JAWAHARLALNEHRUTECHNOLOGICALUNIVERSITYHYDERABAD
M.Tech. INFORMATION TECHNOLOGY
EFFECTIVE FROM ACADEMIC YEAR 2025-26 ADMITTED BATCH

R25 COURSE STRUCTURE AND SYLLABUS

I YEAR I–SEMESTER

Course Code	Course Title	L	T	P	Credits
Professional Core- I	Full Stack Development	3	0	0	3
Professional Core- II	Advanced Data Structures	3	0	0	3
Professional Elective - I	1. Web and Social Media Analytics 2. Database Programming with PL/SQL 3. Mobile Application Development	3	0	0	3
Professional Elective - II	1. IT Project Management 2. Enterprise Architecture 3. Information Security	3	0	0	3
Lab- I	Advanced Data Structures Lab	0	0	4	2
Lab- II	Professional Elective-I Lab	0	0	4	2
	Research Methodology & IPR	2	0	0	2
Audit-I	Audit Course-I	2	0	0	0
	Total	**16**	**0**	**8**	**18**

Professional Elective-I and Professional Elective-I Lab must be of same course.

I YEAR II–SEMESTER

Course Code	Course Title	L	T	P	Credits
Professional Core- III	Deep Learning	3	0	0	3
Professional Core- IV	Natural Language Processing	3	0	0	3
Professional Elective-III	1. Game Development 2. Enterprise Cloud Concepts 3. Big Data Analytics	3	0	0	3
Professional Elective-IV	1. UI and UX Design 2. Augmented Reality and Virtual Reality 3. Agile Methodology	3	0	0	3
Lab- III	Deep Learning & Natural Language Processing Lab	0	0	4	2
Lab- IV	Professional Elective-III Lab	0	0	4	2
	Mini Project with Seminar	0	0	4	2
Audit-II	Audit Course- II	2	0	0	0
	Total	**14**	**0**	**12**	**18**

Professional Elective-III and Professional Elective-III Lab must be of same course.

II YEAR I – SEMESTER

Course Code	Course Title	L	T	P	Credits
Professional Elective - V	1. DevOps 2. Edge & Fog Computing 3. Blockchain Technology	3	0	0	3
Open Elective	Open Elective	3	0	0	3
Dissertation	Dissertation Work Review- II	0	0	12	6
	Total	**6**	**0**	**12**	**12**

II YEAR II-SEMESTER

Course Code	Course Title	L	T	P	Credits
Dissertation	Dissertation Work Review- III	0	0	12	6
Dissertation	Dissertation Viva-Voce	0	0	28	14
	Total	**0**	**0**	**40**	**20**

***For Dissertation Work Review-I, Please R25 Academic Regulations.**

Audit Course I&II:

1. Research Paper Writing in English
2. Disaster Management
3. Sanskrit for Technical Knowledge
4. Value Education
5. Constitution of India
6. Pedagogy Studies
7. Stress Management by yoga
8. Personality Development Through Life Enlightenment Skills

Open Electives for other Departments:

1. Intellectual Property Rights
2. Fault Tolerance Systems
3. Intrusion Detection Systems
4. Digital Forensics
5. Optimization Techniques
6. Cyber Physical Systems
7. Graph Analytics

FULL STACK DEVELOPMENT (PC-1)

M.Tech IT I Year I Sem.

L	T	P	C
3	0	0	3

Course Objectives:

1. To learn the core concepts of both the frontend and backend programming course. 2. To get familiar with the latest web development technologies.
2. To learn all about databases.
3. To learn complete web development process
4. To provide an in-depth study of the various web development tools

Course Outcomes:

1. Develop a fully functioning website and deploy on a web server.
2. Gain Knowledge about the front end and back end Tools
3. Find and use code packages based on their documentation to produce working results in a project.
4. Create web pages that function using external data.

UNIT - I:
Web Development Basics: Web development Basics - HTML & Web servers Shell - UNIX CLI Version control - Git & Github HTML, CSS

UNIT - II:
Frontend Development: Javascript basics OOPS Aspects of JavaScript Memory usage and Functions in JS AJAX for data exchange with server jQuery Framework jQuery events, UI components etc. JSON data format.

UNIT - III:
REACT JS: Introduction to React React Router and Single Page Applications React Forms, Flow Architecture and Introduction to Redux More Redux and Client-Server Communication

UNIT - IV:
Java Web Development: JAVA PROGRAMMING BASICS, Model View Controller (MVC) Pattern MVC Architecture using Spring RESTful API using Spring Framework Building an application using Maven

UNIT - V:
Databases & Deployment: Relational schemas and normalization Structured Query Language (SQL) Data persistence using Spring JDBC Agile development principles and deploying application in Cloud

TEXT BOOKS:

1. Web Design with HTML, CSS, JavaScript and JQuery Set Book by Jon Duckett Professional JavaScript for Web Developers Book by Nicholas C. Zakas
2. Learning PHP, MySQL, JavaScript, CSS & HTML5: A Step-by-Step Guide to Creating Dynamic Websites by Robin Nixon
3. Full Stack JavaScript: Learn Backbone.js, Node.js and MongoDB. Copyright © 2015 BY AZAT MARDAN

REFERENCE BOOKS:

1. Full-Stack JavaScript Development by Eric Bush.
2. Mastering Full Stack React Web Development Paperback – April 28, 2017 by Tomasz Dyl, Kamil Przeorski , Maciej Czarnecki

ADVANCED DATA STRUCTURES (PC - II)

M.Tech IT I Year I Sem.

L	T	P	C
3	0	0	3

Prerequisites: A course on "Data Structures"

Course Objectives

1. Introduces the heap data structures such as leftist trees, binomial heaps, Fibonacci and min- max heaps
2. Introduces a variety of data structures such as disjoint sets, hash tables, search structures and digital search structures

Course Outcomes

1. Ability to select the data structures that efficiently model the information in a problem
2. Ability to understand how the choice of data structures impact the performance of programs
3. Design programs using a variety of data structures, including hash tables, search structures and digital search structures

UNIT - I

Heap Structures

Introduction, Min-Max Heaps, Leftist trees, Binomial Heaps, Fibonacci heaps.

UNIT - II

Hashing and Collisions

Introduction, Hash Tables, Hash Functions, different Hash Functions: Division Method, Multiplication Method, Mid-Square Method, Folding Method, Collisions

UNIT - III

Search Structures: OBST, AVL trees, Red-Black trees, Splay trees,

Multiway Search Trees: B-trees, 2-3 trees

UNIT - IV

Digital Search Structures

Digital Search trees, Binary tries and Patricia, Multiway Tries, Suffix trees, Standard Tries, Compressed Tries

UNIT - V

Pattern matching

Introduction, Brute force, the Boyer –Moore algorithm, Knuth-Morris-Pratt algorithm, Naïve String, Harspool, Rabin Karp

TEXT BOOKS:

1. Fundamentals of data structures in C++ Sahni, Horowitz, Mehatha, Universities Press.
2. Introduction to Algorithms, TH Cormen, PHI

REFERENCES:

1. Design methods and analysis of Algorithms, SK Basu, PHI.
2. Data Structures & Algorithm Analysis in C++, Mark Allen Weiss, Pearson Education.
3. Fundamentals of Computer Algorithms, 2nd Edition, Ellis Horowitz, Sartaj Sahni, Sanguthevar Rajasekaran, Universities Press.

WEB AND SOCIAL MEDIA ANALYTICS (Professional Elective - I)

M.Tech IT I Year I Sem.

L	T	P	C
3	0	0	3

Course Objectives: Exposure to various web and social media analytic techniques.

Course Outcomes:

1. Knowledge on decision support systems
2. Apply natural language processing concepts on text analytics
3. Understand sentiment analysis
4. Knowledge on search engine optimization and web analytics

UNIT - I

Introduction: Definition, Process, Key terms: Site references, Keywords and Key phrases; building block terms: Visit characterization terms, Content characterization terms, Conversion metrics; Categories: Offsite web, On site web; Web analytics platform, Web analytics evolution, Need for web analytics, Advantages, Limitations. Data Collection: Click stream Data: Web logs, Web Beacons, JavaScript tags, Packet Sniffing; Outcomes Data: E-commerce, Lead generation, Brand/Advocacy and Support; Research data: Mindset, Organizational structure, Timing; Competitive Data: Panel-Based measurement, ISP-based measurement, Search Engine data.

UNIT - II

Web Metrics: Common metrics: Hits, Page views, Visits, Unique visitors, Unique page views, Bounce, Bounce rate, Page/visit, Average time on site, New visits; Optimization (e-commerce, non e-commerce sites): Improving bounce rates, Optimizing adwords campaigns; Real time report, Audience report, Traffic source report, Custom campaigns, Content report, Google analytics, Introduction to KPI, characteristics, Need for KPI, Perspective of KPI, Uses of KPI. Relevant Technologies: Internet & TCP/IP, Client / Server Computing, HTTP (Hypertext Transfer Protocol), Server Log Files & Cookies, Web Bugs.

UNIT - III

Introduction to Social Media Analytics (SMA): Social media landscape, Need for SMA; SMA in Small organizations; SMA in large organizations; Application of SMA in different areas Network fundamentals and models: The social networks perspective - nodes, ties and influencers, Social network and web data and methods. Graphs and Matrices- Basic measures for individuals and networks. Information visualization

UNIT - IV

Making connections: Link analysis. Random graphs and network evolution. Social contexts: Affiliation and identity. Web analytics tools and techniques: Click stream analysis, A/B testing, online surveys, Use of Google Analytics; Web crawling and Indexing; Natural Language Processing Techniques for Micro-text Analysis

UNIT - V

Facebook Analytics: Introduction, parameters, demographics. Analyzing page audience. Reach and Engagement analysis. Post-performance on FB, Use of Facebook Business Manager; Social campaigns. Measuring and Analyzing social campaigns, defining goals and evaluating outcomes, Network Analysis. (LinkedIn, Instagram, YouTube Twitter etc.

TEXT BOOKS:

1. Clifton B., Advanced Web Metrics with Google Analytics, Wiley Publishing, Inc.2nd ed.
2. Mathew Ganis, Avinash Koihrkar Social Media Analytics IBM Press 2015 / 1st

REFERENCES:

1. Jim Sterne Social Media Metrics Wiley Latest
2. Oliver Blanchard Social Media ROI Que Publishing Latest
3. Marshall Sponder, Gorah F. Khan Digital Analytics for Marketing Routledge 2017 / 1st
4. Marshall Sponder Social Media Analytics McGraw Hill Latest
5. Kaushik A., Web Analytics 2.0, The Art of Online Accountability and Science of

Customer Centricity, Wiley Publishing, Inc. 1st ed.
6. Sterne J., Web Metrics: Proven methods for measuring web site success, John Wiley and Sons

DATABASE PROGRAMMING WITH PL/SQL (Professional Elective - I)

M.Tech IT I Year I Sem.

L	T	P	C
3	0	0	3

Course Objectives:

1. Knowledge on significance of SQL fundamentals.
2. Evaluate functions and triggers of PL/SQL
3. Knowledge on control structures, packages in PL/SQL and its applications

Course Outcomes:

1. Understand importance of PL/SQL basics
2. Implement functions and procedures using PL/SQL
3. Understand the importance of triggers in database

UNIT - I

PL/SQL Basics: Block Structure, Behavior of Variables in Blocks, Basic Scalar and Composite Data Types, Control Structures, Exceptions, Bulk Operations, Functions, Procedures, and Packages, Transaction Scope.

UNIT - II

Language Fundamentals & Control Structures: Lexical Units, Variables and Data Types, Conditional Statements, Iterative Statements, Cursor Structures, Bulk Statements, Introduction to Collections, Object Types: Varray and Table Collections, Associative Arrays, Oracle Collection API.

UNIT - III

Functions and Procedures: Function and Procedure Architecture, Transaction Scope, Calling Subroutines, Positional Notation, Named Notation, Mixed Notation, Exclusionary Notation, SQL Call Notation, Functions, Function Model Choices, Creation Options, Pass-by-Value Functions, Pass-by- Reference Functions, Procedures, Pass-by-Value Procedures, Pass-by-Reference Procedures, Supporting Scripts.

UNIT - IV

Packages: Package Architecture, Package Specification, Prototype Features, Serially Reusable Precompiler Directive, Variables, Types, Components: Functions and Procedures, Package Body, Prototype Features, Variables, Types, Components: Functions and Procedures, Definer vs. Invoker Rights Mechanics, Managing Packages in the Database Catalog, Finding, Validating, and Describing Packages, Checking Dependencies, Comparing Validation Methods: Timestamp vs. Signature.

UNIT - V

Triggers: Introduction to Triggers, Database Trigger Architecture, Data Definition Language Triggers, Event Attribute Functions, Building DDL Triggers, Data Manipulation Language Triggers, Statement- Level Triggers, Row-Level Triggers, Compound Triggers, INSTEAD OF Triggers, System and Database Event Triggers, Trigger Restrictions, Maximum Trigger Size, SQL Statements, LONG and LONG RAW Data Types.

TEXT BOOKS:

1. Oracle Database 12c PL/SQL Programming Michael McLaughlin, McGrawHill Education

REFERENCES:

1. Benjamin Rosenzweig, Elena Silvestrova Rakhimov, Oracle PL/SQL by example Fifth Edition
2. Dr. P. S. Deshpande, SQL & PL / SQL for Oracle 11g Black Book

MOBILE APPLICATION DEVELOPMENT (Professional Elective - I)

M.Tech IT I Year I Sem.

L	T	P	C
3	0	0	3

Pre-requisites:

1. Acquaintance with JAVA programming
2. A Course on DBMS

Course Objectives:

1. To demonstrate their understanding of the fundamentals of Android operating systems
2. To improves their skills of using Android software development tools
3. To demonstrate their ability to develop software with reasonable complexity on mobile platform
4. To demonstrate their ability to deploy software to mobile devices
5. To demonstrate their ability to debug programs running on mobile devices

Course Outcomes:

1. Students understand the working of Android OS Practically.
2. Student will be able to develop Android user interfaces
3. Students will be able to develop, deploy and maintain the Android Applications.

UNIT - I

Introduction to Android Operating System: Android OS design and Features – Android development framework, SDK features, Installing and running applications on Android Studio, Creating AVDs, Types of Android applications, Best practices in Android programming, Android tools Android application components – Android Manifest file, Externalizing resources like values, themes, layouts, Menus etc, Resources for different devices and languages, Runtime Configuration Changes

Android Application Lifecycle – Activities, Activity lifecycle, activity states, monitoring state changes

UNIT - II

Android User Interface: Measurements – Device and pixel density independent measuring UNIT - s Layouts – Linear, Relative, Grid and Table Layouts

User Interface (UI) Components –Editable and non-editable TextViews, Buttons, Radio and Toggle Buttons, Checkboxes, Spinners, Dialog and pickers

Event Handling – Handling clicks or changes of various UI components

Fragments – Creating fragments, Lifecycle of fragments, Fragment states, Adding fragments to Activity, adding, removing and replacing fragments with fragment transactions, interfacing between fragments and Activities, Multi-screen Activities

UNIT - III

Intents and Broadcasts: Intent – Using intents to launch Activities, Explicitly starting new Activity, Implicit Intents, Passing data to Intents, Getting results from Activities, Native Actions, using Intent to dial a number or to send SMS

Broadcast Receivers – Using Intent filters to service implicit Intents, Resolving Intent filters, finding and using Intents received within an Activity

Notifications – Creating and Displaying notifications, Displaying Toasts

UNIT - IV

Persistent Storage: Files – Using application specific folders and files, creating files, reading data from files, listing contents of a directory Shared Preferences – Creating shared preferences, saving and retrieving data using Shared Preference

UNIT - V

Database – Introduction to SQLite database, creating and opening a database, creating tables, inserting retrieving and etindelg data, Registering Content Providers, Using content Providers (insert, delete, retrieve and update)

TEXT BOOKS:

1. Professional Android 4 Application Development, Reto Meier, Wiley India, (Wrox), 2012

2. Android Application Development for Java Programmers, James C Sheusi, Cengage Learning, 2013

REFERENCE BOOK:

1. Beginning Android 4 Application Development, Wei-Meng Lee, Wiley India (Wrox), 2013

IT PROJECT MANAGEMENT (Professional Elective - II)

M.Tech IT I Year I Sem.

L	T	P	C
3	0	0	3

Pre-requisites:

1. A course on “Software Engineering”.

Course Objectives: Knowledge on fundamental concepts of scope, time, quality of information technology project management.

Course Outcomes:

1. Understand the fundamentals of project management and information technology context
2. Analyze project integration management
3. Understand the significance of project scope and time management
4. Discuss the importance of project quality management

UNIT - I

Introduction to Project Management: Introduction, What Is a Project, Program and Project Portfolio Management, The Role of the Project Manager, The Project Management Profession.
The Project Management and Information Technology Context: A Systems View of Project Management, Understanding Organizations, Stakeholder Management, Project Phases and the Project Life Cycle, The Context of Information Technology Projects, Recent Trends Affecting Information Technology Project Management.

UNIT - II

Project Integration Management: What Is Project Integration Management? Strategic Planning and Project Selection, Developing a Project Charter, Developing a Project Management Plan, Directing and Managing Project Execution, Monitoring and Controlling Project Work, Performing Integrated Change Control, Closing Projects or Phases, Using Software to Assist in Project Integration Management.

UNIT - III

Project Scope Management: What Is Project Scope Management? Collecting Requirements, Defining Scope, Creating the Work Breakdown Structure, Verifying Scope, Controlling Scope
Project Time Management: The Importance of Project Schedules, Defining Activities, Sequencing Activities, Estimating Activity Resources, Estimating Activity Durations, Developing the Schedule, Controlling the Schedule, Using Software to Assist in Project Time Management.

UNIT - IV

Project Cost Management: The Importance of Project Cost Management, Basic Principles of Cost Management, Planning Cost Management, Estimating Costs, Determining the Budget, Controlling Costs Using Project, Management Software to Assist in Project Cost Management, Considerations for Agile/Adaptive Environments.
Project Quality Management: The Importance of Project Quality Management, What Is Project Quality Management? Planning Quality, Performing Quality Assurance, Performing Quality Control, Modern Quality Management, Improving Information Technology Project Quality, Using Software to Assist in Project Quality Management

UNIT - V

Project Resource Management: The Importance of Resource Management, What Is Project Resource Management? Keys to Managing and Leading People, Motivation Theories, Developing the Resource Management Plan and Team Charter, Estimating Activity Resources, Developing the Project Team, Managing the Project Team, Controlling Resources, Using Software to Assist in Resource Management, Considerations for Agile/Adaptive Environments
Project Risk Management: The Importance of Project Risk Management, Planning Risk Management, Common Sources of Risk on IT Projects, Identifying Risks, Performing Qualitative Risk Analysis, Performing Quantitative Risk Analysis, Planning Risk Responses, Implementing Risk Responses, Monitoring Risks, Using Software to Assist in Project Risk Management, Considerations for Agile/Adaptive Environments

TEXT BOOK:

1. Kathy Schwalbe, information Technology Project Management, 8th edition

REFERENCES:

1. Software Project Management, Bob Hughes and Mike Cotterell: Tata McGraw-Hill Edition.
2. Software Project Management, Joel Henry, Pearson Education.
3. Software Project Management in practice, Pankaj Jalote, Pearson Education. 2005

ENTERPRISE ARCHITECTURE (Professional Elective - II)

M.Tech IT I Year I Sem.

L	T	P	C
3	0	0	3

Course Objectives:

1. Learn the fundamentals of EA
2. Study the business architecture
3. Understand the organizational structure of EA
4. Comprehend enterprise engineering
5. Gain insights into cloud computing opportunities for EA

Course Outcomes:

1. Learn the fundamentals of EA
2. Study the business architecture
3. Understand the organizational structure of EA
4. Comprehend enterprise engineering
5. Gain insights into cloud computing opportunities for EA

Unit I

Introduction to EA -System analysis, general system theory, definitions and objectives of considerations, Properties of EA, system approach to EA development, principle definitions

Unit II

Business architecture, definition and features, BSC – balanced score card basics and its reflection in EA, Strategic governance, Event Causality effects in EA under scope of BSC

Unit III

Organizational structure of EA and basic models, Information and technology architecture basics, Introduction to EA structuring and modeling, Business architecture (inc. business process modeling, IBM Component business model), Information architecture, Technology architecture and integration between the layers model

Unit IV

Introduction to enterprise engineering (EE), Enterprise transformations (waterfall and agile), EAP, EA methodologies: PRISM, ARIS Framework, Zachmann Framework , FEAF, DODAF and TOGAF, Introduction to Service orientation in Enterprise Engineering (SOA, SoEA), Technological infrastructure for Big Data handling in EA

Unit-V

Cloud Computing Opportunities for EA, Flexible (agile) business and information architectures (SoEA).

Introduction to Spark, Spark Data Frames, SQL, Datasets through worked examples. Spark's low level APIs, RDDS, execution of SQL & Data Frames.

How Spark Runs on a Cluster.

Structured Streaming, Spark's Stream – Processing Engine.

Suggested Reading

1. Designing Enterprise Architecture Frameworks: Integrating Business Processes with IT Infrastructure by N Zarvić, R Wieringa. Apple Academic Press (19 April 2016), 360 p. URL: https://doi.org/10.1201/b16417
2. Neubauer M., Stary CH., S-BPM in the Production Industry. Stakeholder approach, Springer Open, 2017. URL: https://www.springer.com/gp/book/9783319484655
3. A systematic literature review on Enterprise Architecture Implementation Methodologies by Babak D., Mohd N. Elsevier (June 2015), p. 1-20. URL: https://doi.org/10.1016/j.infsof.2015.01.012
4. Spark : The Definite Guide – Bill Chambers, MateiZaharia, 2018.

INFORMATION SECURITY (Professional Elective - II)

M.Tech IT I Year I Sem.

L	T	P	C
3	0	0	3

Prerequisites

1. A Course on “Computer Networks and a course on Mathematics

Course Objectives

1. To understand the fundamentals of Cryptography
2. To understand various key distribution and management schemes
3. To understand how to deploy encryption techniques to secure data in transit across data networks
4. To apply algorithms used for secure transactions in real world applications

Course Outcomes

1. Demonstrate the knowledge of cryptography, network security concepts and applications.
2. Ability to apply security principles in system design.
3. Ability to identify and investigate vulnerabilities and security threats and mechanisms to counter them.

UNIT - I

Security Attacks (Interruption, Interception, Modification and Fabrication), Security Services (Confidentiality, Authentication, Integrity, Non-repudiation, access Control and Availability) and Mechanisms, A model for Internetwork security.
Classical Encryption Techniques, DES, Strength of DES, Differential and Linear Cryptanalysis, Block Cipher Design Principles and Modes of operation, Blowfish, Placement of Encryption Function, Traffic Confidentiality, key Distribution, Random Number Generation.

UNIT - II

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

UNIT - III

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

UNIT - IV

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

UNIT - V

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

TEXT BOOK:

1. Cryptography and Network Security (principles and approaches) by William Stallings Pearson Education, 4th Edition.

REFERENCES:

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

ADVANCED DATA STRUCTURES LAB (Lab - I)

M.Tech IT I Year I Sem.

L	T	P	C
3	0	0	3

Prerequisites:

1. A course on Computer Programming & Data Structures

Course Objectives:

1. Introduces the basic concepts of Abstract Data Types.
2. Reviews basic data structures such as stacks and queues.
3. Introduces a variety of data structures such as hash tables, search trees, tries, heaps, graphs, and B-trees.
4. Introduces sorting and pattern matching algorithms.

Course Outcomes:

1. Ability to select the data structures that efficiently model the information in a problem.
2. Ability to assess efficiency trade-offs among different data structure implementations or combinations.
3. Implement and know the application of algorithms for sorting and pattern matching.
4. Design programs using a variety of data structures, including hash tables, binary and general tree structures, search trees, tries, heaps, graphs, and B-trees.

List of Programs

1. Write a program to perform the following operations:

a) Insert an element into a binary search tree.
b) Delete an element from a binary search tree.
c) Search for a key element in a binary search tree.

2. Write a program for implementing the following sorting methods:
   a) Merge sort b) Heap sort c) Quick sort

3. Write a program to perform the following operations:
   a) Insert an element into a B- tree.
   b) Delete an element from a B- tree.
   c) Search for a key element in a B- tree.

4. Write a program to perform the following operations:
   a) Insert an element into a Min-Max heap
   b) Delete an element from a Min-Max heap
   c) Search for a key element in a Min-Max heap

5. Write a program to perform the following operations:
   a) Insert an element into a Lefiist tree
   b) Delete an element from a Leftist tree
   c) Search for a key element in a Leftist tree

6. Write a program to perform the following operations:
   a) Insert an element into a binomial heap
   b) Delete an element from a binomial heap.
   c) Search for a key element in a binomial heap
7. Write a program to perform the following operations:
   a) Insert an element into a AVL tree.
   b) Delete an element from a AVL search tree.
   c) Search for a key element in a AVL search tree.

8. Write a program to perform the following operations:
   a) Insert an element into a Red-Black tree.
   b) Delete an element from a Red-Black tree.
   c) Search for a key element in a Red-Black tree.

9. Write a program to implement all the functions of a dictionary using hashing.

10. Write a program for implementing Knuth-Morris-Pratt pattern matching algorithm.

11. Write a program for implementing Brute Force pattern matching algorithm.

12. Write a program for implementing Boyer pattern matching algorithm.

TEXT BOOKS:

1. Fundamentals of Data structures in C, E. Horowitz, S. Sahni and Susan Anderson Freed, 2nd Edition, Universities Press
2. Data Structures Using C – A.S. Tanenbaum, Y. Langsam, and M.J. Augenstein, PHI/Pearson education.
3. Introduction to Data Structures in C, Ashok Kamthane, 1st Edition, Pearson.

REFERENCES:

1. The C Programming Language, B.W. Kernighan, Dennis M. Ritchie, PHI/Pearson Education
2. C Programming with problem solving, J.A. Jones & K. Harrow, Dreamtech Press
3. Data structures: A Pseudocode Approach with C, R.F. Gilberg And B.A. Forouzan, 2nd Edition, Cengage Learning

WEB AND SOCIAL MEDIA ANALYTICS LAB (Lab - 2)

M.Tech IT I Year I Sem.

L	T	P	C
0	0	4	2

Course Objectives:

- Exposure to various web and social media analytic techniques.

Course Outcomes:

- Knowledge on decision support systems
- Apply natural language processing concepts on text analytics
- Understand sentiment analysis
- Knowledge on search engine optimization and web analytics

List of Experiments

1. Preprocessing text document using NLTK of Python
   a. Stopword elimination
   b. Stemming
   c. Lemmatization
   d. POS tagging
   e. Lexical analysis
2. Sentiment analysis on customer review on products
3. Web analytics
   a. Web usage data (web server log data, clickstream analysis)
   b. Hyperlink data
4. Search engine optimization- implement spamdexing
5. Use Google analytics tools to implement the following
   a. Conversion Statistics
   b. Visitor Profiles
6. Use Google analytics tools to implement the Traffic Sources.

Resources:

1. Stanford core NLP package
2. GOOGLE.COM/Analytics

TEXT BOOK:

1. Ramesh Sharda, Dursun Delen, Efraim Turban, Business Intelligence and Analytics: Systems for Decision Support, Pearson Education

REFERENCE BOOKS:

1. Rajiv Sabherwal, Irma Becerra-Fernandez, “Business Intelligence–Practice, Technologies and Management”, John Wiley 2011.
2. Lariss T. Moss, Shaku Atre, “Business Intelligence Roadmap”, Addison-Wesley It Service.
3. Yuli Vasiliev, “Oracle Business Intelligence: The Condensed Guide to Analysis and Reporting”, SPD Shroff, 2012.

DATABASE PROGRAMMING WITH PL/SQL LAB (Lab - II)

M.Tech IT I Year I Sem.

L	T	P	C
0	0	4	2

Course Objectives:

1. Knowledge on significance of SQL fundamentals.
2. Evaluate functions and triggers of PL/SQL
3. Knowledge on control structures, packages in PL/SQL and its applications

Course Outcomes:

1. Understand importance of PL/SQL basics
2. Implement functions and procedures using PL/SQL
3. Understand the importance of triggers in database

List of Experiments:

1. Write a Pl/SQL program using FOR loop to insert ten rows into a database table.
2. Given the table EMPLOYEE (EmpNo, Name, Salary, Designation, DeptID), write a cursor to select the five highest paid employees from the table.
3. Illustrate how you can embed PL/SQL in a high-level host language such as C/Java And demonstrates how a banking debit transaction might be done.
4. Given an integer i, write a PL/SQL procedure to insert the tuple (i, 'xxx') into a given relation.
5. Write a PL/SQL program to demonstrate Exceptions.
6. Write a PL/SQL program to demonstrate Cursors.
7. Write a PL/SQL program to demonstrate Functions.
8. Write a PL/SQL program to demonstrate Packages.
9. Write PL/SQL queries to create Procedures.
10. Write PL/SQL queries to create Triggers.

MOBILE APPLICATION DEVELOPMENT LAB (Lab - II)

M.Tech IT I Year I Sem.

L	T	P	C
0	0	4	2

Prerequisites: --- NIL---

Course Objectives:

1. To learn how to develop Applications in an android environment.
2. To learn how to develop user interface applications.
3. To learn how to develop URL related applications.

Course Outcomes:

1. Students understand the working of Android OS Practically.
2. Students will be able to develop user interfaces.
3. Students will be able to develop, deploy and maintain the Android Applications.

List of Experiments:

1. Create an Android application that shows Hello + name of the user and run it on an emulator. (b) Create an application that takes the name from a text box and shows hello message along with the name entered in the text box, when the user clicks the OK button.

2. Create a screen that has input boxes for User Name, Password, Address, Gender (radio buttons for male and female), Age (numeric), Date of Birth (Datepicker), State (Spinner) and a Submit button. On clicking the submit button, print all the data below the Submit Button. Use (a) Linear Layout (b) Relative Layout and (c) Grid Layout or Table Layout.

3. Develop an application that shows names as a list and on selecting a name it should show the details of the candidate on the next screen with a “Back” button. If the screen is rotated to landscape mode (width greater than height), then the screen should show list on left fragment and details on the right fragment instead of the second screen with the back button. Use Fragment transactions and Rotation event listeners.

4. Develop an application that uses a menu with 3 options for dialing a number, opening a website and to send an SMS. On selecting an option, the appropriate action should be invoked using intents.

5. Develop an application that inserts some notifications into Notification area and whenever a notification is inserted, it should show a toast with details of the notification.

6. Create an application that uses a text file to store usernames and passwords (tab separated fields and one record per line). When the user submits a login name and password through a screen, the details should be verified with the text file data and if they match, show a dialog saying that login is successful. Otherwise, show the dialog with a Login Failed message.

7. Create a user registration application that stores the user details in a database table.

8. Create a database and a user table where the details of login names and passwords are stored. Insert some names and passwords initially. Now the login details entered by the user should be verified with the database and an appropriate dialog should be shown to the user.

9. Create an admin application for the user table, which shows all records as a list and the admin can select any record for edit or modify. The results should be reflected in the table.

10. Develop an application that shows all contacts of the phone along with details like name, phone number, mobile number etc.

11. Create an application that saves user information like name, age, gender etc. in shared preference and retrieves them when the program restarts.

12. Create an alarm that rings every Sunday at 8:00 AM. Modify it to use a time picker to set alarm time.

13. Create an application that shows the given URL (from a text field) in a browser.

TEXT BOOKS:

1. Professional Android 4 Application Development, Reto Meier, Wiley India, (Wrox), 2012
2. Android Application Development for Java Programmers, James C Sheusi, Cengage Learning, 2013

REFERENCE BOOK:

1. Beginning Android 4 Application Development, Wei-Meng Lee, Wiley India (Wrox), 2013

RESEARCH METHODOLOGY & IPR

M.Tech IT I Year I Sem.

L	T	P	C
2	0	0	2

Course Objectives:

1. To understand the research problem
2. To know the literature studies, plagiarism and ethics
3. To get the knowledge about technical writing
4. To analyze the nature of intellectual property rights and new developments
5. To know the patent rights

Course Outcomes: At the end of this course, students will be able to

1. Understand research problem formulation.
2. Analyze research related information
3. Follow research ethics
4. Understand that today's world is controlled by Computer, Information Technology, but tomorrow world will be ruled by ideas, concept, and creativity.
5. Understanding that when IPR would take such important place in growth of individuals & nation, it is needless to emphasis the need of information about Intellectual Property Right to be promoted among students in general & engineering in particular.
6. Understand that IPR protection provides an incentive to inventors for further research work and investment in R & D, which leads to creation of new and better products, and in turn brings about, economic growth and social benefits.

UNIT- I:

Meaning of research problem, Sources of research problem, Criteria Characteristics of a good research problem, Errors in selecting a research problem, Scope and objectives of research problem. Approaches of investigation of solutions for research problem, data collection, analysis, interpretation, Necessary instrumentations

UNIT- II:

Effective literature studies approaches, analysis, Plagiarism, Research ethics

UNIT- III:

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

UNIT- IV:

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

UNIT- V:

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

TEXT BOOKS:

1. Stuart Melville and Wayne Goddard, "Research methodology: an introduction for science & engineering students'"
2. Wayne Goddard and Stuart Melville, "Research Methodology: An Introduction"

REFERENCE BOOKS:

1. Ranjit Kumar, 2nd Edition, "Research Methodology: A Step by Step Guide for beginners"
2. Halbert, "Resisting Intellectual Property", Taylor & Francis Ltd ,2007.
3. Mayall, "Industrial Design", McGraw Hill, 1992.
4. Niebel, "Product Design", McGraw Hill, 1974.
5. Asimov, "Introduction to Design", Prentice Hall, 1962.

6. Robert P. Merges, Peter S. Menell, Mark A. Lemley, “Intellectual Property in New Technological Age”, 2016.
7. T. Ramappa, “Intellectual Property Rights Under WTO”, S. Chand, 2008

DEEP LEARNING (PC - III)

M.Tech IT I Year II Sem.

L	T	P	C
3	0	0	3

Course Objectives: students will be able

1. To understand complexity of Deep Learning algorithms and their limitations
2. To be capable of performing experiments in Deep Learning using real-world data.

Course Outcomes:

1. Implement deep learning algorithms, understand neural networks and traverse the layers of data
2. Learn topics such as convolutional neural networks, recurrent neural networks, training deep networks and high-level interfaces
3. Understand applications of Deep Learning to Computer Vision
4. Understand and analyze Applications of Deep Learning to NLP

UNIT - I

Introduction: Feed forward Neural networks, Gradient descent and the back propagation algorithm, Unit saturation, the vanishing gradient problem, and ways to mitigate it. RelU Heuristics for avoiding bad local minima, Heuristics for faster training, Nestors accelerated gradient descent, Regularization, Dropout

UNIT - II

Convolutional Neural Networks: Architectures, convolution/pooling layers, Recurrent Neural Networks: LSTM, GRU, Encoder Decoder architectures. Deep Unsupervised Learning: Auto encoders, Variational Auto-encoders, Adversarial Generative Networks, Auto-encoder and DBM Attention and memory models, Dynamic Memory Models

UNIT - III

Applications of Deep Learning to Computer Vision: Image segmentation, object detection, automatic image captioning, Image generation with Generative adversarial networks, video to text with LSTM models, Attention Models for computer vision tasks

UNIT - IV

Applications of Deep Learning to NLP: Introduction to NLP and Vector Space Model of Semantics, Word Vector Representations: Continuous Skip-Gram Model, Continuous Bag-of-Wordsmodel (CBOW), Glove, Evaluations and Applications in word similarity

UNIT - V

Analogy reasoning: Named Entity Recognition, Opinion Mining using Recurrent Neural Networks: Parsing and Sentiment Analysis using Recursive Neural Networks: Sentence Classification using Convolutional Neural Networks, Dialogue Generation with LSTMs

TEXT BOOKS:

1. Deep Learning by Ian Goodfellow, Yoshua Bengio and Aaron Courville, MIT Press.
2. The Elements of Statistical Learning by T. Hastie, R. Tibshirani, and J. Friedman, Springer.
3. Probabilistic Graphical Models. Koller, and N. Friedman, MIT Press.

REFERENCES:

1. Bishop, C, M., Pattern Recognition and Machine Learning, Springer, 2006.
2. Yegnanarayana, B., Artificial Neural Networks PHI Learning Pvt. Ltd, 2009.
3. Golub, G.,H., and Van Loan,C.,F., Matrix Computations, JHU Press,2013.
4. Satish Kumar, Neural Networks: A Classroom Approach, Tata McGraw-Hill Education, 2004.

NATURAL LANGUAGE PROCESSING (PC - IV)

M.Tech IT I Year II Sem.

L	T	P	C
3	0	0	3

Prerequisites:

1. Data structures, finite automata and probability theory.

Course Objectives:

1. Introduction to some of the problems and solutions of NLP and their relation to linguistics and statistics.

Course Outcomes:

1. Show sensitivity to linguistic phenomena and an ability to model them with formal grammars.
2. Understand and carry out proper experimental methodology for training and evaluating empirical NLP systems
3. Able to manipulate probabilities, construct statistical models over strings and trees, and estimate parameters using supervised and unsupervised training methods.
4. Able to design, implement, and analyze NLP algorithms Able to design different language modeling Techniques.
5. Able to design different language modeling Techniques.

UNIT - I

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

UNIT - II

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

UNIT - III

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

UNIT - IV

Predicate-Argument Structure, Meaning Representation Systems, Software.

UNIT - V

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

TEXT BOOKS:

1. Multilingual natural Language Processing Applications: From Theory to Practice – Daniel M. Bikel and Imed Zitouni, Pearson Publication
2. Natural Language Processing and Information Retrieval: Tanvier Siddiqui, U.S. Tiwary

REFERENCE:

1. Speech and Natural Language Processing - Daniel Jurafsky & James H Martin, Pearson Publications

GAME DEVELOPMENT (Professional Elective - III)

M.Tech IT I Year II Sem.

L	T	P	C
3	0	0	3

Course Objectives: Knowledge on concepts of game development using python and AI

Course Outcomes:

1. Understand the concepts of Game design and development.
2. Learn the processes, mechanics and issues in Game Design.
3. Be exposed to the Core architectures of Game Programming.
4. Know about Game programming platforms, frameworks and engines.
5. Learn to develop games.

UNIT - I

Introducing Pygame: History of Pygame, Installing Pygame, Using Pygame, Hello World Revisited, Understanding Events, Opening a Display, Using the Font Module, When Pygame Goes Wrong, Pygame in Action.

Creating Visuals: Using Pixel Power, Working with Color, Using Images, Drawing with Pygame.

UNIT - II

Making Things Move: Understanding Frame Rate, Moving in a Straight Line, Exploring Vectors, Using Vectors to Create Movement.

Accepting User Input: Controlling the Game, Understanding Keyboard Control Implementing Mouse Control, Implementing Joystick Control, Seeing Joysticks in Action .

UNIT - III

Artificial Intelligence for Games: Introduction to Intelligence, Exploring AI, Implementing State Machines, Game Entities, Building Worlds, Ant Entity Class, Building the Brains.

UNIT - IV

Moving into the Third Dimension: Creating the Illusion of Depth, Understanding 3D Space, Using 3D Vectors, Time-Based Movement in 3D, Projecting 3D Points, Parallel Projections, Perspective Projections, A 3D World.

UNIT - V

Exploring the Third Dimension: Definition of Matrix? Using the Matrix Class, Introducing OpenGL, Installing PyOpenGL, Initializing OpenGL, OpenGL Primer, Seeing OpenGL in Action.

TEXT BOOKS:

1. Will McGugan, “Beginning Game Development with Python and Pygame: From Novice to Professional”, Apress Publishers, 2007.
2. Sanjay Madhav, “Game Programming Algorithms and Techniques: A Platform Agnostic Approach”, Addison-Wesley Professional, 2013.

REFERENCES:

1. Paul Craven, “Python Arcade games”, Apress Publishers, 2016.
2. David H. Eberly, “3D Game Engine Design: A Practical Approach to Real-Time Computer Graphics”, Second Edition, CRC Press, 2006.
3. Jung Hyun Han, “3D Graphics for Game Programming”, Chapman and Hall/CRC, 2011.

ENTERPRISE CLOUD CONCEPTS (Professional Elective - III)

M.Tech IT I Year II Sem.

L	T	P	C
3	0	0	3

Course Objectives: Knowledge on significance of cloud computing and its fundamental concepts and models.

Course Outcomes:

1. Understand importance of cloud architecture
2. Illustrating the fundamental concepts of cloud security
3. Analyze various cloud computing mechanisms
4. Understanding the architecture and working of cloud computing.

UNIT - I

Understanding Cloud Computing: Origins and influences, Basic Concepts and Terminology, Goals and Benefits, Risks and Challenges.
Fundamental Concepts and Models: Roles and Boundaries, Cloud Characteristics, Cloud Delivery Models, Cloud Deployment Models.

UNIT - II

Cloud-Enabling Technology: Broadband Networks and Internet Architecture, Data Center Technology, Virtualization Technology.
Cloud Computing Mechanisms:
Cloud Infrastructure Mechanisms: Logical Network Perimeter, Virtual Server, Cloud Storage Device, Cloud Usage Monitor, Resource Replication.

UNIT - III

Cloud Management Mechanisms: Remote Administration System, Resource Management System, SLA Management System, Billing Management System, Case Study Example
Cloud Computing Architecture
Fundamental Cloud Architectures: Workload Distribution Architecture, Resource Pooling Architecture, Dynamic Scalability Architecture, Elastic Resource Capacity Architecture, Service Load Balancing Architecture, Cloud Bursting Architecture, Elastic Disk Provisioning Architecture, Redundant Storage Architecture, Case Study Example

UNIT - IV

Cloud-Enabled Smart Enterprises: Introduction, Revisiting the Enterprise Journey, Service-Oriented Enterprises, Cloud Enterprises, Smart Enterprises, The Enabling Mechanisms of Smart Enterprises **Cloud-Inspired Enterprise Transformations:** Introduction, The Cloud Scheme for Enterprise Success, Elucidating the Evolving Cloud Idea, Implications of the Cloud on Enterprise Strategy, Establishing a Cloud-Incorporated Business Strategy

UNIT - V

Transitioning to Cloud-Centric Enterprises: The Tuning Methodology, Contract Management in the Cloud
Cloud-Instigated IT Transformations
Introduction, Explaining Cloud Infrastructures, A Briefing on Next-Generation Services, Service Infrastructures, Cloud Infrastructures, Cloud Infrastructure Solutions, Clouds for Business Continuity, The Relevance of Private Clouds, The Emergence of Enterprise Clouds

TEXT BOOKS:

1. Erl Thomas, Puttini Ricardo, Mahmood Zaigham, Cloud Computing: Concepts, Technology & Architecture 1st Edition,
2. Pethuru Raj, Cloud Enterprise Architecture, CRC Press

REFERENCES:

1. James Bond,The Enterprise Cloud, O'Reilly Media, Inc.

BIG DATA ANALYTICS (Professional Elective - III)

M.Tech IT I Year II Sem.

L	T	P	C
3	0	0	3

Course Objectives

1. The purpose of this course is to provide the students with the knowledge of Big data Analytics principles and techniques.
2. This course is also designed to give an exposure of the frontiers of Big data Analytics

Courses Outcomes

1. Ability to explain the foundations, definitions, and challenges of Big Data and various Analytical tools.
2. Ability to program using HADOOP and Map reduce, NOSQL
3. Ability to understand the importance of Big Data in Social Media and Mining.

UNIT - I

Getting an Overview of Big Data: What is Big Data? History of Data Management – Evolution of Big Data, Structuring Big Data, Elements of Big Data, Big Data Analytics, Careers in Big Data, Future of Big Data

Technologies for Handling Big Data: Distributed and Parallel Computing for Big Data, Introducing Hadoop, Cloud Computing and Big Data, In-Memory Computing Technology for Big Data.

UNIT - II

Understanding Hadoop Ecosystem: Hadoop Ecosystem, Hadoop Distributed File System, MapReduce, Hadoop YARN, Hbase, Hive, Pig and Pig Latin, Sqoop, ZooKeeper, Flume, Oozie

Understanding MapReduce Fundamentals and Hbase: The MapReduce Framework, Techniques to Optimize MapReduce Jobs, Uses of MapReduce, Role of HBase in Big Data Processing

UNIT - III

Understanding Analytics and Big Data: Comparing Reporting and Analysis, Types of Analytics, Points to Consider during Analysis, Developing an Analytic Team, Understanding Text Analytics **Analytical Approaches and Tools to Analyze Data:** Analytical Approaches, History of Analytical Tools. Introduction to Popular Analytical Tools, Comparing Various Analytical Tools, Installing R

UNIT - IV

Data Visualization-I: Introducing Data Visualization, Techniques Used for Visual Data Representation, Types of Data Visualization, Applications of Data Visualization, Visualizing Big Data, Tools Used in Data Visualization, Tableau Products

Data Visualization with Tableau (Data Visualization-II): Introduction to Tableau Software, Tableau Desktop Workspace, Data Analytics in Tableau Public, Using Visual Controls in Tableau Public

UNIT - V

Social Media Analytics and Text Mining: Introducing Social Media, Introducing Key Elements of Social Media, Introducing Text Mining, Understanding Text Mining Process, Sentiment Analysis, Performing Social Media Analytics and Opinion
Mining on Tweets

Mobile Analytics: Introducing Mobile Analytics, Introducing Mobile Analytics Tools, Performing Mobile Analytics, Challenges of Mobile Analytics

TEXT BOOKS:

1. Big data, blackbook, dreamtech press,2015
2. Big Data Analytics, SeemaAcharya, Subhashini Chellappan, Wiley 2015.
3. Simon Walkowiak, Big Data Analytics with R, Packt Publishing, ISBN: 9781786466457

REFERENCES:

1. Big Data, Big Analytics: Emerging Business Intelligence and Analytic Trends for

Today's Business, Michael Minelli, Michehe Chambers, 1st Edition, Ambiga Dhiraj, Wiley CIO Series, 2013.
2. Hadoop: The Definitive Guide, Tom White, 3rd Edition, O"Reilly Media, 2012.
3. Big Data Analytics: Disruptive Technologies for Changing the Game, Arvind Sathi, 1st Edition, IBM Corporation, 2012.

UI AND UX DESIGN (Professional Elective - IV)

M.Tech IT I Year II Sem.

L	T	P	C
3	0	0	3

Course Objectives: UI/UX course is to provide students with the knowledge of user-centered design, user -centered methods in design, graphic design on screens

Course Outcomes:

1. Understand the importance of UX
2. Analyze User observation and experience in UI and UX design
3. Understand the importance of user interface design principles
4. Illustrate web interface design and Mobile interface design

UNIT - I

Introduction: Introduction about UX - Five Main Ingredients of UX - Three "Whats" of User Perspective
- Pyramid of UX Impact - UX Is a Process - UX - Not an Event or Task. Behaviour Basics: Psychology versus Culture - User Psychology - Experience - Conscious vs Subconscious Experience - Emotions - Gain and Loss – Motivations.

UNIT - II

User Observation And Experience: User Research - Subjective Research - Objective Research - Sample Size - Three Basic Types of Questions. Observe a User: Watch How They Choose - Interviews
- Surveys - Card Sorting - Creating User Profiles - Bad profile - Useful profile.

UNIT - III

User Interface Design Principles: Designing Behaviour: Designing with Intention - Rewards and Punishments - Conditioning and Addiction - Timing Matters - Gamification - Social/Viral Structure–Trust
- Hidden versus Visible. Basic Visual Design Principles: Visual Weight - Contrast - Depth and Size - Color. Layout: Page Framework - Footers - Navigation -Images, and Headlines - Forms - One Long Page or a Few Short Pages - Input Types - Labels and Instructions - Primary and Secondary Buttons - Adaptive and Responsive Design - Touch versus Mouse.

UNIT - IV

Web Interface Design: Designing Web Interfaces – Drag and Drop, Direct Selection, Contextual Tools, Overlays, Inlays and Virtual Pages, Process Flow – Using Motion for UX - Design Pattern: Z-Pattern - F-Pattern - Visual Hierarchy - Lookup patterns – Feedback patterns.

UNIT - V

Mobile Interface Design: Mobile Ecosystem: Platforms, Application frameworks- Types of Mobile Applications: Widgets, Applications, Games- Mobile Information Architecture, Mobile 2.0, Mobile Design: Elements of Mobile Design, Tools.

TEXTBOOKS:

1. Joel Marsh, "UX for Beginners", O'Reilly Media, Inc., 1st Edition 2015.
2. Xia Jiajia, "UI UX Design", O"Reilly, Artpower International, 2016.
3. Brian Fling, "Mobile Design and Development", O"Reilly Media Inc., 1st Edition, 2009.

REFERENCES:

1. Alan Dix, Janet Finlay, Gregory Abowd, Russell Beale, "Human Computer Interaction", Pearson Education, 3rd Edition, 2004.
2. Alan Cooper, "The Essential Of User Interface Design", Wiley Dream Tech Ltd., 2002.

AUGMENTED REALITY & VIRTUAL REALITY (Professional Elective - IV)

M.Tech IT I Year II Sem.

L	T	P	C
3	0	0	3

Course objectives:

1. The objective of this course is to provide a foundation to the fast growing field of AR and make the students aware of the various AR devices**.**
2. To give historical and modern overviews and perspectives on virtual reality. It describes the fundamentals of sensation, perception, technical and engineering aspects of virtual reality systems.

Course Outcomes:

1. Describe how AR systems work and list the applications of AR.
2. Understand and analyze the hardware requirement of AR.
3. Describe how VR systems work and list the applications of VR.
4. Understand the design and implementation of the hardware that enables VR systems tobe built.

UNIT - I:

Introduction to Augmented Reality: What Is Augmented Reality - Defining augmented reality, history of augmented reality, The Relationship Between Augmented Reality and Other Technologies-Media, Technologies, Other Ideas Related to the Spectrum Between Real and Virtual Worlds, applications of augmented reality Augmented Reality Concepts- How Does Augmented Reality Work? Concepts Related to Augmented Reality, Ingredients of an Augmented Reality Experience**.**

UNIT - II:

AR Devices & Components: AR Components – Scene Generator, Tracking system, monitoring system, display, Game scene. AR Devices – Optical See- Through HMD, Virtual retinal systems, Monitor bases systems, Projection displays, Video see-through systems

UNIT - III:

Introduction to Virtual Reality: Defining Virtual Reality, History of VR, Human Physiology and Perception, Key Elements of Virtual Reality Experience, Virtual Reality System, Interface to the Virtual World-Input & output- Visual, Aural & Haptic Displays, Applications of Virtual Reality

UNIT - IV:

Representing the Virtual World: Representation of the Virtual World, Visual Representation in VR, Aural Representation in VR and Haptic Representation in VR
CaseStudy: GHOST (General Haptics Open Software Toolkit) software development toolkit.

UNIT - V:

Visual Perception & Rendering: Visual Perception - Perception of Depth, Perception of Motion, Perception of Color, Combining Sources of Information.
Visual Rendering - Ray Tracing and Shading Models, Rasterization, Correcting Optical Distortions, Improving Latency and Frame Rates.

TEXT BOOKS:

1. Allan Fowler-AR Game Developmentll, 1st Edition, A press Publications, 2018, ISBN 978- 1484236178
2. Virtual Reality, Steven M. LaValle, Cambridge University Press, 2016

REFERENCES:

1. Augmented Reality: Principles & Practice by Schmalstieg / Hollerer, Pearson Education India;First edition (12 October 2016),ISBN-10: 9332578494
2. Understanding Virtual Reality: Interface, Application and Design, William R Sherman andAlan B Craig, (The Morgan Kaufmann Series in Computer Graphics)". Morgan Kaufmann Publishers, San Francisco, CA, 2002
3. Developing Virtual Reality Applications: Foundations of Effective Design, Alan B Craig,William R Sherman and Jeffrey D Will, Morgan Kaufmann, 2009

4. Designing for Mixed Reality, Kharis O'Connell Published by O'Reilly Media, Inc., 2016, ISBN: 9781491962381
5. Sanni Siltanen- Theory and applications of marker-based augmented reality. Julkaisija – Utgivare Publisher. 2012. ISBN 978-951-38-7449-0
6. Gerard Jounghyun Kim, “Designing Virtual Systems: The Structured Approach”, 2005.

AGILE METHODOLOGY (Professional Elective - IV)

M.Tech IT I Year II Sem.

L	T	P	C
3	0	0	3

Course Objectives: Knowledge on concepts of Agile development, releasing, planning and developing

Course Outcomes

1. Understand basic concepts of agile methods and extreme programming
2. Analyze real customer involvement and ubiquitous language
3. Discuss risk management and iteration planning
4. Summarize incremental requirements, refactoring, incremental design and architecture

UNIT - I

Introduction Extreme Programming (XP) - Agile Development: Why Agile - Understanding Success, Beyond Deadlines, Importance of Organizational Success, Introduction to Agility How to Be Agile - Agile methods, Don't make your own method, Road to mastery Understanding XP (Extreme Programming) - XP life cycle, XP team, XP Concepts Adopting XP - Knowing whether XP is suitable, Implementing XP, assessing Agility Practicing XP - Thinking - Pair Programming, Energized work, Informative Workspace, Root cause Analysis, Retrospectives

UNIT - II

Collaborating: Trust, Sit together, Real customer involvement, Ubiquitous language, meetings, coding standards, Iteration demo, Reporting

UNIT - III

Releasing: Bugfree Release, Version Control, fast build, continuous integration, Collective ownership, Documentation

UNIT – IV

Planning: Version, Release Plan, Risk Management, Iteration Planning, Slack, Stories, Estimating

UNIT - V

Developing: Incremental requirements, Customer tests, Test driven development, Refactoring, Incremental design and architecture, spike solutions, Performance optimization, Exploratory testing

TEXT BOOK:

1. The art of Agile Development, James Shore and Shane Warden, 11th Indian Reprint, O'Reilly, 2018.

REFERENCES:

1. Learning Agile, Andrew Stellman and Jennifer Greene, O’Reilly, 4th Indian Reprint, 2018.
2. Practices of an Agile Developer, Venkat Subramaniam and Andy Hunt, SPD, 5th Indian Reprint, 2015.
3. Agile Project Management - Jim Highsmith, Pearson Low price Edition 2004.

DEEP LEARNING AND NATURAL LANGUAGE PROCESSING LAB (Lab - III)

M.Tech IT I Year I Sem.

L	T	P	C
0	0	4	2

Course Objectives:

1. To Build the Foundation of Deep Learning.
2. To Understand How to Build the Neural Network.
3. To enable students to develop successful machine learning concepts
4. To Develop and explore the problems and solutions of NLP.

Course Outcomes:

Upon the Successful Completion of the Course, the Students would be able to:

1. Learn The Fundamental Principles Of Deep Learning.
2. Identify The Deep Learning Algorithms For Various Types of Learning Tasks in various domains.
3. Implement Deep Learning Algorithms And Solve Real-world problems.
4. Show sensitivity to linguistic phenomena and an ability to model them with formal grammars.
5. Able to manipulate probabilities, construct statistical models over strings and trees, and estimate parameters using supervised and unsupervised training methods.
6. Able to design, implement, and analyze NLP algorithms

LIST OF EXPERIMENTS IN DEEP LEARNING:

1. Setting up the Spyder IDE Environment and Executing a Python Program
2. Installing Keras, Tensorflow and Pytorch libraries and making use of them
3. Applying the Convolution Neural Network on computer vision problems
4. Image classification on MNIST dataset (CNN model with Fully connected layer)
5. Applying the Deep Learning Models in the field of Natural Language Processing

LIST OF EXPERIMENTS IN NATURAL LANGUAGE PROCESSING:

Implement the following using Python

1. Tokenization
2. Stemming
3. Stop word removal (a, the, are)
4. Word Analysis
5. Word Generation
6. Pos tagging
7. Morphology
8. chunking
9. N-Grams
10. N-Grams Smoothing

TEXT BOOKS:

1. Deep Learning by Ian Goodfellow, Yoshua Bengio and Aaron Courville, MIT Press.
2. The Elements of Statistical Learning by T. Hastie, R. Tibshirani, and J. Friedman, Springer.
3. Probabilistic Graphical Models. Koller, and N. Friedman, MIT Press.
4. Multilingual natural Language Processing Applications: From Theory to Practice – Daniel M. Bikel and Imed Zitouni, Pearson Publication.
5. Natural Language Processing and Information Retrieval: Tanvier Siddiqui, U.S. Tiwary.

REFERENCES:

1. Bishop, C, M., Pattern Recognition and Machine Learning, Springer, 2006.
2. Yegnanarayana, B., Artificial Neural Networks PHI Learning Pvt. Ltd, 2009.
3. Golub, G.H., and Van Loan C.F., Matrix Computations, JHU Press, 2013.
4. Satish Kumar, Neural Networks: A Classroom Approach, Tata McGraw-Hill Education, 2004.
5. Speech and Natural Language Processing - Daniel Jurafsky & James H Martin, Pearson Publications.

Extensive Reading:

- http://www.deeplearning.net
- https://www.deeplearningbook.org/
- https://developers.google.com/machine-learning/crash-course/ml-intro
- www.cs.toronto.edu/~fritz/absps/imagenet.pdf
- http://neuralnetworksanddeeplearning.com/

GAME DEVELOPMENT LAB (Lab - IV)

M.Tech IT I Year II Sem.

L	T	P	C
0	0	4	2

Course Objectives: Understanding and implementing the game development using Pygame.

Course Outcomes:

1. Understand the concepts of Game design and development.
2. Learn the processes, mechanics and issues in Game Design.
3. Be exposed to the Core architectures of Game Programming.
4. Know about Game programming platforms, frameworks and engines.
5. Learn to develop games.

List of Experiments:

1. Create a Hello World script with Pygame that opens a graphical window on your desktop and draws an image under the standard mouse cursor.
2. Write a simple Pygame script to display all the events that are generated and Display the Message Queue
3. Write a simple Pygame script using Keyboard Events to Move a Background
4. Write a simple Pygame script that demonstrates going from windowed mode to full-screen mode. If you press the F key, the display will fill the entire screen (there may be a delay of a few seconds while this happens). Press F a second time, and the display will return to a window.
5. Write a simple Pygame script that demonstrates how to respond to VIDEO RESIZE events.
6. Write a simple Pygame script to create a large image with every possible color value.
7. Write a simple Pygame script for Tweaking Colors
8. Write a simple Pygame script to draw the following
    a. Rectangle
    b. Polygon
    c. Circle
    d. Ellipse
    e. Arc
    f. Line
9. Write a simple Pygame script to detect any pressed keys and display a list of them on the screen.
10. Write a simple Pygame script to create visuals with an apparent third dimension.

ENTERPRISE CLOUD CONCEPTS LAB (Lab - IV)

M.Tech IT I Year II Sem.

L	T	P	C
0	0	4	2

Course Objectives: Knowledge on significance of cloud computing and its fundamental concepts and models.

Course Outcomes:

1. Understand importance of cloud architecture
2. Illustrating the fundamental concepts of cloud security
3. Analyze various cloud computing mechanisms
4. Understanding the architecture and working of cloud computing.

List of Experiments:

1. Install Virtualbox/VMware Workstation with different flavors of linux or windows OS on top of windows7 or 8.
2. Install a C compiler in the virtual machine created using virtual box and execute Simple Programs
3. Install Google App Engine. Create a hello world app and other simple web applications using python/java..
4. Find a procedure to transfer the files from one virtual machine to another virtual machine.
5. Find a procedure to launch virtual machine using trystack (Online Openstack Demo Version)
6. Install Hadoop single node cluster and run simple applications like word count.

E-Resources:

1. https://www.iitk.ac.in/nt/faq/vbox.htm
2.https://www.google.com/urlsa=t&rct=j&q=&esrc=s&source=web&cd=&ved=2ahUKEwjqrNG0za73Ah XZt1YBHZ21DWEQFnoECAMQAQ&url=http%3A%2F%2Fwww.cs.columbia.edu%2F~sedwards%2F classes%2F2015%2F1102-fall%2Flinuxvm.pdf&usg=AOvVaw3xZPuF5xVgk-AQnBRsTtHz
3. https://www.cloudsimtutorials.online/cloudsim/
4.https://edwardsamuel.wordpress.com/2014/10/25/tutorial-creating-openstack-instance-in-trystack/
5. https://www.edureka.co/blog/install-hadoop-single-node-hadoop-cluster

BIG DATA ANALYTICS LAB (Lab - IV)

M.Tech IT I Year II Sem.

L	T	P	C
0	0	4	2

Course Objectives:

1. The purpose of this course is to provide the students with the knowledge of Big data Analytics principles and techniques.
2. This course is also designed to give an exposure of the frontiers of Big data Analytics

Course Outcomes:

1. Use Excel as a Analytical tool and visualization tool.
2. Ability to program using HADOOP and Map reduce
3. Ability to perform data analytics using ML in R.
4. Use cassandra to perform social media analytics

List of Experiments:

1. Implement a simple map-reduce job that builds an inverted index on the set of input documents (Hadoop)
2. Process big data in HBase
3. Store and retrieve data in Pig
4. Perform Social media analysis using cassandra
5. Buyer event analytics using Cassandra on suitable product sales data.
6. Using Power Pivot (Excel) Perform the following on any dataset
   a) Big Data Analytics
   b) Big Data Charting
7. Use R-Project to carry out statistical analysis of big data
8. Use R-Project for data visualization of social media data

TEXT BOOKS:

1. Big Data Analytics, SeemaAcharya, Subhashini Chellappan, Wiley 2015.
2. Big Data, Big Analytics: Emerging Business Intelligence and Analytic Trends for Today's Business, Michael Minelli, Michehe Chambers, 1st Edition, Ambiga Dhiraj, Wiely CIO Series, 2013.
3. Hadoop: The Definitive Guide, Tom White, 3rd Edition, O"Reilly Media, 2012.
4. Big Data Analytics: Disruptive Technologies for Changing the Game, Arvind Sathi, 1st Edition, IBM Corporation, 2012.

REFERENCES:

1. Big Data and Business Analytics, Jay Liebowitz, Auerbach Publications, CRC press (2013)
2. Using R to Unlock the Value of Big Data: Big Data Analytics with Oracle R Enterprise and Oracle R Connector for Hadoop, Tom Plunkett, Mark Hornick, McGraw-Hill/Osborne Media (2013), Oracle press.
3. Professional Hadoop Solutions, Boris lublinsky, Kevin t. Smith, Alexey Yakubovich, Wiley, ISBN: 9788126551071, 2015.
4. Understanding Big data, Chris Eaton, Dirk deroos et al., McGraw Hill, 2012.
5. Intelligent Data Analysis, Michael Berthold, David J. Hand, Springer, 2007.
6. Taming the Big Data Tidal Wave: Finding Opportunities in Huge Data Streams with Advanced Analytics, Bill Franks, 1st Edition, Wiley and SAS Business Series, 2012.

DEVOPS (Professional Elective - V)

M.Tech IT II Year I Sem.

L	T	P	C
3	0	0	3

Course Objectives: The main objectives of this course are to

- Describe the agile relationship between development and IT operations.
- Understand the skill sets and high-functioning teams involved in DevOps and related methods to reach a continuous delivery capability
- Implement automated system update and DevOps lifecycle

Course Outcomes: On successful completion of this course, students will be able to:

1. Identify components of Devops environment
2. Describe Software development models and architectures of DevOps
3. Apply different project management, integration, testing and code deployment tool
4. Investigate different DevOps Software development models
5. Assess various Devops practices
6. Collaborate and adopt Devops in real-time projects

UNIT - I

Introduction: Introduction, Agile development model, DevOps, and ITIL. DevOps process and Continuous Delivery, Release management, Scrum, Kanban, delivery pipeline, bottlenecks, examples

UNIT - II

Software development models and DevOps: DevOps Lifecycle for Business Agility, DevOps, and Continuous Testing.

DevOps influence on Architecture: Introducing software architecture, The monolithic scenario, Architecture rules of thumb, The separation of concerns, Handling database migrations, Microservices, and the data tier, DevOps, architecture, and resilience.

UNIT - III

Introduction to project management: The need for source code control, The history of source code management, Roles and code, source code management system and migrations, Shared authentication, Hosted Git servers, Different Git server implementations, Docker intermission, Gerrit, The pull request model, GitLab.

UNIT - IV

Integrating the system: Build systems, Jenkins build server, Managing build dependencies, Jenkins plugins, and file system layout, The host server, Build slaves, Software on the host, Triggers, Job chaining and build pipelines, Build servers and infrastructure as code, Building by dependency order, Build phases, Alternative build servers, Collating quality measures.

UNIT - V

Testing Tools and automation: Various types of testing, Automation of testing Pros and cons, Selenium - Introduction, Selenium features, JavaScript testing, Testing backend integration points, Test-driven development, REPL-driven development

Deployment of the system: Deployment systems, Virtualization stacks, code execution at the client, Puppet master and agents, Ansible, Deployment tools: Chef, SaltStackand Docker

TEXT BOOKS:

1. Joakim Verona. Practical Devops, Second Edition. Ingram short title; 2nd edition (2018). ISBN-10: 1788392574
2. Deepak Gaikwad, Viral Thakkar. DevOps Tools from Practitioner's Viewpoint. Wiley publications. ISBN: 9788126579952

REFERENCE BOOKS

1. Len Bass, Ingo Weber, Liming Zhu. DevOps: A Software Architect's Perspective. Addison Wesley; ISBN-10:

EDGE & FOG COMPUTING (Professional Elective - V)

M.Tech IT II Year I Sem.

L	T	P	C
3	0	0	3

Course Outcomes

CO1: Understand the foundations of fog and edge computing networks and different architectures
CO2: Design fog and edge computing-based systems and applications using reference architectures
CO3: Understand and apply data collection, analysis, decision making and learning methodologies over the edge for different applications
CO4: Apply optimization techniques for edge and fog computing

UNIT-1

Foundations: Introduction to IoT, Fog and Edge Computing, hierarchy of Fog and Edge Computing, edge network, Edge computing architectures, OpenFog Reference Architecture for Fog Computing, Optimization in Fog and Edge Computing, Case Study: open source platforms like Apache Edgent.

UNIT-II

Middleware: Middleware for Fog and Edge Computing: Design Issues, Lightweight Container Middleware for Edge Cloud Architectures, Data Management in Fog Computing, Predictive

UNIT-III

Analysis to Support Fog Application Deployment, Using Machine Learning for Protecting the Security and Privacy of Internet of Things (IoT) Systems, Anomaly Detection in Fog-based IoT Networks, Federated Learning for Privacy-Preserving IoT Analytics

UNIT-IV

Applications: Applications of Fog Computing in Big Data Analytics, health monitoring, smart surveillance, smart transportation, Modeling. Simulation of Fog and Edge Computing Environments Using open source platforms like iFogSim Toolkit

UNIT-V

Emerging Trends in Fog & Edge Computing,: Security and Privacy Challenges in Multi-tier IoT , Weather Monitoring with Edge ,Energy-efficient Fog and Edge Computing, Role of Fog Computing in Smart Homes, Weather Monitoring with Edge Devices

Text Books/ References

1. Rajkumar Buyya, Satish Narayana Srirama, “Fog and Edge Computing: Principles and Paradigms”, Wiley, 2019
2. Javid Taheri, Shuiguang Deng, “Edge Computing: Models, technologies and applications”, IET, 2020
3. Khaldoun Al Agha, Pauline Loygue, Guy Pujolle, “ Edge Networking”,Wiley-ISTE,2022.
4. Xin Sun and Amin Vahdat, “Edge Computing: A Primer”, CRC Press, 2019.
5. “OpenFog Reference Architecture for Fog Computing”, Industry IoT Consortium, OpenFog_Reference_Architecture_2_09_17.pdf (iiconsortium.org
6. “IEEE Standard for Adoption of Openfog Reference Architecture for Fog Computing,” Aug. 2018, standard No. 1934-2018″, [online] Available: ttps://standards.ieee.org/standard/1934-2018.html.

BLOCKCHAIN TECHNOLOGY (Professional Elective - V)

M.Tech IT II Year I Sem.

L	T	P	C
3	0	0	3

Pre-requisites:

1. Knowledge in information security and applied cryptography.
2. Knowledge in distributed databases.

Course Objectives:

1. To learn the fundamentals of BlockChain and various types of block chain and consensus mechanism.
2. To understand public block chain system, Private block chain system and consortium blockchain.
3. Able to know the security issues of blockchain technology.

Course Outcomes: Able to work in the field of block chain technologies.

UNIT - I

Fundamentals of Blockchain: Introduction, Origin of Blockchain, Blockchain Solution, Components of Blockchain, Block in a Blockchain,The Technology and the Future. Blockchain Types and Consensus Mechanism: Introduction, Decentralization and Distribution, Types of Blockchain, Consensus Protocol. **Cryptocurrency – Bitcoin, Altcoin and Token:** Introduction, Bitcoin and the Cryptocurrency, Cryptocurrency Basics, Types of Cryptocurrencies, Cryptocurrency Usage.

UNIT - II

Public Blockchain System: Introduction, Public Blockchain, Popular Public Blockchains, The Bitcoin Blockchain, Ethereum Blockchain.

Smart Contracts: Introduction, Smart Contract, Characteristics of a Smart Contract, Types of Smart Contracts, Types of Oracles, Smart Contracts in Ethereum, Smart Contracts in Industry.

UNIT - III

Private Blockchain System: Introduction, Key Characteristics of Private Blockchain, Why We Need Private Blockchain, Private Blockchain Examples, Private Blockchain and Open Source, E-commerce Site Example, Various Commands (Instructions) in E-commerce Blockchain, Smart Contract in Private Environment, State Machine, Different Algorithms of Permissioned Blockchain, Byzantine Fault, Multichain.

Consortium Blockchain: Introduction, Key Characteristics of Consortium Blockchain, Why We Need Consortium Blockchain, Hyperledger Platform, Overview of Ripple, Overview of Corda. Initial Coin Offering: Introduction, Blockchain Fundraising Methods, Launching an ICO, Investing in an ICO, Pros and Cons of Initial Coin Offering, Successful Initial Coin Offerings, Evolution of ICO, ICO Platforms.

UNIT - IV

Security in Blockchain: Introduction, Security Aspects in Bitcoin, Security and Privacy Challenges of Blockchain in General, Performance and Scalability, Identity Management and Authentication, Regulatory Compliance and Assurance, Safeguarding Blockchain Smart Contract (DApp), Security Aspects in Hyperledger Fabric.

Applications of Blockchain: Introduction, Blockchain in Banking and Finance, Blockchain in Education, Blockchain in Energy, Blockchain in Healthcare, Blockchain in Real-estate, Blockchain in Supply Chain, The Blockchain and IoT. Limitations and Challenges of Blockchain.

UNIT - V

Blockchain Case Studies: Case Study 1 – Retail, Case Study 2 – Banking and Financial Services, Case Study 3 – Healthcare, Case Study 4 – Energy and Utilities. Blockchain Platform using Python: Introduction, Learn How to Use Python Online Editor, Basic Programming Using Python, Python Packages for Blockchain.

Blockchain platform using Hyperledger Fabric: Introduction, Components of Hyperledger Fabric Network, Chain codes from Developer.ibm.com, Blockchain Application Using Fabric

Java SDK.

TEXT BOOKS:

1. “Block chain Technology”, Chandramouli Subramanian, Asha A.George, Abhilash K A and Meena Karthikeyan, Universities Press.

REFERENCES:

1. Blockchain Blueprint for Economy, Melanie Swan, SPD O'reilly.
2. Blockchain for Business, Jai Singh Arun, Jerry Cuomo, Nitin Gaur, Pearson Addition Wesley.

INTELLECTUAL PROPERTY RIGHTS (Open Elective)

M.Tech IT II Year I Sem.

L	T	P	C
3	0	0	3

Course Objectives:

1. To explain the art of interpretation and documentation of research work
2. To explain various forms of intellectual property rights
3. To discuss leading International regulations regarding Intellectual Property Rights

Course Outcomes: Upon the Successful Completion of the Course, the Students would be able to:

1. Understand types of Intellectual Property
2. Analyze trademarks and its functionality
3. Illustrate law of copy rights and law of patents

UNIT- I

Introduction to Intellectual property: Introduction, types of intellectual property, international organizations, agencies and treaties, importance of intellectual property rights.

UNIT - II

Trade Marks: Purpose and function of trademarks, acquisition of trade mark rights, protectable matter, selecting, and evaluating trade mark, trade mark registration processes.

UNIT - III

Law of copy rights: Fundamental of copy right law, originality of material, rights of reproduction, rights to perform the work publicly, copy right ownership issues, copy right registration, notice of copy right, international copy right law.

Law of patents: Foundation of patent law, patent searching process, ownership rights and transfer

UNIT - IV

Trade Secrets: Trade secret law, determination of trade secrete status, liability for misappropriations of trade secrets, protection for submission, trade secrete litigation.

Unfair competition: Misappropriation right of publicity, false advertising.

UNIT - V

New development of intellectual property: new developments in trade mark law; copy right law, patent law, intellectual property audits.

International overview on intellectual property, international – trade mark law, copy right law, international patent law, and international development in trade secrets law.

TEXT BOOKS & REFERENCES:

1. Intellectual property right, Deborah. E. Bouchoux, Cengage learning.
2. Intellectual property right – Unleashing the knowledge economy, prabuddha ganguli, Tata McGraw Hill Publishing company ltd.

FAULT TOLERANCE SYSTEMS (Open Elective)

M.Tech IT II Year I Sem.

L	T	P	C
3	0	0	3

Course Objectives:

1. To know the different advantages and limits of fault avoidance and fault tolerance techniques.
2. To impart the knowledge about different types of redundancy and its application for the design of computer system being able to function correctly even under presence of faults and data errors.
3. To understand the relevant factors in evaluating alternative system designs for a specific set of requirements.
4. To understand the subtle failure modes of "fault-tolerant" distributed systems.

Course Outcomes: Upon the Successful Completion of the Course, the Students would be able to:

1. Become familiar with general and state of the art techniques used in design and analysis of fault tolerant digital systems.
2. Be familiar with making system fault tolerant, modeling and testing, and benchmarking to evaluate and compare systems.

UNIT - I

Introduction to Fault Tolerant Computing: Basic concepts and overview of the course; Faults and their manifestations, Fault/error modeling, Reliability, availability and maintainability analysis, System evaluation, performance reliability tradeoffs.

UNIT - II

System level fault diagnosis: Hardware and software redundancy techniques. Fault tolerant system design methods, Mobile computing and Mobile communication environment, Fault injection methods.

UNIT - III

Software fault tolerance: Design and test of defect free integrated circuits, fault modeling, built in self- test, data compression, error correcting codes, simulation software/hardware, fault tolerant system design, CAD tools for design for testability.

UNIT - IV

Information Redundancy and Error Correcting Codes: Software Problem. Software Reliability Models and Robust Coding Techniques, Reliability in Computer Networks Time redundancy. Re execution in SMT, CMP Architectures, Fault Tolerant Distributed Systems, Data replication.

UNIT - V

Case Studies in FTC: ROC, HP Non-Stop Server. Case studies of fault tolerant systems and current research issues.

TEXT BOOK:

1. Fault Tolerant Computer System Design by D. K. Pradhan, Prentice Hall.

REFERENCES:

1. Fault Tolerant Systems by I. Koren, Morgan Kauffman.
2. Software Fault Tolerance Techniques and Implementation by L. L. Pullum, Artech House Computer Security Series.
3. Reliability of Computer Systems and Networks: Fault Tolerance Analysis and Design by M. L. Shooman, Wiley.

INTRUSION DETECTION SYSTEMS (Open Elective)

M.Tech IT II Year I Sem.

L	T	P	C
3	0	0	3

Prerequisites: Computer Networks, Computer Programming

Course Objectives:

1. Compare alternative tools and approaches for Intrusion Detection through quantitative analysis to determine the best tool or approach to reduce risk from intrusion.
2. Identify and describe the parts of all intrusion detection systems and characterize new and emerging IDS technologies according to the basic capabilities all intrusion detection systems share.

Course Outcomes: After completion of the course, students will be able to:

1. Possess a fundamental knowledge of Cyber Security.
2. Understand what vulnerability is and how to address most common vulnerabilities.
3. Know basic and fundamental risk management principles as it relates to Cyber Security and Mobile Computing.
4. Have the knowledge needed to practice safer computing and safeguard your information using Digital Forensics.
5. Understand basic technical controls in use today, such as firewalls and Intrusion Detection systems.
6. Understand legal perspectives of Cyber Crimes and Cyber Security.

UNIT - I

The state of threats against computers, and networked systems-Overview of computer security solutions and why they fail-Vulnerability assessment, firewalls, VPN's -Overview of Intrusion Detection and Intrusion Prevention, Network and Host-based IDS

UNIT - II

Classes of attacks - Network layer: scans, denial of service, penetration Application layer: software exploits, code injection-Human layer: identity theft, root access-Classes of attackers-Kids/hackers/sop Hesitated groups-Automated: Drones, Worms, Viruses

UNIT - III

A General IDS model and taxonomy, Signature-based Solutions, Snort, Snort rules, Evaluation of IDS, Cost sensitive IDS

UNIT - IV

Anomaly Detection Systems and Algorithms-Network Behavior Based Anomaly Detectors (rate based)- Host-based Anomaly Detectors-Software Vulnerabilities-State transition, Immunology, Payload Anomaly Detection

UNIT - V

Attack trees and Correlation of alerts- Autopsy of Worms and Botnets-Malware detection - Obfuscation, polymorphism- Document vectors.
Email/IM security issues-Viruses/Spam-From signatures to thumbprints to zero-day detection-Insider Threat issues-Taxonomy-Masquerade and Impersonation Traitors, Decoys and Deception-Future: Collaborative Security

TEXT BOOKS:

1. Peter Szor, The Art of Computer Virus Research and Defense, Symantec Press ISBN 0-321-30545-3.
2. Markus Jakobsson and Zulfikar Ramzan, Crimeware, Understanding New Attacks and Defenses.

REFERENCE BOOKS:

1. Saiful Hasan, Intrusion Detection System, Kindle Edition.
2. Ankit Fadia, Intrusion Alert: An Ethical Hacking Guide to Intrusion Detection.

Online Websites/Materials:
1. https://www.intechopen.com/books/intrusion-detection-systems/

Online Courses:
1. https://www.sans.org/course/intrusion-detection-in-depth
2. https://www.cybrary.it/skill-certification-course/ids-ips-certification-training-course

DIGITAL FORENSICS (Open Elective)

M.Tech IT II Year I Sem.

L	T	P	C
3	0	0	3

Pre-Requisites: Cybercrime and Information Warfare, Computer Networks

Course Objectives:

1. provides an in-depth study of the rapidly changing and fascinating field of computer forensics.
2. Combines both the technical expertise and the knowledge required to investigate, detect and prevent digital crimes.
3. Knowledge on digital forensics legislations, digital crime, forensics processes and procedures, data acquisition and validation, e-discovery tools
4. E-evidence collection and preservation, investigating operating systems and file systems, network forensics, art of steganography and mobile device forensics

Course Outcomes: On completion of the course the student should be able to

1. Understand relevant legislation and codes of ethics.
2. Computer forensics and digital detective and various processes, policies and procedures.
3. E-discovery, guidelines and standards, E-evidence, tools and environment.
4. Email and web forensics and network forensics.

UNIT - I

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

UNIT - II

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

UNIT - III

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

UNIT - IV

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

UNIT - V

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

TEXT BOOKS:

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

REFERENCES:

1. William Oettinger, Learn Computer Forensics: A beginner's guide to searching, analyzing, and securing digital evidence, Packt Publishing; 1st edition (30 April 2020), ISBN: 1838648178.
2. Thomas J. Holt, Adam M. Bossler, Kathryn C. Seigfried-Spellar, Cybercrime and Digital Forensics: An Introduction, Routledge.

OPTIMIZATION TECHNIQUES (Open Elective)

M.Tech IT II Year I Sem.

L	T	P	C
3	0	0	3

Prerequisite: Mathematics –I, Mathematics –II

Course Objectives:

1. To introduce various optimization techniques i.e classical, linear programming, transportation problem, simplex algorithm, dynamic programming
2. Constrained and unconstrained optimization techniques for solving and optimizing electrical and electronic engineering circuits design problems in real world situations.
3. To explain the concept of Dynamic programming and its applications to project implementation.

Course Outcomes: After completion of this course, the student will be able to:

1. explain the need of optimization of engineering systems.
2. understand optimization of electrical and electronics engineering problems.
3. apply classical optimization techniques, linear programming, simplex algorithm, transportation problem.
4. apply unconstrained optimization and constrained non-linear programming and dynamic programming.
5. Formulate optimization problems.

UNIT - I

Introduction and Classical Optimization Techniques: Statement of an Optimization problem – design vector – design constraints – constraint surface – objective function – objective function surface
- classification of Optimization problems.

Linear Programming: Standard form of a linear programming problem – geometry of linear programming problems – definitions and theorems – solution of a system of linear simultaneous equations – pivotal reduction of a general system of equations – motivation to the simplex method – simplex algorithm.

UNIT - II

Transportation Problem: Finding initial basic feasible solution by north – west corner rule, least cost method and Vogel's approximation method – testing for optimality of balanced transportation problems. Degeneracy.

Assignment problem – Formulation – Optimal solution - Variants of Assignment Problem; Traveling Salesman problem.

UNIT - III

Classical Optimization Techniques: Single variable Optimization – multi variable Optimization without constraints – necessary and sufficient conditions for minimum/maximum – multivariable Optimization with equality constraints: Solution by method of Lagrange multipliers – Multivariable Optimization with inequality constraints: Kuhn – Tucker conditions.
Single Variable Nonlinear Unconstrained Optimization: Elimination methods: Uni Model function-its importance, Fibonacci method & Golden section method.

UNIT - IV

Multi variable nonlinear unconstrained optimization: Direct search methods – Univariant method, Pattern search methods – Powell's, Hooke - Jeeves, Rosenbrock's search methods. Gradient methods: Gradient of function & its importance, Steepest descent method, Conjugate direction methods: Fletcher- Reeves method & variable metric method.

UNIT - V

Dynamic Programming: Dynamic programming multistage decision processes – types – concept of sub optimization and the principle of optimality – computational procedure in dynamic programming – examples illustrating the calculus method of solution - examples illustrating the tabular method of solution.

TEXT BOOKS:

1. Optimization Techniques & Applications by S.S.Rao, New Age International.
2. Optimization for Engineering Design by Kalyanmoy Deb, PHI

REFERENCES:

1. George Bernard Dantzig, Mukund Narain Thapa, “Linear programming”, Springer series in Operations Research 3rd edition, 2003.
2. H. A. Taha, “Operations Research: An Introduction”, 8th Edition, Pearson/Prentice Hall, 2007.
3. Optimization Techniques by Belegundu & Chandrupatla, Pearson Asia.
4. Optimization Techniques Theory and Practice by M.C. Joshi, K.M. Moudgalya, Narosa Publications

CYBER PHYSICAL SYSTEMS (Open Elective)

M.Tech IT II Year I Sem.

L	T	P	C
3	0	0	3

Course Objective: To learn about design of cyber-physical systems

Course Outcomes: Upon the Successful Completion of the Course, the Students would be able to:

1. Understand the core principles behind CPS
2. Identify Security mechanisms of Cyber physical systems
3. Understand Synchronization in Distributed Cyber-Physical Systems

UNIT - I

Symbolic Synthesis for Cyber-Physical Systems

Introduction and Motivation, Basic Techniques - Preliminaries, Problem Definition, Solving the Synthesis Problem, Construction of Symbolic Models, Advanced Techniques: Construction of Symbolic Models, Continuous-Time Controllers, Software Tools

UNIT - II

Security of Cyber-Physical Systems

Introduction and Motivation, Basic Techniques - Cyber Security Requirements, Attack Model, Countermeasures, Advanced Techniques: System Theoretic Approaches

UNIT - III

Synchronization in Distributed Cyber-Physical Systems: Challenges in Cyber-Physical Systems, A Complexity-Reducing Technique for Synchronization, Formal Software Engineering, Distributed Consensus Algorithms, Synchronous Lockstep Executions, Time-Triggered Architecture, Related Technology, Advanced Techniques

UNIT - IV

Real-Time Scheduling for Cyber-Physical Systems

Introduction and Motivation, Basic Techniques - Scheduling with Fixed Timing Parameters, Memory Effects, Multiprocessor/Multicore Scheduling, Accommodating Variability and Uncertainty

UNIT - V

Model Integration in Cyber-Physical Systems

Introduction and Motivation, Causality, Semantic Domains for Time, Interaction Models for Computational Processes, Semantics of CPS DSMLs, Advanced Techniques, ForSpec, The Syntax of CyPhyML, Formalization of Semantics, Formalization of Language Integration.

TEXT BOOKS:

1. Raj Rajkumar, Dionisio De Niz, and Mark Klein, Cyber-Physical Systems, Addison-Wesley Professional.
2. Rajeev Alur, Principles of Cyber-Physical Systems, MIT Press, 2015

GRAPH ANALYTICS (Open Elective)

M.Tech IT II Year I Sem.

L	T	P	C
3	0	0	3

Course Objectives:

1. To explore the concept of Graphs and related algorithms.
2. To learn new ways to model, store, retrieve and analyze graph-structured data.
3. To be aware of advanced concepts in graph analytic techniques and its applications.

Course Outcomes: Upon the Successful Completion of the Course, the Students would be able to:

1. Understand Large-scale Graph and its Characteristics
2. Analyze Breadth-First Search Algorithm
3. Illustrate Recent Advances in Scalable Network Generation

UNIT - I

Introduction and Application of Large-scale Graph: Characteristics, Complex Data Sources - Social Networks, Simulations, Bioinformatics; Categories- Social, Endorsement, Location, Co-occurrence graphs; Graph Data structures, Parallel, Multicore and Graph Algorithms

UNIT - II Algorithms: Search and Paths

A Work-Efficient Parallel Breadth-First Search Algorithm (or How To Cope With the Nondeterminism of Reducers), Multi-Objective Shortest Paths

UNIT - III Algorithms: Structure

Multicore Algorithms for Graph Connectivity Problems, Distributed Memory Parallel Algorithms for Massive Graphs, Massive-Scale Distributed Triangle Computation and Applications

UNIT - IV Models

Recent Advances in Scalable Network Generation, Computational Models for Cascades in Massive Graphs, Executing Dynamic Data-Graph Computations Deterministically Using Chromatic Scheduling.

UNIT - V Frameworks and Software

Graph Data Science Using Neo4j, A Cloud-Based Approach to Big Graphs, Interactive Graph Analytics at Scale in Arkouda

TEXT BOOKS:

1. David A. Bader, Massive Graph Analytics, CRC Press

REFERENCES:

1. Stanley Wasserman, Katherine Faust, "Social Network Analysis: Methods and Applications", (Structural Analysis in the Social Sciences), Cambridge University Press, 1995.
2. Matthew O. Jackson, "Social and Economic Networks", Princeton University Press, 2010.
3. Tanja Falkowski, "Community Analysis in Dynamic Social Networks", (Dissertation), University Magdeburg, 2009.