriented frame works, Hierarchical object oriented design process and heuristics, the fusion method, the unified process.
Component-based Design: The component concept, designing with components, designing components, COTS.

User Interface Design: The Golden rules, Interface analysis and design models, user and task analysis, analysis of display content and work environment, applying interface design issues, design evaluation.

UNIT-IV:

Concepts of Software Projects:

Project Management: The management spectrum: people, product, process and project, W5HH principle, Critical practices.

Metrics for Process and Projects: Process metrics, project metrics, size-oriented metrics, function-oriented metrics, Object-oriented and use-case metrics, metrics for software quality, integrating metrics with in software process.

UNIT-V:

Project Scheduling and Management: Project Scheduling: Basic concepts, project scheduling, defining a task set and task network, timeline charts, tracking the schedule, tracking the progress for an OO project, Earned value analysis.

UNIT-VI

Risk Management: Reactive Vs. Proactive risk strategies, software risks, risk identification, risk projection, risk refinement, risk mitigation and monitoring, the RMMM plan.

TEXT BOOKS:

1. Software Design, David Budgen, Second Edition, Pearson Education, 2003
2. Software Engineering: A Practitioner's Approach, Roger S. Pressman, Sixth Edition, McGraw-Hill International Edition, 2005

REFERENCES:

1. Applying Domain- Driven Design and Patterns, Jimmy Nilsson, Pearson Education, 2006
2. Software Engineering Foundations, Ian Sommerville, Seventh Edition, Pearson Education, 2004
3. Software Project Management, Bob Hughes & Mike Cotterell, Fourth Edition, Tata McGraw-Hill
4. Software Engineering: A Primer, Waman S. Jawadekar, Tata McGraw-Hill, 2008
5. The Art of Project Management, Scott Berkun, O'Reilly, 2005

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M.Tech. III Semester (CSE)	**L**	**T/P**	**C**
	3	**0**	**3**

(18PE1CP11) BLOCKCHAIN TECHNOLOGY

COURSE OBJECTIVES:
- To get the terminologies and overview of Blockchain technology
- To study the concepts and foundation of Blockchain Technology
- To understand security mechanism and Consensus in Blockchain
- To design use cases and architecture Blockchain Technology
- To study benefits, limitations and identify application area of Blockchain Technology

COURSE OUTCOMES: After completion of the course, students should be able to
CO-1: Gain a clear understanding of the concepts that underlie digital distributed ledger
CO-2: Understand key mechanisms like decentralization, transparency and trust, Immutability
CO-3: Understand and apply the concept of Hash Function and Related Hash algorithms for high secure and availability of systems
CO-4: Learn how to design and implement any application in Blockchain Technology

UNIT-I:
Introduction to Blockchain Part I: Introduction to centralized decentralized and distributed system, History of Blockchain, Various technical definitions of Blockchain.
Introduction to Blockchain Technology Part II: Generic elements of a blockchain: Block, Transaction, Peer-to-peer network, Node, Smart contract, Why It's Called "Blockchain".

UNIT-II:
Concept of Blockchain Technology Part I: Cryptography, Hashing, Nonce, Distributed database, Consensus, Smart Contract, Component of block, Structure of Blockchain.
Concept of Blockchain Technology Part II: Applications of blockchain technology, Tiers of blockchain technology Bolckchain 0, Bolckchain 1, Bolckchain 2, Bolckchain 3, Generation of Blockchain X.

UNIT-III:
Cryptography and Technical Foundations: Cryptography, Confidentiality, Integrity, Authentication, Cryptographic primitives, Public and private keys, RSA, Discrete logarithm problem,
Hash Function: Message Digest (MD), Secure Hash Algorithms (SHAs), Design of Secure Hash Algorithms (SHA), SHA-256, Design of SHA3, Elliptic Curve Digital signature algorithm.

UNIT-IV:
Types of Blockchain: Public blockchains, Private blockchains, Semi-private blockchains, Sidechains, Permissioned ledger Distributed ledger Shared ledger Fully private and proprietary blockchains, Tokenized blockchains, Tokenless blockchains, CAP theorem and blockchain

UNIT-V:
Financial markets and trading, Trading, Exchanges, Trade life cycle, Order anticipators, Market manipulation.
Crypto Currency: Bitcoin, Bitcoin definition, Keys and addresses, Public keys in Bitcoin, Private keys in Bitcoin, Bitcoin currency units

UNIT-VI:
Implementation Platforms: Hyperledger as a protocol, Reference architecture, Hyperledger Fabric, Transaction Flow, Hyperledger Fabric Details, Fabric Membership, Fabric Membership

TEXT BOOKS:

1. Mastering Blockchain, Imaran Bashir

REFERENCES:

1. Blockchain For Dummies®, IBM Limited Edition, John Wiley & Sons, Inc.

VNR VIGNANA JYOTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

M.Tech. III Semester (CSE)	**L**	**T/P**	**C**
	3	**0**	**3**

(18OE1CN01) BUSINESS ANALYTICS

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, students 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

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.

UNIT-VI:

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 FT Press
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

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M.Tech. III Semester (CSE)	**L**	**T/P**	**C**
	3	**0**	**3**

(18OE1AM01) INDUSTRIAL SAFETY

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, students 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

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-Cold bending and chamfering of pipes – metal cutting – shot blasting, grinding, painting – power press and other machines

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 – Firefighting 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.

UNIT-VI:

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

TEXT BOOKS:

1. Safety Management, John V. Grimaldi and Rollin H. Simonds, All India Travellers Bookseller, New Delhi, 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 Publisher's, Trivandrum
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, New Delhi, 1996
5. Industrial Safety Management: Hazard Identification and Risk Control, L. M. Deshmukh, McGraw-Hill Education (India) Private Limited, 2005

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M.Tech. III Semester (CSE)	**L**	**T/P**	**C**
	3	**0**	**3**

(18OE1AM02) OPERATIONS RESEARCH

COURSE PRE-REQUISITES: Mathematics, Industrial Engineering

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 the theory of games, replacement, inventory and queuing models and their solution methodology for solving problems
- To evaluate the dynamic programming and simulation models

COURSE OUTCOMES: After completion of the course, students should be able to
CO-1: Apply and solve the dynamic programming problems
CO-2: Apply the concept of non-linear programming
CO-3: Carry out sensitivity analysis
CO-4: Model the real world problem and simulate it

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.

UNIT-II:
Revised simplex method - duality theory - dual simplex method – sensitivity or post optimality analysis - parametric programming

UNIT-III:
Nonlinear programming problem - Kuhn-Tucker condition, min cost flow problem - max flow problem - CPM/PERT

UNIT-IV:
Scheduling and sequencing, Inventory models, deterministic inventory, models - Probabilistic inventory control models - Geometric Programming.

UNIT-V:
Waiting line Models, Single and Multi-channel Problems, Dynamic Programming, Game Theory, Simulation.

UNIT-VI:
Introduction to Genetic Algorithms, Operators, applications to engineering optimization, Problems.

TEXT BOOKS:
1. Operations Research, S. D. Sharma, Kedarnath Ramnath, Meerut, New Delhi
2. Engineering Optimization, S. S. Rao, New Age International Publications, 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, Delhi, 1982
3. Introduction to Optimization: Operations Research, J. C. Pant, Jain Brothers, Delhi, 2008

4. Operations Research, Hitler Liebermann McGraw-Hill Pub., 2009
5. Operations Research, Pannerselvam, Prentice Hall of India, 2010

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M.Tech. III Semester (CSE)	**L**	**T/P**	**C**
	3	**0**	**3**

(18OE1AM03) COMPOSITE MATERIALS

COURSE PRE-REQUISITES: Maths, Physics, Chemistry, Engineering Mechanics, Mechanics of Solids

COURSE OBJECTIVES:
- To understand composite materials and their properties, relationship between them and manufacturing methods
- To understand the principles of material science applied to composite materials
- To study the equations to analyze problems by making good assumptions and learn systematic engineering methods to solve practical composite mechanics problems

COURSE OUTCOMES: After completion of the course, students should be able to
CO-1: Apply fundamental knowledge of mathematics to modeling and analysis of composite materials
CO-2: Understand the manufacturing methods of various composite materials
CO-3: Analyze the failure modes of composites

UNIT-I:
Introduction: Definition – Classification and characteristics of Composite materials. Advantages and application of composites. Functional requirements of reinforcement and matrix. Effect of reinforcement (size, shape, distribution, volume fraction) on overall composite performance.

UNIT-II:
Reinforcements: Preparation-layup, curing, properties and applications of glass fibers, carbon fibers, Kevlar fibers and Boron fibers. Properties and applications of whiskers, particle reinforcements.
Mechanical Behavior of Composites: Rule of mixtures, Inverse rule of mixtures. Isostrain and Isostress conditions.

UNIT-III:
Manufacturing of Metal Matrix Composites: Casting – Solid State diffusion technique, Cladding – Hot isostatic pressing. Properties and applications.
Manufacturing of Ceramic Matrix Composites: Liquid Metal Infiltration – Liquid phase sintering. Manufacturing of Carbon – Carbon composites: Knitting, Braiding, Weaving. Properties and applications.

UNIT-IV:
Manufacturing of Polymer Matrix Composites: Preparation of Moulding compounds and prepregs – hand layup method – Autoclave method – Filament winding method – Compression moulding – Reaction injection moulding. Properties and applications, Introduction to Machining of Composites.

UNIT-V:
Elastic Behavior of Laminate: Basic assumptions, Strain-displacement relations, Stress-strain relation of layer within a laminate, Force and moment resultant, General load–deformation relations, Analysis of different types of laminates

UNIT-VI:
Strength: Laminar Failure Criteria-strength ratio, maximum stress criteria, maximum strain criteria, interacting failure criteria, hygrothermal failure. Laminate first ply failure-insight

strength; Laminate strength-ply discount truncated maximum strain criterion; strength design using caplet plots; stress concentrations.

TEXT BOOKS:

1. Material Science and Technology, Vol. 13–Composites, R. W. Cahn – VCH, West Germany
2. Analysis and Performance of Fiber Composites, Third Edition, B. D. Agarwal, Wiley Publishers

REFERENCES:

1. Mechanics of Composite Materials, Second Edition. Robert M. Jones, Scripta Book Company
2. Materials Science and Engineering-An Introduction, W. D. Callister Jr., Adapted by R. Bala Subramaniam, John Wiley & Sons, NY, Indian Edition, 2007
3. Composite Materials, K. K. Chawla
4. Composite Materials Science and Applications, Deborah D. L. Chung
5. Composite Materials Design and Applications, Danial Gay, Suong V. Hoa and Stephen W. Tasi

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M.Tech. III Semester (CSE)	**L**	**T/P**	**C**
	3	**0**	**3**

(18OE1PS01) WASTE TO ENERGY

COURSE PRE-REQUISITES: None

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, students should be able to
CO1: Find different types of energy from waste to produce electrical power
CO2: Estimate the use of bio waste to produce electrical energy
CO3: Understand different types of bio waste and its energy conversions
CO4: Analyze the bio waste utilization to avoid the environmental pollution

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

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 – Equilibrium and kinetic consideration in gasifier operation.

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.

UNIT-VI:
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, New York, 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 Handbook, Khandelwal, K. C. and Mahdi, S. S., Vol. I & II, Tata McGraw-Hill Publishing Co. Ltd., 1983
3. Food, Feed and Fuel from Biomass, Challal, D. S., IBH Publishing Co. Pvt. Ltd., 1991
4. Biomass Conversion and Technology, C. Y. WereKo-Brobby and E. B. Hagan, John Wiley & Sons, 1996

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M.Tech. III Semester (CSE)	**L**	**T/P**	**C**
	0	**16**	**8**

(18PW4CP03) PROJECT PART-I

M.Tech. IV Semester (CSE)	**L**	**T/P**	**C**
	0	**28**	**14**

(18PW4CP04) PROJECT PART-II

COURSE OUTCOMES: After completion of the course, students should be able to
CO-1: Identify and formulate the problem (Industry/technical/societal)
CO-2: Analyze, design and develop a solution to industry/technical/societal problems
CO-3: Implement and execute the solution
CO-4: Demonstrate effective communication skills through oral presentation
CO-5: Engage in effective written communication through project report

COURSE OUTLINE:

- M.Tech. project work shall be for a minimum duration of 40 weeks spread over two semesters i.e., Project Part-I in III semester and Project Part-II in IV semester.
- A student shall be permitted to register for the major project after satisfying the attendance requirement in all the courses, i.e., theory and practical courses.
- Project reviews namely Project Review I and Project Review II in III semester and Project Review III and Project Pre-submission Seminar in IV semester shall be conducted during the course of Project work.
- A Project Review Committee (PRC) consisting of the Head of the Department as Chairperson and PG Coordinator, Project Supervisor and one senior faculty member of the Department offering the M. Tech. programme as members shall evaluate the progress of project work.
- In Project Review I, a student, in consultation with his Project Supervisor, shall present the title, objective and plan of action of his/her project work to the PRC for approval within four weeks from the commencement of III semester.
- A student can initiate the project work only after obtaining the approval of the PRC.
- The work on the project shall be initiated at the beginning of the III semester.
- Project Review II shall be conducted and evaluated at the end of the III semester.
- Project Review III shall be conducted during IV semester to examine the overall progress of the project work.
- A project pre-submission seminar shall be conducted to decide whether or not the project is eligible for final submission.
- After approval from the PRC, a soft copy of the thesis shall be submitted for PLAGIARISM check to the Examination Branch.
- At the end of IV semester upon fulfilling the above conditions, project viva-voce shall be conducted.
- A student shall submit project progress in prescribed report format during each of the project reviews.