| Course-Code | Course Title | | | | | Core/ Elective |
|---|---|---|---|---|---|---|
| **U23MB701** | **BUSINESS ECONOMICS AND FINANCIAL ANALYSIS** | | | | | **Core Course** |
| Prerequisites | Contact Hour per Week | | | CIE | SEE | Credit |
| | L | T | P | | | |
| | 3 | - | - | 40 | 60 | 3 |

**Course Objectives:** Student will be able to

1. Understand the concepts of Business and Economics
2. Comprehend the concepts of market dynamics namely elasticity of demand and pricing in different market structures.
3. Gain the knowledge on the production theories and cost analysis while dealing with the production and the concept of breakeven analysis.
4. To acquire the in depth knowledge on Financial Accounting concepts and principles and preparation of final accounts.
5. To understand the financial statements through ration analysis and cash flow techniques.

**Course Outcomes:** Student will be able to

1. Apply the concepts of business and economics during his professional and personal life.
2. Understand the elasticity of the demand of the product, different types, and measurement of elasticity of demand and factors influencing on elasticity of demand.
3. Recognize the Production function, features of Iso-Quants and Iso-Costs, different types of internal economies, external economies and law of returns with appropriate examples.
4. Prepare the financial statements of the firm.
5. To Analyze the financial statements using ratio analysis and cash flow techniques.

UNIT **– I**

Introduction to Business and Economics: Business: Structure of Business Firm, Theory of Firm, Types of Business Entities, Sources of Capital for a Company, Non-Conventional Sources of Finance. Economics: Significance of Economics, Micro and Macro Economic Concepts, Business Cycle, Features and Phases of Business Cycle. Nature and Scope of Business Economics, Multidisciplinary nature of Business Economics.

**UNIT – II**

Demand and Supply Analysis: Elasticity of Demand: Elasticity, Types of Elasticity, Law of Demand, Measurement and Significance of Elasticity of Demand, Factors affecting Elasticity of Demand, Elasticity of Demand in decision making, Demand Forecasting: Characteristics of Good Demand Forecasting, Steps in Demand Forecasting, Methods of Demand Forecasting.

**UNIT- III**

Production, Cost, and Market Structures & Pricing: Production Analysis: Factors of Production, Production Function, Production Function. Cost analysis: Types of Costs, Short run and Long run Cost Functions. Market Structures: Features of Perfect competition, Monopoly, Oligopoly, and Monopolistic Competition. Pricing: Types of Pricing, Product Life Cycle based Pricing, Break Even Analysis, & Cost Volume Profit Analysis.

UNIT – IV

Financial Accounting: Accounting concepts and Conventions, Accounting Equation, Double Entry system of Accounting, Rules for maintaining Books of Accounts, Journal, Posting to Ledger, Preparation of Trial Balance, Elements of Financial Statements, and Preparation of Final Accounts.

UNIT - V

Financial Analysis through Ratios: Concept of Ratio Analysis, Liquidity Ratios, Turnover Ratios, Profitability Ratios, Proprietary Ratios, Solvency, Leverage Ratios (simple problems),

**TEXT BOOKS:**

I. A.R. Aryasri, "Managerial Economics and Financial Analysis", TMH Publications, 3nd Edition, 2007.

**REFERENCE BOOKS:**

II. D.N. Dwivedi, "Managerial Economics", Vikas Publication House Pvt. Ltd, 2nd Edition, 2012.

III. S.N. Maheshwari & S.K.Maheshwari, "Financial Accounting", Vikas Publication House Pvt.Ltd, 4th Edition, 2012.

IV. R. Narayana Swamy, "Financial Accounting- A managerial Perspective", Pearson publications, 1st Indian Reprint Edition, 2012.

V. J.V. Prabhakar Rao & P.V. Rao, "Managerial Economics & Financial Analysis", Maruthi Publishers, 1st Revised Edition, 2011.

VI. M.Kasi Reddy & Saraswathi, "Managerial Economics and Financial Analysis", PHI Publications, New Delhi, 10th Revised Edition, 2012.

VII. Varshney & Maheswari, "Managerial Economics", Sulthan Chand Publishers, 1st Revised Edition, 2009.

| Course Code | Course Title | | | | | | Core/Elective |
|---|---|---|---|---|---|---|---|
| U23IT701 | BIG DATA ANALYTICS | | | | | | CORE |
| Prerequisite | Contact Hours Per Week | | | | CIE | SEE | Credits |
| DBMS | L | T | D | P | | | |
| | 3 | - | - | - | 40 | 60 | 3 |

**Course Objectives**

Develop ability to

1. Understand big data for business intelligence.
2. Identify name nodes and data nodes of HDFS and can work with the file systems.
3. Work and defend big data using NOSQL.
4. Discuss the process of data analytics using Hadoop and related tools.
5. Work with the Pig, Hive and HiveQL.

**Course Outcomes**

At the end of the course, student would be able to

1. Explain big data and use cases from selected business domains.
2. Implement the knowledge of NoSQL big data management with Install, configure, and run Hadoop and HDFS.
3. Apply the concept of Sharding and Map Reduce with the procedural approach
4. Analyze map-reduce analytics using Hadoop.
5. Apply big data and echo system techniques for real world

**UNIT – I**

**Understanding Big Data:** Characteristics of Data, Introduction to Big Data and its importance, Challenges posed by Big Data, Big data analytics and its classification.

**Big Data Applications:** big data and healthcare, big data in banking, advertising and big data, big data technologies.

**UNIT – II**

**Hadoop Distributed File System:** Hadoop Ecosystem, Hadoop Architecture, HDFS Concepts, Blocks, Name nodes and Data nodes, Hadoop File Systems, The Java Interface, Reading Data from a Hadoop URL, Writing Data, Querying the File System, Deleting Data, Anatomy of File Read and Write.

**UNIT- III**

**NOSQL Data Management:** Introduction to NOSQL, aggregate data models, aggregates key value and document data models, relationships, graph databases, schema less databases, Sharding, map reduce, partitioning and combining, composing map-reduce calculations.

**UNIT – IV**

**Map Reduce and Yarn:** Hadoop Map Reduce paradigm, Map and Reduce tasks, Job and Task trackers, Mapper, Reducer, Map Reduce workflows, classic Map-reduce, YARN – failures in classic Map-reduce and YARN – job scheduling, shuffle and sort, task execution, Map Reduce types, input formats, output formats.

**UNIT - V**

**Pig:** Installing and Running Pig, an Example, Comparison with Databases, Pig Latin, User-Defined Functions, Data Processing Operators.

**Hive:** The Hive Shell, An Example, Running Hive, Comparison with Traditional Databases, HiveQL, Tables, Querying Data, User- Defined Functions, writing a User Defined Functions.

**Suggested Readings:**

1.Tom White, "Hadoop: The Definitive Guide", Fourth Edition, O'Reilly, 2023, ISBN: 978-93-5213-067-2.

2. Pramod Sadalage, Martin Fowler, "NoSQL Distilled - A brief guide to the emerging world of polyglot Persistence", Addison Wesley 2013.

3. Vignesh Prajapati, Big data analytics with R and Hadoop, 2013, ISBN -13:978- 1782163282.

| Course Code | Course Title | | | | | Core/Elective |
|---|---|---|---|---|---|---|
| U23IT7L1 | WEB APPLICATION DEVELOPMENT LAB | | | | | CORE |
| Prerequisite | Contact Hours Per Week | | | | CIE | SEE | Credits |
| | L | T | D | P | | | |
| Java | - | - | - | 2 | 25 | 50 | 1 |

**Course Objectives**

Develop ability to

1. Develop web pages using HTML tags and perform validation using scripting
2. Implement various types of styling using CSS and transform data into various forms
3. Understand, analyze and create XML documents and XML Schema
4. Implement applications using JQuery and AngularJS
5. Understand and implement the concepts of MEAN Stack and SMACK stack Course

**Course Outcomes**

At the end of the course, student would be able to

1. Design Web pages and perform form validation using HTML5.0 in built functions.
2. Apply Styles to the web content using CSS.
3. Create and process web publishing content using XML and JSON.
4. Use JQuery to perform client-side Dynamics.
5. Create single page applications (Front End) using AngularJS. And design Big data applications using Mean stack or SMACK stack Frameworks.

**List of Experiments**

1. Implement HTML:
   i. Basic HTML Tags
   ii. Design a Class Time Table using Table Tag & its Attributes
   iii. Implement FRAMES
2. Design the following static web pages required for an online book store web site.
   i) HOME PAGE: The static home page must contain three frames.
   ii) LOGIN PAGE
   iii) CATOLOGUE PAGE: The catalogue page should contain the details of all the books
   available in the web site in a table.
   iii) REGISTRATION PAGE
3. Create a web page using
   i) Inline CSS,
   ii) Internal CSS
   iii) External CSS
4. Write JavaScript to validate the following fields of the Registration page.
   1. First Name (Name should contains alphabets and the length should not be less than 6 characters).
   2. Password (Password should not be less than 6 characters length).
   3. E-mail id (should not contain any invalid and must follow the standard pattern name@domain.com)
   4. Mobile Number (Phone number should contain 10 digits only).
   5. Last Name and Address (should not be Empty).

   document

5. Display the various forms of XML document
   i) Raw XML ii) XML using CSS
6. Write a program to create a website using HTML, CSS and JavaScript?
7. Write a program to create a voting application using React JS.
8. Write a program to create and Build a Password Strength Check using Jquery.
9. Create a NodeJS server that serves static HTML and CSS files to the user without using Express.
10. Create a NodeJS server using Express that stores data from a form as a JSON file and displays it in another page. The redirect page should be prepared using Handlebars.

**Suggested Readings:**

1. Web Technologies, Oxford University Press, Uttam K Roy, 1st Edition,2010.
2. Java Script: The Definitive Guide, David Flanagan O'Reilly, 6th Edition

| Course Code | Course Title | | | | | | Core/Elective |
|---|---|---|---|---|---|---|---|
| U23IT7L2 | BIG DATA ANALYTICS LAB | | | | | | CORE |
| Prerequisite | Contact Hours Per Week | | | | CIE | SEE | Credits |
| DBMS | L | T | D | P | | | |
| | - | - | - | 3 | 25 | 50 | 1.5 |

**Course Objectives**

Develop ability to

1.Understand how to setup a Hadoop Cluster
2.Work with mappings and to develop programs using MapReduce Techniques
3.Learn file handling in HDFS
4.Work with the NOSQL and can differentiate between SQL and NOSQL
5.Implement Pig, Pig Latin and HiveQL to process big data.

**Course Outcomes**

At the end of the course, student would be able to

1. Explain big data and use cases from selected business domains.
2.Install, configure and run Hadoop and HDFS.
3. Apply the concept of Sharding and Map Reduce with the procedural approach.
4.Analyze map-reduce analytics using Hadoop.
5.Apply big data and echo system techniques for user defined functions in Hive platform.

**List of Experiments**

1. Understanding and using basic HDFS commands.
2. Word count application using Mapper Reducer on single node cluster.
3. Working with files in Hadoop file system: Reading, Writing and Copying.
4. Develop a MapReduce program to implement Matrix Multiplication.
5. Develop a MapReduce program to find the maximum temperature in each year.
6. Implement a MapReduce program to find the grades of students.
7. Detect Suspicious Login Patterns using Pig Latin.
8. Develop Pig Latin Scripts to sort, group, join, project and filter the data.
9. Use and implement hive to analyze user usage of system data.
10. Implement User Defined functions for Data cleaning and Format transformation in Hive

**Suggested Readings:**

1. Tom White, "Hadoop: The Definitive Guide", Fourth Edition, O'Reilly, 2023, ISBN: 978-93-5213-067-2.

2. Alan Gates, "Programming Pig", O'Reilly Media Inc, 2011.

| Course Code | Course Title | | | | | | Core/Elective |
|---|---|---|---|---|---|---|---|
| **U23IT7P1** | **PROJECT PHASE-I** | | | | | | **PROJ** |
| **Prerequisite** | **Contact Hours per Week** | | | | **CIE** | **SEE** | **Credits** |
| | **L** | **T** | **D** | **P** | | | |
| **Mini Project, Programming Languages** | **-** | **-** | **-** | **4** | **50** | **50** | **2** |

**Course Objectives:**

Develop ability to:

1. Enhance practical and professional skills
2. Familiarize tools and techniques of systematic literature survey and documentation
3. Expose the students to industry practices and team work.
4. Encourage students to work with innovative and entrepreneurial ideas
5. Obtain knowledge of societal and environmental related areas.

**Course Outcomes:**

At the end of the course, students would be able to:

1. Demonstrate the ability to synthesize and apply the knowledge and skills acquired in the academic program to real-world problems.
2. Evaluate different solutions based on economic and technical feasibility.
3. Analyse various modules pertaining to the sub routines of the projects.
4. Effectively plan a project and confidently perform all aspects of project management.
5. Demonstrate effective written and oral communication skills.

The department can initiate the project allotment procedure at the end of VI semester and finalize it in the first two weeks of VII semester. The department will appoint a project coordinator who will coordinate the following:

1. Collection of project topics/ descriptions from faculty members (Problems can also be invited from the industries)
2. Grouping of students (max 3 in a group)
3. Allotment of project guides

The aim of project work is to develop solutions to realistic problems applying the knowledge and skills obtained in different courses, new technologies and current industry practices. This requires students to understand current problems in their domain and methodologies to solve these problems. To get awareness on current problems and solution techniques, the first 4 weeks of VII semester will be spent on special lectures by faculty members, research scholars, post graduate students of the department and invited lectures by engineers from industries and R&D institutions. After completion of these seminars each group has to formalize the project proposal based on their own ideas or as suggested by the project guide. Seminar schedule will be prepared by the coordinator for all the students from the 5th week to the last week of the semester which should be strictly adhered to.

Each group will be required to:

1. Submit a one-page synopsis before the seminar for display on notice board.
2. Give a 30 minutes' presentation followed by 10 minutes' discussion.
3. Submit a technical write-up on the talk.

At least two teachers will be associated with the Project Seminar to evaluate students for the award of sessional marks which will be on the basis of performance in all the 3 items stated above.

The seminar presentation should include the following components of the project:

1. Problem definition and specification
2, Literature survey
3. Broad knowledge of available techniques to solve a particular problem.
4. Planning of the work, preparation of bar (activity) charts
5. Presentation- oral and written.

| Course Code | Course Title | | | | | | Core/Elective |
|---|---|---|---|---|---|---|---|
| U23IT702 | ADVANCED IOT | | | | | | Professional Elective-II |
| Prerequisite | Hours Per Week | | | | CIE | SEE | Credits |
| ES&IoT | L | T | D | P | | | |
| | 3 | - | - | - | 40 | 60 | 3 |

**Course Objectives**

Develop ability to

1. Understand the basics of IoT and IIOT.
2 Impart necessary and practical knowledge in Industrial Internet of Things.
3.Working on applications and Raspberry Pi.
4 Develop skills required to build real-time IIoT based projects
5.Evaluate the use of Smart Transportation, Water Management learning through case studies

**Course Outcomes**

At the end of the course, student would be able to

1. Explore the Internet of Things and IIOT basics components.
2. Illustrate working of I/O devices, sensors & communication module.
3. Analyse the use of protocols in IoT.
4. Interface I/O devices, Sensors & communication module
5. Develop real time IoT based projects.

**UNIT-I**

**Internet of Things**: The Third Wave? Advantages and Disadvantages of IoT. The Industrial Internet of Things (IIoT): Definition of IIoT, IoT, and M2M, IIoT Challenges, IIoT Requirements, IIoT Benefits. Internet of Things: More than Smart "Things": IoT key attributes, Three Major Challenges Facing IoT: Technology, Technological Challenges, Business, Categories of IoT, Architecture of IoT.

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**UNIT-II**

**IoT Implementation and Challenges**: Components of IoT Implementation: Sensors, Networks, Standards, Intelligent analysis, Intelligent actions. IoT Standardization and Implementation Challenges, Communication modules, I/O interfaces, Programming API's.

**UNIT-III**

Configuring Raspberry Pi, MicroPython Pyboard, and Jetson Nano for Python: Raspberry Pi Board Feature, Configuration of Raspberry Pi, Simple Applications with Raspberry Pi: OLED Display Interface, Camera Interfacing, Motor Control (DC Motor, Stepper Motor, and Servo Motor), Raspberry Pi and Mobile Interface Through Bluetooth.

**UNIT-IV**

IoT data protocols: MQTT, CoAP, AMQP, DDS, HTTP, WebSocket. Network Protocols for IoT: 6LowPAN, RPL, WiFi, Bluetooth, ZigBee, Z-Wave, LoRaWan, , XMPP.

**UNIT-V**

IIoT Case Studies: Smart Grids for Energy Management, Connected Agriculture, Smart Buildings and Facilities Management, Supply Chain Optimization, Connected Healthcare, Smart Retail, Smart Transportation, Water Management

**Suggested Reading:**

1. Ahmed Banafa by Introduction to Internet of Things (IoT) Published 2023 by River Publishers

2. Jivan S. Parab · Madhusudan Ganuji Lanjewar · Marlon Darius Sequeira · Gourish Naik · Arman Yusuf Shaikh by Python Programming Recipes for IoT Applications , Springer Nature Singapore Pte Ltd. 2023.
3. ArshdeepBahga, Vijay Madisetti, Internet of Things: A hands on approach, 2014, VPT publishers

| Course Code | Course Title | | | | | | Core/Elective |
|---|---|---|---|---|---|---|---|
| U23IT703 | DATA SCIENCE WITH R PROGRAMMING | | | | | | Professional Elective-II |
| Prerequisite | Contact Hours Per Week | | | | CIE | SEE | Credits |
| Python Programming | L | T | D | P | | | |
| | 3 | - | - | - | 40 | 60 | 3 |

**Course Objectives**

Develop ability to

1. Learn basics of R Programming environment: R language, R- studio and R packages
2. Learn various statistical concepts like linear and logistic regression, cluster analysis, time series forecasting
3. Learn Decision tree induction, association rule mining and text mining
4. Analyze a data set in R and present findings using the appropriate R packages.
5. Prepare or tidy data for in preparation for analysis

**Course Outcomes**

At the end of the course, student would be able to

1. Identify and execute basic syntax and programs in R.
2.Perform the Matrix operations using R built in functions.
3.Apply non numeric values in vectors
4. Create the list and data frames.
5. Exploit the graph using ggplot2.

## UNIT – I

**Overview of R:** History and Overview of R- Basic Features of R-Design of the R System- Installation of R-Console and Editor Panes, Comments, Installing and Loading R Packages, Help Files and Function Documentation Saving Work and Exiting R-Conventions, R for Basic Math, Arithmetic-Logarithms and Exponentials E-Notation, Assigning Objects, Vectors- Creating a Vector, Sequences, Repetition, Sorting, and Lengths- Sub setting and Element Extraction- Vector-Oriented Behavior.

## UNIT – II

**Exploring Data in R**: Introduction, Data Frames, R Functions for Understanding Data in Data Frames, Load Data Frames, Exploring Data, Data Summary, Finding the Missing Values, Invalid Values and Outliers, Descriptive Statistics, Spotting Problems in Data with Visualization.

## UNIT- III

**Linear Regression Using R**: Introduction, Model Fitting, Linear Regression, Assumptions of Linear Regression, Validating Linear Assumption. Logistic Regression: Introduction, What Is Regression? Introduction to Generalized Linear Model, Logistic Regression, Binary Logistic Regression, Diagnosing Logistic Regression, Multinomial Logistic Regression Model.

## UNIT – IV

**Lists And Data Frames**: Lists of Objects-Component Access-Naming-Nesting-Data Frames-Adding Data Columns and Combining Data Frames-Logical Record Subsets-Some Special Values-Infinity-NaN-NA-NULL Attributes-Object-Class-Is-Dot Object-Checking Functions-As-Dot Coercion Functions.

## UNIT - V

**Clustering:** Introduction, What Is Clustering, Basic Concepts in Clustering, Hierarchical Clustering, K- Means Algorithm, CURE Algorithm, clustering in Non-Euclidean Space, Clustering for Streams and Parallelism. Association Rules: Introduction, Frequent Itemset, Data Structure Overview, Mining Algorithm Interfaces, Auxiliary Functions, Sampling from Transaction, Generating Synthetic Transaction Data, Additional Measures of Interestingness, Distance Based Clustering Transaction and Association.

**Suggested Readings:**

1. Nina Zumel, Practical Data Science with R, Manning Publications, 2014.
2.Peter Bruce and Andrew Bruce, Practical Statistics for Data Scientists, O'Reilly, 2017.

3.Hadley Wickham and Garrett Grolemund, R for Data Science, O'Reilly, 2017.
4.Roger D Peng, R Programming for Data science, Lean Publishing, 2016.
5.Rafael A Irizarry, Introduction to Data Science, Lean Publishing,2016.

| Course Code | Course Title | | | | | | Core/Elective |
|---|---|---|---|---|---|---|---|
| U23IT704 | INFORMATION SECURITY | | | | | | Professional Elective-II |
| Prerequisite | Contact Hours Per Week | | | | CIE | SEE | Credits |
| Computer Networks | L | T | D | P | | | |
| | 3 | - | - | - | 40 | 60 | 3 |

**Course Objectives**

Develop ability to

1. Learn legal and technical issues in building secure information systems
2. Provide an understanding of network security
3. Give an exposure to the students towards security standards and practices
4. Provide an understanding of cryptography and Security Tools
5. Learn Implementing Information Security and Information Security Maintenance

**Course Outcomes**

At the end of the course, student would be able to

1. Describe the steps in Security Systems development life cycle (Sec SDLC).
2. Understand the common threats, legal and ethical issues.
3. Identify security and risk management for business needs & use of security frameworks in preparing security blue print for the organization.
4. Usage of reactive solutions, firewalls, software and Intrusion Detection techniques.
5. Use ethical hacking tools and secure communication protocols and use of the technical and non-technical security aspects.

**UNIT – I**

**Introduction**: History, Critical Characteristics of Information, NSTISSC Security Model, Components of an Information System, Securing the Components, Balancing Security and Access, The SDLC, The Security SDLC.
**Need for Security:** Business Needs, Threats, Attacks, and Secure Software Development

**UNIT – II**

**Legal, Ethical and Professional Issues**: Law and ethics in Information Security, Relevant U.S. Laws, International Laws and Legal Bodies, Ethics and Information Security.
**Risk Management**: Overview, Risk Identification, Risk Assessment, Risk Control Strategies, selecting a Risk Control Strategy, Quantitative versus Qualitative Risk Control Practices, Risk Management Discussion Points, Recommended Risk Control Practices

**UNIT- III**

**Planning for Security**: Security policy, Standards and Practices, Security Blue Print, Security Education, Continuity strategies.
**Security Technology:** Firewalls and VPNs: Physical Design, Firewalls, Protecting Remote connections

**UNIT – IV**

**Security Technology**: Intrusion Detection, Access Control, and other Security Tools: Intrusion Detection and Prevention Systems-Scanning, and Analysis Tools- Access Control Devices.
**Cryptography**: Foundations of Cryptology, Cipher methods, Cryptographic Algorithms, Cryptographic Tools, Protocols for Secure Communications, Attacks on Cryptosystems

**UNIT - V**

**Implementing Information Security**: Information security project management, Technical topics of implementation, Non-Technical Aspects of implementation, Security Certification and Accreditation.
**Information Security Maintenance**: Security management models, Maintenance model Short case studies in Cryptography and Security, Secure Multi party calculation, Virtual Elections, Single Sign On, Secure Inter Branch Payment transactions, Cross site scripting vulnerability.

**Suggested Readings:**

1. Michael E Whitman and Herbert J Mattord, Principles of Information Security, Cengage Learning, 6 th Edition 2018
2. Atul khate, Cryptography and Network Security" 4 th edition , Tata Mc Graw Hill , 2019

| Course Code | Course Title | | | | | | Core/Elective |
|---|---|---|---|---|---|---|---|
| U23IT705 | SOFTWARE TESTING AND QUALITY ASSURANCE | | | | | | Professional Elective-II |
| Prerequisite | Contact Hours Per Week | | | | CIE | SEE | Credits |
| Software Engineering | L | T | D | P | | | |
| | 3 | - | - | - | 40 | 60 | 3 |

**Course Objectives**

Develop ability to

1. Demonstration of software quality assurance and testing as a fundamental component of software lifecycle.
2. Define the scope of software projects.
3. Apply software quality assurance and testing activities using modern software tools.
4. Estimate cost of a project and manage budgets and prepare test plans and schedules for a software quality assurance and testing project.
5. Develop software quality assurance and testing project staffing requirements and effectively manage a project.

**Course Outcomes**

At the end of the course, student would be able to

1.Apply modern software testing processes in relation to software development and project management.
2.Create test strategies and plans, design test cases, prioritize and execute them.
3.Manage incidents and risks within a project.
4.Contribute to efficient delivery of software solutions and implement improvements in the software development processes.
5.Gain expertise in designing, implementation and development of computer based systems and IT processes.

**UNIT – I**

The Software Quality Challenge, Introduction Software Quality Factors, The Components of the Software Quality Assurance System – Overview, Development and Quality Plans.

**UNIT – II**

Integrating Quality Activities in the Project Life Cycle, Assuring the Quality of Software Maintenance Components, CASE Tools and their effect on Software Quality, Procedure and Work Instructions, Supporting Quality Devices, Configuration Management, Documentation Control, Project Progress Control

**UNIT- III**

Software Quality Metrics, Costs of Software Quality, Quality Management Standards – ISO 9000 and Companion ISO Standards, CMM, CMMI, PCMM, Malcom Balridge, 3 Sigma, 6 Sigma, SQA Project Process Standards – IEEE Software Engineering Standards.

**UNIT – IV**

Building a Software Testing Strategy, establishing a Software Testing Methodology, Determining Your Software Testing Techniques, eleven – Step Software Testing Process Overview, Assess Project
Management Development Estimate and Status, Develop Test Plan, Requirements Phase Testing, Design Phase Testing, Program Phase Testing, Execute Test and Record Results, Acceptance Test, Report Test Results, Test Software Changes, Evaluate Test Effectiveness.

**UNIT - V**

Testing Client / Server Systems, Testing the Adequacy of System Documentation, Testing Web-based Systems, Testing Off – the – Shelf Software, testing in a Multiplatform Environment, Testing Security, testing a Data Warehouse, Creating Test Documentation, Software Testing Tools, Taxonomy of Testing Tools, Methodology to Evaluate Automated Testing Tools, Load Runner, Win Runner and Rational Testing Tools, Java Testing Tools, JMetra, JUNIT and Cactus.

**Suggested Readings:**

1. Daniel Galin, Software Quality Assurance–From Theory to Implementation, Pearson Education.2004
2. Mordechai Ben Menachem / Garry S. Marliss, Software Quality–Producing Practical, Consistent Software, BS Publications, 2014
3. William E. Perry, Effective Methods for Software Testing, 2nd Edition, Wiley.

| Course Code | Course Title | | | | | | Core/Elective |
|---|---|---|---|---|---|---|---|
| U23IT706 | CLOUD COMPUTING | | | | | | Professional Elective-II |
| Prerequisite | Contact Hours Per Week | | | | CIE | SEE | Credits |
| Operating Systems | L | T | D | P | | | |
| | 3 | - | - | - | 40 | 60 | 3 |

**Course Objectives**

Develop ability to

1. Understand basic concepts of cloud computing & enabling Technologies
2. Perform Auto Scaling , capacity planning and load balanicing in cloud
3. Understand security, privacy and compliance issues in clouds
4. Introduce cloud management standards and programming models
5. Work with the load balancing techniques

**Course Outcomes**

At the end of the course, student would be able to

1. Understand the architecture and concept of different cloud models: IaaS, PaaS, SaaS
2. Create virtual Machine images and deploy them on cloud
3. Identify Security and compliance issues in clouds
4. Analyze the various service provides and the security issues with service models.
5. Work with the cloud management and the enterprise applications.

**UNIT – I**

Computing Paradigms: High-Performance Computing, Parallel Computing, Distributed Computing, Cluster Computing, Grid Computing, Cloud Computing, Bio computing, Mobile Computing, Quantum Computing, Optical Computing, Nano computing.

**UNIT – II**

Introduction, Benefits and challenges, Cloud computing services, Resource Virtualization, Resource pooling sharing and provisioning Scaling in the Cloud, Capacity Planning, Load Balancing, File System and Storage

**UNIT- III**

Cloud Computing Architecture and Management: Cloud architecture, Layer, Anatomy of the Cloud, Network Connectivity in Cloud Computing, Applications, on the Cloud, Managing the Cloud, Managing the Cloud Infrastructure Managing the Cloud application, Migrating Application to Cloud, Phases of Cloud Migration Approaches for Cloud Migration.

**UNIT – IV**

Cloud Service Models: Infrastructure as a Service, Characteristics of IaaS. Suitability of IaaS, Pros and Cons of IaaS, Summary of IaaS Providers, Platform as a Service, Characteristics of PaaS, Suitability of PaaS, Pros and Cons of PaaS, Summary of PaaS Providers, Software as a Service, Characteristics of SaaS, Suitability of SaaS, Pros and Cons of SaaS, Summary of SaaS Providers, Other Cloud Service Models.

**UNIT - V**

Portability and Interoperability Issues, Cloud Management and a Programming Model Case Study, Popular Cloud Services Enterprise architecture and SOA, Enterprise Software, Enterprise Custom Applications, Workflow and Business Processes, Enterprise Analytics and Search, Enterprise Cloud Computing Ecosystem.

**Suggested Readings:**

1. Essentials of cloud Computing: K. Chandrasekhran, CRC press, 2014
2. Cloud Computing – Sandeep Bhowmik, Cambridge University Press, 2017.
3. Enterprise Cloud Computing – Technology, Architecture, Applications by Gautam Shroff, Cambridge University Press, 2016.

| Course Code | Course Title | | | | | | Core/Elective |
|---|---|---|---|---|---|---|---|
| U23IT707 | AUGMENTED REALITY | | | | | | Professional Elective-III |
| Prerequisite | Contact Hours Per Week | | | | CIE | SEE | Credits |
| AI / ML | L | T | D | P | | | |
| | 3 | - | - | - | 40 | 60 | 3 |

**Course Objectives**

Develop ability to

1. Familiarize with the fundamental concepts and working principles of Augmented Reality.
2. Understand different types of AR systems, hardware and software components.
3. Explore and use AR applications in education and industrial domains.
4. Analyze the impact of AR in real-world sectors such as food and learning.
5. Enrich knowledge of emerging technologies and tools used for AR development.

**Course Outcomes**

At the end of the course, student would be able to

1. Demonstrate understanding of basic concepts and architecture of Augmented Reality systems.
2. Identify and use various types of AR technologies in different application domains.
3. Analyze and evaluate the use of AR in food and beverage industries.
4. Apply AR concepts to enhance teaching and learning processes.
5. Explore and demonstrate the use of AR tools, devices and future technologies.

**UNIT- I: AUGMENTED RELALITY**

Introduction to Augmented Reality, How Augmented Reality Works with Technology, Hardware Components to Power Augmented Reality- Augmented Reality Business Applications, Tools Available for Augmented Reality and Recognition.

**UNIT- II: Industry 4.0: Augmented and Virtual Reality in Education**

Augmented Reality-Important Concepts Used in AR., Types of AR, Hardware , Software ,AR in Education, Industrial Applications of AR, Applications of AR.

**UNIT- III: Augmented Reality Changing the Food and Beverage Industries**

Introduction, Applications of AR in the Food and Beverage Industries, Virtual 3D Food, Product-Customer Interaction, Restaurant Entertainment, Employee Training AR Restaurant Tours,
AR for Food Packaging, Technologies Used and Impact on Industries, Conclusion and Future of Food.

**UNIT- IV: Augmented Reality: A Boon for the Teaching and Learning Process**

Introduction, Augmented Reality, Augmented Reality in Education, Utilization of AR in Education, Utilization of AR in Education, AR in Learning and Educational Domain. Multidisciplinary Use of AR Utilization of AR in Education.

**UNIT- V: New Horizons for Learning: Augmented Reality in Education**

Introduction. Augmented Reality, Directions of AR in Academic Environments, Technologies for Augmented Reality, Need and Significance of AR in Education. Augmented Reality Apps: A Developer's Perception- Introduction, AR/VR – The Big Picture, Augmented Reality Powered Devices, Augmented Reality Libraries.

**Suggested Readings:**

1. P. Kaliraj and T. Devi, Innovating with Augmented Reality: Applications in Education and Industry, CRC Press, 2022.
2. Alan B. Craig, Understanding Augmented Reality: Concepts and Applications, Morgan Kaufmann, 2013.
3. Dieter Schmalstieg and Tobias Höllerer, Augmented Reality: Principles and Practice, Addison-Wesley, 2016.

| Course Code | Course Title | | | | | | Core/Elective |
|---|---|---|---|---|---|---|---|
| U23IT708 | GENERATIVE AI | | | | | | Professional Elective-III |
| Prerequisite | Contact Hours per Week | | | | CIE | SEE | Credits |
| | L | T | D | P | | | |
| Machine Learning | 3 | - | - | - | 40 | 60 | 3 |

**Course Objectives:**
Develop ability to
1. Learn the fundamental concepts of Generative AI.
2. Acquire the knowledge of encoders, decoders and autoregressive models.
3. Acquire the knowledge of various generative models for image generation, style transfer and text generation.
4. Learn to apply transforms, prompt engineering and APIs for real world problems.
5. Learn to implement develop application using chat GPTs and open API.

**Course Outcomes**
At the end of the course, student would be able to
1. Understand the fundamental concepts and significance of Generative AI and the unique challenges associated with generative models.
2. Learn the structure, function, and applications of autoencoders and autoregressive models in machine learning.
3. Understand the principles, architecture, and applications of Generative Adversarial Networks for image generation and style transfer.
4. Grasp the architecture and functionality of transformers, and apply prompt engineering techniques using Hugging Face pretrained transformers and APIs.
5. Explore the advancements, capabilities, and practical applications of GPT models, including developing a GPT-3 powered question-answering application.

**UNIT-I**
Introduction: An Introduction to Generative AI, Applications of AI, The rules of Probability, Why use generative models, Unique challenges of generative models.

**UNIT-II**
Auto Encoders and Autoregressive Models: Auto encoders, Regularized autoencoders, Stochastic Encoders and Decoders, Autoregressive Models, Fully Visible Sigmoid Belief Network (FVSBN), Neural Autoregressive Density Estimation (NADE), Masked Autoencoder for Distribution Estimation (MADE)

**UNIT-III**
Generative Adversarial Network: Generative Adversarial Networks, Vanilla GAN, Progressive GAN, Style transfer and Image transformation, Image Generation with GANs, Style Transfer with GANs

**UNIT-IV**
Transformers and Prompt Engineering: Transformers, Large Language Models, MLM/NSP, Generative Pretrained Transformers (GPT), Task-Specific GPT Fine Tuning, Prompt Engineering, Hugging Face pretrained Transformers, Hugging Face APIs

**UNIT-V**
Chat GPTs and OpenAI GPT 3, 3.5, 4, OpenAI APIs, working with the OpenAI Playground, Application and Use Cases: Content Filtering, Generating and Transforming Text, Classifying and Categorizing Text, building a GPT-3 Powered Question Answering App

**Suggested Readings:**
1. Steve Tingiris, Exploring GPT-3, Packt Publishing Ltd. UK, 2021
2. Joseph Babcock, Raghav Bali, Generative AI with Python and TensorFlow 2, Packt Publishing Ltd. UK, 2021

| Course Code | Course Title | | | | | | Core/Elective |
|---|---|---|---|---|---|---|---|
| U23IT709 | ETHICAL HACKING | | | | | | Professional Elective-III |
| Prerequisite | Contact Hours Per Week | | | | CIE | SEE | Credits |
| Computer Networks | L | T | D | P | | | |
| | 3 | - | - | - | 40 | 60 | 3 |

**Course Objectives**

Develop ability to

1. To present Information security threats & countermeasures
2. To perform security auditing & testing
3. To impart knowledge on issues relating to ethical hacking
4. To present network defense measures
5. To familiarize penetration and security testing issues

**Course Outcomes**

At the end of the course, student would be able to

1.Identify the vulnerabilities, threats and attacks.
2. Describe penetration & security testing.
3. Interpret safe penetration techniques on the World Wide Web.
4. Design a computer against a variety of security attacks using various tools.
5. Become a professional ethical hacker

**UNIT – I**

**Ethical Hacking Overview & Vulnerabilities**: Understanding the importance of security, Concept of ethical hacking and essential Terminologies- Threat, Attack, Vulnerabilities, Target of Evaluation, Exploit. Phases involved in hacking.

**UNIT – II**

**Footprinting & Port Scanning**: Footprinting - Introduction to foot printing, Understanding the information gathering methodology of the hackers, Tools used for the reconnaissance phase. Port Scanning-Introduction, using port scanning tools, ping sweeps, Scripting Enumeration-Introduction, Enumerating windows OS & Linux OS.

**UNIT- III**

**System Hacking**: Aspect of remote password guessing, Role of eavesdropping ,Various methods of password cracking, Keystroke Loggers, Understanding Sniffers ,Comprehending Active and Passive Sniffing, ARP Spoofing and Redirection, DNS and IP Sniffing, HTTPS Sniffing.

**UNIT – IV**

**Hacking Web Services & Session Hijacking**: Web application vulnerabilities, application coding errors, SQL injection into Back-end Databases, cross-site scripting, cross-site request forging, authentication bypass, web services and related flaws, protective http headers Understanding Session Hijacking, Phases involved in Session Hijacking, Types of Session Hijacking, Session Hijacking Tools.

**UNIT - V**

**Hacking Wireless Networks**: Introduction to 802.11, Role of WEP, Cracking WEP Keys, Sniffing Traffic, Wireless DOS attacks, WLAN Scanners, WLAN Sniffers, Hacking Tools, Securing Wireless Networks.

**Suggested Readings:**

1. Kimberly Graves, "Certified Ethical Hacker", Wiley India Pvt Ltd, 2010.
2. Michael T. Simpson, "Hands-on Ethical Hacking & Network Defense", Course Technology, 2010

| Course Code | Course Title | | | | | | Core/Elective |
|---|---|---|---|---|---|---|---|
| U23IT710 | SOFTWARE REUSE TECHNIQUES | | | | | | Professional Elective-III |
| Prerequisite | Contact Hours Per Week | | | | CIE | SEE | Credits |
| Software Engineering | L | T | D | P | | | |
| | 3 | - | - | - | 40 | 60 | 3 |

**Course Objectives**

Develop ability to

1. Provide overview of software reuse techniques.
2. Compare design patterns for a given problem.
3. Demonstrate the structural patterns for better class and object composition.
4. Apply behavioral patterns for better organization and communication between objects.
5. Analyze different architectural patterns for a software design.

**Course Outcomes**

At the end of the course, student would be able to

1. Apply object-oriented techniques for designing reusable, maintainable and modifiable software.
2. Compare different design patterns for a given problem.
3. Demonstrate structural design patterns for better class and object composition.
4. Apply behavioral patterns for better organization and communication between the objects.
5. Analyze different architectural patterns for a software design.

**UNIT – I**

**Introduction**: Software Reuse Success Factors, Reuse Driven Software Engineering Business, Object Oriented Software Engineering, Applications and Component Subsystem, Use case Components, Object Components.

**UNIT – II**

**Design Patterns**: Introduction, Creational Patterns: Factory, Factory Method, Abstract Factory, Singleton, Builder Prototype.

**UNIT- III**

**Structural Patterns**: Adapter, Bridge, Composite, Decorator, Fiacade, Flyweight, Proxy. Behavioral Patterns: Chain of Responsibility, Command, Interpreter.

**UNIT – IV**

**Behavioral Patterns**: Iterator, Mediator, Momento, Observer, Stazte, Strategy, Template, Visitor, Other Design Pattern: Whole Part, Master-Slave, View Handler-reciever, Client-Dispatcher-Server, Publisher-Subscriber.

**UNIT - V**

**Architectural Patterns**: Layers, Pipes and Filters, Black Board, Broker, Model View Controller. Presentation: Abstraction-Control, Micro Kernet, Reflection.

**Suggested Readings:**

1. Ivar jacabson, Martin Griss, Patrick Hohson – Software Reuse. Architecture, Process and Organization for Bussiness Success, ACM Press, 1997.
2. Erich Gamma, Richard Helm, Ralph Johnson, John Vlissides – Design Patterns- Addison, 1995, Pearson Education.
3. Frank Buschmann etc. – Pattern Oriented Software Architecture – Volume 1, Wiley 1996.

| Course Code | Course Title | | | | | | Core/Elective |
|---|---|---|---|---|---|---|---|
| **U23IT711** | **INFORMATION RETRIEVAL SYSTEM** | | | | | | **Professional Elective-III** |
| **Prerequisite** | **Contact Hours per Week** | | | | **CIE** | **SEE** | **Credits** |
| | **L** | **T** | **D** | **P** | | | |
| **Operating Systems, DBMS** | **3** | **-** | **-** | **-** | **40** | **60** | **3** |

**Course Objectives:**

Develop ability to

1. Understand indexing and querying in information retrieval systems
2. Learn the different models for information retrieval
3. Understand the modes of the information systems
4. Expose the students to text classification and clustering
5. Learn about web searching

**Course Outcomes**

At the end of the Course, Student would be:

1. Understand the algorithms and techniques for information retrieval systems
2. Analyze different types of indexing, compression, scoring techniques and query processing
3. Quantitatively evaluate information retrieval systems using metrics
4. Classify and cluster documents for efficient retrieval
5. Demonstrate comprehension of web search principles and matrix decompositions for information retrieval.

**UNIT - I**

**Introduction to Information Retrieval Systems:** Definition of Information Retrieval System, Objectives of Information Retrieval Systems, Functional Overview, Relationship to Database Management Systems, Digital Libraries and Data Warehouses.

**Boolean Retrieval:** An example information, Building an inverted index, processing Boolean queries, the extended Boolean model versus ranked retrieval.

**The term vocabulary and postings lists:** Document delineation and character sequence decoding, determining the vocabulary of terms, Faster postings list intersection via skip pointers, Positional postings, and Phrase queries.

**Dictionaries and tolerant retrieval:** Search structures for dictionaries, Wildcard queries, spelling correction.

**UNIT - II**

**Index construction: H**ardware basics, blocked sort-based indexing, Single-pass in memory indexing, Distributed indexing, Dynamic indexing, Other types of indexes.

**Index compression:** Statistical properties of terms in information retrieval, Dictionary compression, Postings file compression.

**Cataloging and Indexing:** History and Objectives of Indexing, Indexing Process, Automatic Indexing, Information Extraction.

**Scoring, term weighting and the vector space model:** Parametric and zone indexes, Term frequency and weighting, the vector space model for scoring, and Variant tf-id functions

**UNIT - III**

**Evaluation in information retrieval:** Information retrieval system evaluation, Standard test collections, Evaluation of unranked retrieval sets, Evaluation of ranked retrieval results, Assessing relevance.
**Relevance feedback and query expansion:** Relevance feedback and pseudo relevance feedback, Global methods for query reformulation.
**Probabilistic information retrieval: Basic probability theory,** The Probability Ranking Principle, The Binary Independence Model.
**Language models for information retrieval:** Language models, The query likelihood

**UNIT - IV**

**Text classification and Naive Bayes:** The text classification problem, Naive Bayes text classification, The Bernoulli model, Properties of Naive Bayes, and Feature selection.
**Vector space classification:** Document representations and measures of relatedness in vector spaces, Rocchio classification, k- nearest neighbor, Linear versus nonlinear classifiers.
**Flat clustering:** Clustering in information retrieval, Problem statement, Evaluation of clustering, k-means.
**Hierarchical clustering:** Hierarchical agglomerative clustering, Single-link and complete-link clustering, Group-average agglomerative clustering, Centroid clustering, Divisive clustering.

**UNIT - V**

**Matrix decompositions and Latent semantic indexing:** Linear algebra review, Term-document matrices and singular value decompositions, Low-rank approximations, Latent semantic indexing.
**Web search basics:** Background and history, Web characteristics, Advertising as the economic model, The search user experience, Index size and estimation, Near-duplicates and shingling.
**Web crawling and Indexes:** Overview, Crawling, Distributing indexes, Connectivity servers. Link analysis: The Web as a graph, Page Rank, Hubs and Authorities

**Suggested Readings*:***

. Christopher D. Manning, PrabhakarRaghavan, HinrichSchütze, An Introduction to Information Retrieval, Cambridge University Press, Cambridge, England,2008

. David A. Grossman, OphirFrieder, Information Retrieval–Algorithms and Heuristics, Springer, 2nd Edition (Distributed by Universities Press),2004.

| Course Code | Course Title | | | | | | Core/Elective |
|---|---|---|---|---|---|---|---|
| U23IT801 | EDGE COMPUTING | | | | | | Professional Elective-IV |
| Prerequisite | Contact Hours Per Week | | | | CIE | SEE | Credits |
| | L | T | D | P | | | |
| Computer Networks | 3 | - | - | - | 40 | 60 | 3 |

**Course Objectives**

Develop ability to

1. Introduce fundamental concepts and architectures of Edge Computing.
2. Analyze IoT architectures and their integration with Edge Computing using real-world scenarios.
3. Develop practical knowledge of Raspberry Pi hardware, configuration, and interfacing.
4. Implement edge-to-cloud communication using MQTT and related protocols.
5. Explore industrial and commercial applications of Edge Computing systems.

**Course Outcomes**

At the end of the course, student would be able to

1. Explain Edge Computing concepts, architectures, and differentiate Edge and Fog computing models.
2. Apply IoT architectures and analyze real-world Edge-enabled IoT systems.
3. Configure and interface Raspberry Pi with sensors and peripherals for edge applications.
4. Implement and analyze MQTT-based communication for edge-to-cloud integration.
5. Design Edge Computing solutions for industrial and commercial IoT use cases.

**UNIT- I: IoT AND EDGE COMPUTING DEFINITION AND USE CASES**

Introduction to Edge Computing Scenario's and Use cases- Edge computing purpose and definition, Edge computing use cases, Edge computing hardware architectures, Edge platforms, Edge *vs* Fog Computing, Communication Models-Edge, Fog and M2M

**UNIT- II: IoT ARCHITECTURE AND CORE IoT MODULES**

A Connected ecosystem, IoT versus machine-to-machine versus, SCADA, The value of Network and Metcalfe's and Beckstroms's laws, IoT and Edge Architecture, Role of an architect, Understanding Implementations with examples-Example use case and deployment, Case study-Telemedicine palliative care, Requirements, Implementation, Use case retrospective.

**UNIT- III: RASBERRYPi**

RasberryPi: Introduction to RasberryPi, About RasberryPi Board, Hardware Layout and Pin outs, Operating systems on RasberryPi, Configuring RasberryPi, Programming RasberryPi, Connecting RasberryPi via SSH, Remote access tools, Interfacing DHT Sensor with Pi, Pi as Webserver, Pi Camera.

**UNIT- IV: INTERFACING RASBERRYPi & MQTT**

Implementation of Microcomputer RasberryPi and device Interfacing, Edge to Cloud Protocols- MQTT Protocols, MQTT publish-subscribe, MQTT Architecture, MQTT state transitions, MQTT packet structure, MQTT data types, MQTT communication formats, MQTT 3.1.1 working example.

**UNIT- V: EDGE COMPUTING WITH RASBERRYPi**

Edge Computing with RasberryPi, Industrial and Commercial IoT and Edge, Edge Computing and solutions.

**Suggested Readings:**

1. IoT Edge Computing for Architects –Second Edition, by Perry Lea, Publisher: Packet Publishing, 2020.
2. Raspberry Pi Cookbook, 3rd Edition, by Simon Monk, Publisher: O'Reilly Media, Inc.

| Course Code | Course Title | | | | | | Core/Elective |
|---|---|---|---|---|---|---|---|
| U23IT802 | DEEP LEARNING | | | | | | Professional Elective-IV |
| Prerequisite | Contact Hours Per Week | | | | CIE | SEE | Credits |
| Machine Learning | L | T | D | P | | | |
| | 3 | - | - | - | 40 | 60 | 3 |

**Course Objectives**

Develop ability to

1.Understand the concept of neural networks, convolutional neural networks, and recurrent neural networks.
2.Implement deep learning algorithms, and learn how to train deep networks.
3.Gain in-depth knowledge of TensorFlow along with its functions, operations, and the execution pipeline.
4.Understanding the major Architectures of Neural Networks and getting into the Convolutional neural Networks.
5.Understand the applications of implementing deep learning such as image processing, natural language processing, speech recognition, deep face - facial recognition system.

**Course Outcomes**

At the end of the course, student would be able to

1. Understand the fundamentals of deep learning.
2. Understand deep learning algorithms and design neural network.
3. Train and implement a neural network.
4. Gain knowledge about convolutional neural networks.
5. Apply neural networks in various fields.

**UNIT – I**

**Introduction to deep Learning:** What is deep learning? Artificial intelligence, Machine learning, and Deep learning- Artificial intelligence -Machine learning – Learning representations from data - The "deep" in deep learning -Understanding how deep learning works, in three figures -What deep learning has achieved so far.

**UNIT – II**

**Getting started with Neural Networks :** Anatomy of a neural network - Layers: the building blocks of deep learning - Models: networks of layers - Loss functions and optimizers: keysto configuring the learning process.

**The Neural Network :** Building Intelligent Machines, The Limits of Traditional Computer Programs, The Mechanics of Machine Learning, The Neuron, Expressing Linear Perceptrons as Neurons, Feed-Forward Neural Networks, Linear Neurons and Their Limitations, Sigmoid, Tanh

**UNIT- III**

**Training the Neural Networks:** Training Feed-Forward Neural Networks - The Fast-Food Problem - Gradient Descent - The Delta Rule and Learning Rates, Gradient Descent with Sigmoidal Neurons, The Backpropagation Algorithm- Stochastic and Minibatch Gradient Descent - Test Sets, Validation Sets, and Overfitting, Preventing Overfitting in Deep Neural Networks. Implementing Neural Networks in TensorFlow, What is TensorFlow, Creating and Manipulating TensorFlow Variables, TensorFlow Operations, Placeholder Tensors- Sessions in TensorFlow, Navigating Variable Scopes and Sharing Variables- Managing Models over the CPU and GPU, Specifying the Logistic Regression Model in TensorFlow - Logging and Training the Logistic Regression Model

**UNIT – IV**

**Introduction to Major Architectures of Deep Networks**: Unsupervised Pretrained Networks (UPNs), Convolutional Neural Networks (CNNs), Recurrent Neural Networks, Recursive Neural Networks

**Convolutional Neural Networks-** Neurons in Human Vision, The Shortcomings of Feature Selection, Vanilla Deep Neural Networks Don't Scale, Filters and Feature Maps, Full Description of the Convolutional Layer, Max Pooling, Full Architectural Description of Convolution Networks.

**UNIT - V**

**DL Applications:** Deep Learning Applications, Large Scale Deep Learning - Computer Vision - Speech Recognition - Natural Language Processing - Other Applications.

**Suggested Readings:**

1. Nikhil Buduma and Nicholas Locascio - Fundamentals of Deep Learning : Designing Next-Generation Machine Intelligence Algorithms – First Edition - O'Reilly , 2017
2. Francois Chollet-Deep Learning with Python-Second Edition, Manning Publications, 2017
3. Josh Patterson and Adam Gibson- Deep Learning: A Practitioner's Approach - First Edition - O'Reilly , 2017
4. Ian Goodfellow, Yoshua Bengio, Aaron Courville - Deep Learning – Second Edition- MIT Press , 2016

| Course Code | Course Title | | | | | | Core/Elective |
|---|---|---|---|---|---|---|---|
| U23IT803 | WEB APPLICATION SECURITY | | | | | | Professional Elective-IV |
| Prerequisite | Contact Hours Per Week | | | | CIE | SEE | Credits |
| | L | T | D | P | | | |
| Computer Networks | 3 | - | - | - | 40 | 60 | 3 |

**Course Objectives**

Develop ability to

1. Understand the core security challenges associated with web applications, including the potential risks posed by user input.
2. Learn the essential defense mechanisms for securing web applications, including authentication, session management, and handling user input securely.
3. Recognize the vulnerabilities associated with session management in web applications and understand techniques used by attackers to exploit them
4. Explore common web security threats such as XSS, CSRF, and injection attacks, and understand strategies for defending against them.
5. Understand advanced web security threats such as DoS attacks and session hijacking, and explore comprehensive strategies for securing modern web applications.

**Course Outcomes**

At the end of the course, student would be able to

1.Identify and address fundamental security risks in web applications, including strategies to mitigate vulnerabilities in user input handling.
2. Implement and manage robust authentication and error handling systems in web applications.
3. Assess and improve the security of session management systems by implementing encryption and mitigating token hijacking risks.
4.Implement best practices to safeguard against XSS, CSRF, and injection attacks, demonstrating skill in detecting and mitigating web application threats.
5.Implement defensive software architectures and conduct vulnerability management to secure web applications against advanced threats.

**UNIT – I**

**Web Application (In)security**: The Evolution of Web Applications-Common Web Application Functions, Benefits of Web Applications, Web Application Security - “This Site Is Secure”, The Core Security Problem, Users Can Submit Arbitrary Input.

**Web Application Technologies**: The HTTP Protocol:- HTTP Requests, HTTP Responses ,HTTP Methods , URLs, REST, HTTP Headers, Cookies, Status Codes , HTTPS, HTTP Proxies, HTTP Authentication,

**Web Functionality**: Server-Side Functionality, Client-Side Functionality, State and Sessions, Encoding Schemes: URL Encoding, Unicode Encoding, HTML Encoding, Base64 Encoding, Hex Encoding, Remoting and Serialization Frameworks.

**UNIT – II**

**Core Defense Mechanisms:- Handling User Access** –Authentication, Session Management, Access Control, **Handling User Input-** Varieties of Input, Approaches to Input Handling ,Boundary Validation , Multistep Validation and Canonicalization, **Handling Attackers**:- Handling Errors, Maintaining Audit Logs, Alerting Administrators, Reacting to Attacks, Managing the Application.

**Mapping the Application:- Analyzing the Application:** Identifying Entry Points for User Input, Identifying Server-Side Technologies, Identifying Server-Side Functionality, Mapping the Attack Surface. **Transmitting Data Via the Client** :- Hidden Form Fields ,HTTP Cookies, URL Parameters , The Referrer Header

**UNIT- III**

**Attacking Session Management:**- The Need for State, Alternatives to Sessions, **Weaknesses in Token Generation-** Meaningful Tokens, Predictable Tokens, Encrypted Tokens, **Weaknesses in Session Token**

**Handling:**- Disclosure of Tokens on the Network, Disclosure of Tokens in Logs, Vulnerable Mapping of Tokens to Sessions, Vulnerable Session Termination, Client Exposure to Token Hijacking, Securing Session Management.

**Attacking Authentication:-** Design Flaws in Authentication Mechanisms- Bad Passwords, Brute-Forcible Login, Vulnerable Transmission of Credentials. **Securing Authentication:**- Use Strong Credentials, Handle Credentials Secretively, Prevent Brute-Force Attacks, Prevent Information Leakage

**UNIT – IV**

**Threats & Defense in Web Security:** CROSS-SITE SCRIPTING ATTACKS, XSS Discovery and Exploitation ,Stored XSS , Reflected XSS, DOM-Based XSS, ,Defending against XSS Attack. **Cross-Site Request Forgery** - CSRF Query Parameter Tampering Alternate GET Payloads ,CSRF Against POST Endpoints, Defending against CSRF Attacks, XML External Entity (XXE)- Direct XXE, Indirect XXE, Defending against XXE Attacks.

**UNIT - V**

**Threats & Defense in Web Security: Injection- SQL Injection:** Code Injection, Command Injection, Defending Against Injection.

**Denial of Service (DoS)-** regex DoS (ReDoS) ,Logical DoS Vulnerabilities, Distributed DoS, Defending Against DoS, Session Hijacking -How Sessions Work , How Attackers Hijack Sessions.

**Securing Modern Web Applications**: Defensive Software Architecture, Comprehensive Code Reviews, Vulnerability Discovery, Vulnerability Analysis, Vulnerability Management, Regression Testing, Mitigation Strategies

**Suggested Readings:**

1. The Web Application Hacker's Handbook: Finding and Exploiting Security Flaws Authors: Dafydd Stuttard and Marcus Pinto, Second Edition, 2011,Wiley
2. Web Application Security, Andrew Hoffman, First Edition, 2020, O'Reilly Media, Inc.

| Course Code | Course Title | | | | | | Core/Elective |
|---|---|---|---|---|---|---|---|
| U23IT804 | SOFTWARE PROJECT MANAGEMENT | | | | | | Professional Elective-IV |
| Prerequisite | Contact Hours Per Week | | | | CIE | SEE | Credits |
| Software Engineering | L | T | D | P | | | |
| | 3 | - | - | - | 40 | 60 | 3 |

**Course Objectives**

Develop ability to

1. Understand the Software Project Planning and Evaluation techniques.
2. Plan and manage projects at each stage of the software development life cycle (SDLC).
3. Learn about the activity planning and risk management principles
4. Manage software projects and control the software deliverables.
5. Learn the management of activities of various phases involved in also learn how to allocate the right job to right people.

**Course Outcomes**

At the end of the course, student would be able to

1. Gain extensive knowledge about the basic project management concepts framework and the process models.
2. Demonstrate and apply the Project Management principles while developing software.
3 Apply software project metrics to estimate the software Efforts, Duration, Cost, and Staff Size, using various estimation techniques.
4.Identify, Analyze, categorize, Estimate and Manage the risks involved in various project activities
5.Learn and practice the staff selection process and the issues related to people management.

**UNIT – I**

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

**UNIT – II**

**Project Life Cycle And Effort Estimation:** Software Process and Process Models, Choice of Process models, mental delivery, Rapid Application Development, Agile methods, Extreme Programming, SCRUM, Managing interactive processes, Basics of Software estimation, Effort and Cost estimation techniques, COSMIC Full function points - COCOMO II, Parametric Productivity Model, Staffing Pattern.

**UNIT- III**

**Activity Planning And Risk Management:** Objectives of Activity planning, Project schedules, Activities, Sequencing and scheduling, Network Planning models, Forwardass & Backward Pass techniques, Critical path (CRM) method, Risk identification, Assessment, Monitoring, PERT technique, Monte Carlo simulation, Resource Allocation, Creation of critical patterns, Cost schedules.

**UNIT – IV**

**Project Management And Control** : Framework for Management and control, Collection of data Project termination,Visualizing progress,Cost monitoring, Earned Value Analysis, Project tracking, Change control- Software Configuration Management, Managing contracts- Contract Management.

**UNIT - V**

**Staffing In Software Projects**: Managing people, Organizational behavior, Best methods of staff selection, Motivation, The Oldham-Hackman job characteristic model, Ethical and Programmed concerns, Working in teams, Decision making, Team structures, Virtual teams, Communications genre, Communication plans.

**Suggested Readings:**

1. Bob Hughes, Mike Cotterell and Rajib Mall: Software Project Management – Fifth Edition, Tata McGraw Hill, New Delhi, 2012.
2. Robert K. Wysocki "Effective Software Project Management" – Wiley Publication,2011.

| Course Code | Course Title | | | | | | Core/Elective |
|---|---|---|---|---|---|---|---|
| U23IT805 | BLOCKCHAIN TECHNOLOGIES | | | | | | Professional Elective-IV |
| Prerequisite | Hours Per Week | | | | CIE | SEE | Credits |
| Computer Networks | L | T | D | P | | | |
| | 3 | 0 | - | 0 | 40 | 60 | 3 |

**Course Objectives**

Develop ability to

1. Understand the fundamentals of blockchain technology and its importance in peer-to-peer digital transactions.
2. Explain the working principles of distributed ledgers, consensus mechanisms, and proof of work.
3. Analyze the structure and functioning of Bitcoin, including mining and transaction processes.
4. Explore Ethereum blockchain and understand the concept of smart contracts.
5. Evaluate the potential impact and applications of blockchain technology in real-world scenarios.

**Course Outcomes**

At the end of the course, student would be able to

1. Understand the basics of block chain like consensus, proof of work, etc.
2. Make use of Bitcoin as cryptocurrency.
3. Analyse Ethereum block chain
4. Design smart contracts as per the requirements.
5. Apply blockchain concepts to develop secure and decentralized applications for real-world use cases.

**UNIT-I**

**Introduction To Cryptocurrencies:** Cryptographic Hash Functions, Hash Pointers and Data Structures, Digital Signatures, Public Keys as Identities, a Simple Crypto currency. How Bit Coin Achieves Decentralization: Centralization vs. Decentralization, Distributed Consensus, Consensus without Identity: the Block Chain, Incentives and Proof of Work, Putting It All Together

**UNIT-II**

**Mechanics of Bitcoin:** Bitcoin Transactions, Bitcoin Scripts, Applications of Bitcoin Scripts, Bitcoin Blocks, The Bitcoin Network, Limitations & Improvements. Store &Usage: How to Store and Use Bitcoins, Hot and Cold Storage, Splitting and Sharing Keys, Online Wallets and Exchanges, Payment Services, Transaction Fees, Currency Exchange Markets.

**UNIT-III**

**Bitcoin Mining:** The Task of Bitcoin Miners, Mining Hardware, Energy Consumption & Ecology, Mining Pools, Mining Incentives and Strategies. Bitcoin And Anonymity: Anonymity Basics, How to de-nonymize Bitcoin, Mixing, Decentralized Mixing, Zero coin and Zero cash, Tor and the Silk Road

**UNIT-IV**

**Ethereum:** Introduction to Ethereum, smart contracts, Solidity & Ethereum Virtual machine. Installing solidity & ethereum wallet, basics of solidity by example, Layout of a solidity source file & structure of smart contracts, General value types, ether units, Time units, Globally available variables and functions

**UNIT-V**

**Operators**: Arithmetic, Logical & Bitwise operators, Control structure (if-else, for, while, do-while), Scoping and declarations, Input parameters and output parameters, Function calls & return

types, Function Modifiers, Fallback functions, Abstract contract, Creating contracts via new operator, Inheriting smart contracts, Importing smart contracts & compiling contracts, Events & logging, exceptions, Examples of smart contract : crowd funding, voting ballot

**Suggested Reading:**

1. Narayanan, A., Bonneau, J., Felten, E., Miller, A., &Goldfeder, S. (2016). Bitcoin and cryptocurrency technologies: a comprehensive introduction. Princeton University Press.
2. Hands–On Smart Contract Development with Solidity and Ethereum O'Reilly 2019
3. Andreas M. Antonopoulos Mastering Bitcoin: Unlocking Digital Cryptocurrencies, O'Reilly Media; 1st edition

| Course Code | Course Title | | | | | | Core/Elective |
|---|---|---|---|---|---|---|---|
| U23IT806 | FOG COMPUTING | | | | | | Professional Elective-V |
| Prerequisite | Contact Hours Per Week | | | | CIE | SEE | Credits |
| Operating Systems | L | T | D | P | | | |
| | 3 | - | - | - | 40 | 60 | 3 |

**Course Objectives**

Develop ability to

1. Understand overview of Fog Computing and its architecture, challenges and applications in different contexts.
2. Examine cloud computing and enabling technologies
3. Explore the need for fog and edge computation
4. Gain the knowledge to log the sensor data and to perform further data analytics
5. Exploiting different case studies in Fog Computing

**Course Outcomes**

At the end of the course, student would be able to

1.Explore technologies behind the communication and management of fogs and edge resources.
2. Learn the techniques for storage and computation in fogs, edges, 5G and clouds.
3. Implement Internet of Everything (IoE) applications through fog computing architecture and use optimization techniques for the same.
4. Analyze the performance and issues of the applications developed using fog and edge architecture.
5. Implement the Fog computing in medical systems, surveillance and object tracking.

**UNIT – I**

Introduction - Relevant Technologies - Fog and Edge Computing Completing the Cloud - Hierarchy of Fog and Edge Computing - Business Models – Edge Computing Platforms - Opportunities and Challenges Introduction - Methodology - Integrated C2F2T Literature by Modeling Technique - Integrated C2F2T Literature by Use - Case Scenarios - Integrated C2F2T Literature by Metrics – Threads - Standards

**UNIT – II**

Introduction – Background - Network Slicing - Network Slicing in Software-Defined Clouds Network Slicing Management in Edge and Fog - Internet of Vehicles (IoV): Architecture, Protocols and Seven-layer security model architecture for Internet of Vehicles - IoV: Network Models, Challenges and future aspects

**UNIT- III**

Preliminaries - The Case for Optimization in Fog Computing-Formal Modeling Framework for Fog Computing – Metrics - Further Quality Attributes - Optimization Opportunities along the Fog Architecture - Optimization Opportunities along the Service Life Cycle - Toward a Taxonomy of Optimization Problems in Fog Computing

**UNIT – IV**

Need for Fog and Edge Computing Middleware - Design Goals-State-of-the-Art Middleware Infrastructures System Model - Case Study. Fog Data Management - Smart Building - Predictive Analysis with Fog Torch Machine Learning in Fog Computing - Data Analytics in the Fog - Data Analytics in the Fog Architecture.

**UNIT - V**

Exploiting Fog Computing in Health Monitoring-Smart Surveillance Video Stream Processing at the Edge for Real - Time Human Objects Tracking-Fog Computing Model for Evolving Smart Transportation Applications - Testing Perspectives of Fog.

**Suggested Readings:**

1 Buyya, Rajkumar, and Satish Narayana Srirama, Fog and Edge computing: Principles and Paradigms, 2019, 1st edition, John Wiley & Sons, USA

| Course Code | Course Title | | | | | | Core/Elective |
|---|---|---|---|---|---|---|---|
| U23IT807 | NATURAL LANGUAGE PROCESSING | | | | | | Professional Elective-IV |
| Prerequisite | Contact Hours Per Week | | | | CIE | SEE | Credits |
| AI/ML | L | T | D | P | | | |
| | 3 | - | - | - | 40 | 60 | 3 |

**Course Objectives**

Develop ability to

1 Learn the fundamentals of natural language processing.
2. Understand the various text processing techniques in NLP.
3. Understand the role Text Classification Deep Learning for Text Classification techniques of NLP
4. Use Modelling for Case Studies and apply the NLP techniques to IR applications.
5. Learn Ecommerce and the Applications used for NLP.

**Course Outcomes**

At the end of the course, student would be able to

1. Understand the basic concepts of Natural language processing pipeline and applications of NLP.
2. Illustrate various text representation techniques in NLP.
3. Analyse text classification techniques and deep learning basics to process natural language text.
4. Explore text summarization methods and example systems.
5. Demonstrate levels of NLP for several case studies.

**UNIT – I**

**NLP:** A Primer, NLP in the Real World, NLP Tasks, NLP Levels, What Is Language? Building Blocks of Language, Why Is NLP Challenging? Machine Learning and Overview Approaches to NLP, Heuristics-Based, Machine Learning, Deep Learning for NLP. NLP Pipeline: Data Acquisition, Pre-Processing Preliminaries Frequent Steps, Advanced Processing Feature Engineering Classical NLP/ML Pipeline.

**UNIT – II**

Text Representation Vector Space Models Basic Vectorization Approaches, One-Hot Encoding Bag of Words, Bag of N-Grams, TF-IDF, Distributed Representations, Word Embedding

**UNIT- III**

Text Classification Applications One Pipeline, Many Classifiers, Using Neural Embeddings in Text Classification Deep Learning for Text Classification Interpreting Text Classification Models. Deep Learning for Text Classification CNNs for Text Classification.

**UNIT – IV**

Topic Modelling Text Summarization, Use Cases Setting Up a Summarizer: An Example Recommender Systems for Textual Data Machine Translation Question-Answering Systems, Social Media, E-Commerce and Retail.

**UNIT - V**

Case Study on NLP Pipeline, Text Classification: Ticketing, Ecommerce, Social media, health care, Recommender systems and other applications of NLP, Language Model Adaptation, Types of Language Models.

**Suggested Readings:**

1. Sowmya Vajjala, Bodhisattwa Majumder, Anuj Gupta & Harshit Surana “Practical Natural Language Processing: A Comprehensive Guide to Building Real world NLP Systems”, O‟Reilly Media, Inc., 1st Edition, 2020. 2. James Allen, “Natural Language Understanding”, Bejamin Cummings, 2nd edition, 1995.
2.Tanveer Siddiqui, U.S. Tiwary, “Natural Language Processing and Information Retrieval”, Oxford University Press, 2008.

| Course Code | Course Title | | | | | | Core/Elective |
|---|---|---|---|---|---|---|---|
| U23IT808 | DIGITAL FORENSICS | | | | | | Professional Elective-V |
| Prerequisite | Contact Hours Per Week | | | | CIE | SEE | Credits |
| Operating Systems | L | T | D | P | | | |
| | 3 | - | - | - | 40 | 60 | 3 |

**Course Objectives**

Develop ability to

1. Analyze different laws, ethics and evidence handling procedures and apply forensic analysis tools to recover important evidence for identifying computer crime.
2. Be well-trained as next-generation computer crime investigators.
3. Analyze how to conduct a digital forensics investigation and validate forensics data.
4. Identify and understand methods and tools used in cybercrimes.
5. Collect, process, analyze and present Computer Forensics Evidence.

**Course Outcomes**

At the end of the course, student would be able to

1. List the different types of cybercrimes and analyze legal frameworks to handle cybercrimes.
2. Discuss the cyber offence and vulnerabilities in programming languages.
3. Identify the Tools and Methods used in cybercrimes.
4. Analyze and resolve cyber security issues and laws governing Cyberspace.
5. Describe the need of Digital Forensics and the importance of digital evidence in prosecution.

**UNIT – I**

Computer forensics fundamentals, Benefits of forensics, computer crimes, computer forensics evidence and courts, legal concerns and private issues.

**UNIT – II**

Understanding Computing Investigations – Procedure for corporate High-Tech investigations, understanding data recovery work station and software, conducting and investigations.

**UNIT- III**

Data acquisition- understanding storage formats and digital evidence, determining the best acquisition method, acquisition tools, validating data acquisitions, performing RAID data acquisitions, remote network acquisition tools, other forensics acquisitions tools.

**UNIT – IV**

Processing crimes and incident scenes, securing a computer incident or crime, seizing digital evidence at scene, storing digital evidence, obtaining digital hash, reviewing case.

**UNIT - V**

Current computer forensics tools- software, hardware tools, validating and testing forensic software, addressing data-hiding techniques, performing remote acquisitions, E-Mail investigations- investigating email crime and violations, understanding E-Mail servers, specialized E-Mail forensics tool.

**Suggested Readings:**

1. Warren G. Kruse II and Jay G. Heiser, “Computer Forensics: Incident Response Essentials”, Addison Wesley, 2002.
2. Nelson, B, Phillips, A, Enfinger, F, Stuart, C., “Guide to Computer Forensics and Investigations, 2nd ed., Thomson Course Technology, 2006.
3. Vacca, J, Computer Forensics, Computer Crime Scene Investigation, 2nd Edition, Charles River Media, 2005

| Course Code | Course Title | | | | | | Core/Elective |
|---|---|---|---|---|---|---|---|
| U23IT809 | AGILE SOFTWARE DEVELOPMENT | | | | | | Professional Elective-V |
| Prerequisite | Contact Hours Per Week | | | | CIE | SEE | Credits |
| Software Engineering | L | T | D | P | | | |
| | 3 | - | - | - | 40 | 60 | 3 |

**Course Objectives**

Develop ability to

1. Learn and familiarize with Agile Life cycle models.
2. Provide insight into the Agile waterfall model and develop scope for requirements.
3. Explore the planning and scheduling mechanisms for Agile project development.
4. Work with Quality principles in Agile space.
5. Understand the matrix management in Agile development

**Course Outcomes**

At the end of the course, student would be able to

1. Summarize the agile methodologies: extreme programming, scrum, and feature driven programming.
2. Apply the Twelve XP Practices and Illustrate pair programming and its characteristics.
3. Apply XP to a small project.
4. Examine Feature-Driven Development and Regaining Control.
5. Relate Agile Modeling and RUP and Choose Tools to help with Agile Development

## UNIT – I

**Introduction:** Agile Methods, Agile Manifesto, and Agile Modeling Introduction, What Is Agile, The Agile Manifesto, Agile Methods, XP: Extreme Programming, DSDM, SCRUM, Feature-Driven Development, Modeling Misconceptions, Agile Modeling, Tools of Misconceptions, Updating Agile Models.

## UNIT – II

**Extreme Programming**: Introduction, Core XP Values, The Twelve XP Practices, About Extreme Programming, Planning XP Projects, Test First Coding, Making Pair Programming Work.

## UNIT- III

**Agile Modeling and XP**: Introduction, The Fit, Common Practices, Modeling Specific Practices, XP Objections to Agile Modeling, Agile Modeling and Planning XP Projects, XP Implementation Phase.

## UNIT – IV

**Feature-Driven Development**: Introduction, Incremental Software Development, Regaining Control: The Motivation behind FDD, Planning an Iterative Project, Architecture Centric, FDD and XP.

## UNIT - V

**Agile Methods with RUP and PRINCE2 and Tools and Obstacles:** Agile Modeling and RUP, FDD and RUP, Agile Methods and Prince2, Tools to Help with Agile Development, Eclipse: An Agile IDE, Obstacles to Agile Software Development, Management Intransigence, The Failed Project Syndrome, Contractual Difficulties, Familiarity with Agility.

## Suggested Readings:

1. Agile software construction, 1/e, John hunt, springer, 2005.
2. Agile and Iterative Development: a manager's guide, Addison-Wesley Craig Larman, Pearson Education
2004.

| Course Code | Course Title | | | | | | Core/Elective |
|---|---|---|---|---|---|---|---|
| U23IT810 | COMPUTATIONAL INTELLIGENCE | | | | | | Professional Elective-V |
| Prerequisite | Contact Hours Per Week | | | | CIE | SEE | Credits |
| Operating Systems | L | T | D | P | | | |
| | 3 | - | - | - | 40 | 60 | 3 |

**Course Objectives**

Develop ability to

1. Provide a strong foundation on fundamental concepts in Computational Intelligence.
2. Understand Problem-solving through various searching techniques.
3. Apply these techniques in applications which involve perception, reasoning and learning.
4. Analyze Computational Intelligence techniques for information retrieval
5. Apply Computational Intelligence techniques primarily for machine learning.

**Course Outcomes**

At the end of the course, student would be able to

1. Understand conventional artificial intelligence approaches, algorithms and methods.
2. Apply conventional artificial intelligence algorithms and approaches to real-life problems.
3. Analyze Fuzzy and swarm optimization systems in application scenarios.
4. Understand hybridization of conventional artificial intelligence algorithms.
5: Improve problem solving skills using the acquired knowledge in the areas of, reasoning, natural language understanding, computer vision, automatic programming and machine learning

**UNIT – I**

**Artificial Intelligence:** A brief review – Pitfalls of traditional AI – Why Computational Intelligence. Computational intelligence concept – Importance of tolerance of imprecision and uncertainty Constituent techniques – Overview of Artificial Neural Networks, Fuzzy Logic, Evolutionary Computation.

**UNIT – II**

**Neural Network:** Biological and artificial neuron, neural networks, supervised and unsupervised learning. Single layer Perceptron, Multilayer Perceptron – Back propagation learning. Neural networks as associative memories – Hopfield networks, Bidirectional Associative Memory. Topologically organized neural networks competitive learning, kohonen maps.

**UNIT- III**

**Fuzzy Logic:** Fuzzy sets, properties, membership functions, fuzzy operations. Fuzzy logic and fuzzy inference and applications, Evolutionary Computation – constituent algorithms, Swarm intelligence algorithms – Overview of other bio-inspired algorithms – Hybrid approaches (neural networks, fuzzy logic, genetic algorithms etc.)

**UNIT – IV**

**Learning:** Probability basics - Bayes Rule and its Applications - Bayesian Networks – Exact and Approximate Inference in Bayesian Networks - Hidden Markov Models - Forms of Learning - Supervised Learning - Learning Decision Trees – Regression and Classification with Linear Models - Artificial Neural Networks – Nonparametric Models - Support Vector Machines - Statistical Learning - Learning with Complete Data - Learning with Hidden Variables- The EM Algorithm Reinforcement Learning.

**UNIT - V**

**Natural Language Processing**: Morphological Analysis-Syntax analysis-Semantic Analysis-AIl applications – Language Models – Information Retrieval – Information Extraction – Machine Translation – Machine Learning – Symbol-Based – Machine Learning: Connectionist – Machine Learning

**Suggested Readings:**

1. Eberhart RC, Shi Y. Computational intelligence: concepts to implementations. Elsevier; 2007.
2.Karray F, Karray FO, De Silva CW. Soft computing and intelligent systems design: theory, tools, and applications. Pearson Education; 2004.

| Course Code | Course Title | | | | | | Core/Elective |
|---|---|---|---|---|---|---|---|
| **U23IT8P1** | **TECHNICAL SEMINAR** | | | | | | **PROJ** |
| **Prerequisite** | **Contact Hours per Week** | | | | **CIE** | **SEE** | **Credits** |
| | **L** | **T** | **D** | **P** | | | |
| **-** | **-** | **-** | **-** | **2** | **50** | **-** | **1** |

**Course Objectives:**

Develop ability to:

1. Prepare and present a topic on engineering/ technology, for a duration of about 8 to 10 minutes.
2. Gain confidence in facing the placement interviews.
3. Enrich the communication skills of the student and presentations of technical topics of interest, this course is introduced.
4. Use various teaching aids such as overhead projectors, power point presentation and demonstrative models.
5. Encourage and motivate the students to read and collect recent and reliable information about their area of interest confined to the relevant discipline, from technical publications.

**Course Outcomes:**

At the end of the course, students would be able to:

1. Develop the habit of referring the journals for literature review.
2. Understand the gist of the research paper.
3. Identify the potential for further scope.
4. Present the work in an efficient manner.
5. Write the documentation in standard format.

Seminar topics may be chosen by the students with advice from the faculty members and the student shall read further relevant articles in the domain.

The seminar must be clearly structured and the power point presentation shall include following aspects:

1. Introduction to the field
2. Literature survey
3. Consolidation of available information
4. Summary and Conclusions
5. References

Each student is required to:

1. Deliver the seminar for a maximum duration of 30 minutes, where the presentation should be for 20minutes in PowerPoint, followed by Question and Answers session for 10 minutes.
2. Submit the detailed report of the seminar in spiral bound in a précised format as suggested by the Department. Guidelines for awarding marks

| S. No | Description | Max. Marks |
|---|---|---|
| 1 | Contents and relevance | 20 |
| 2 | Presentation skills | 20 |
| 3 | Preparation of PPT slides | 10 |
| 4 | Questions and answers | 10 |
| 5 | Report in a prescribed format | 40 |

Note:

1. The seminar presentation should be a gist of at least five research papers from Peer-reviewed or UGC recognized journals.
2. The seminar report should be in the following order: Background of work, literature review, techniques used, prospective deliverables, and discussion on results, conclusions, critical appraisal and reference.
3. At least two faculty members will be associated with the seminar presentation to evaluate and award marks.
4. Attendance of all the students for weekly seminar presentations is compulsory. If the student fails to secure minimum attendance as per O.U. rules, the marks awarded in the seminar presentation shall remain void.

| Course Code | Course Title | | | | | | Core/Elective |
|---|---|---|---|---|---|---|---|
| **U23IT8P2** | **PROJECT PHASE-II** | | | | | | **PROJ** |
| **Prerequisite** | **Contact Hours per Week** | | | | **CIE** | **SEE** | **Credits** |
| | **L** | **T** | **D** | **P** | | | |
| **Project Phase-I** | **-** | **-** | **-** | **16** | **50** | **100** | **8** |

**Course Objectives:**

Develop ability to:

1. Enhance practical and professional skills
2. Familiarize tools and techniques of systematic Literature survey and documentation
3. Expose the students to industry practices and team work.
4. Encourage students to work with innovative and entrepreneurial ideas
5. Obtain knowledge of societal and environmental related areas.

**Course Outcomes:**

At the end of the course, students would be able to:

1. Demonstrate the ability to synthesize and apply the knowledge and skills acquired in the academic program to real-world problems.
2. Evaluate different solutions based on economic and technical feasibility.
3. Analyze various modules pertaining to the sub routines of the projects.
4. Effectively plan a project and confidently perform all aspects of project management.
5. Demonstrate effective written and oral communication skills.

The aim of Project Phase –II is to implement and evaluate the proposal made as part of Project Work - I. Students can also be encouraged to do full time internship as part of project work-II based on the common guidelines for all the departments. The students placed in internships need to write the new proposal in consultation with industry coordinator and project guide within two weeks from the commencement of instruction.

The department will appoint a project coordinator who will coordinate the following:

1. Re-grouping of students - deletion of internship candidates from groups made as part of project Work-I
2. Re-Allotment of internship students to project guides
3. Project monitoring at regular intervals

All re-grouping/re-allotment has to be completed by the 1st week of VIII semester so that students get sufficient time for completion of the project

All projects (internship and departmental) will be monitored at least twice in a semester through student presentation for the award of sessional marks. Sessional marks are awarded by a monitoring committee comprising of faculty members as well as by the supervisor. The first review of projects for25 marks can be conducted after completion of five weeks. The second review for another 25 marks can be conducted after 12 weeks of instruction.

Common norms will be established for the final documentation of the project report by the respective departments. The students are required to submit draft copies of their project report within one week after completion of instruction.

| Course Code | Course Title | | | | | | Core/Elective |
|---|---|---|---|---|---|---|---|
| U23IT712 | BASICS OF ARTIFICIAL INTELLIGENCE | | | | | | Open Elective-III |
| Prerequisite | Contact Hours Per Week | | | | CIE | SEE | Credits |
| Machine Learning | L | T | D | P | | | |
| | 3 | - | - | - | 40 | 60 | 3 |

**Course Objectives**

Develop ability to

1. Understand the importance of the field of AI by discussing its history and various applications.
2. Learn about one of the basic applications of A.I, search state formulations
3. Learn knowledge representation implementation.
4. Learn how to reason when an agent has only uncertain information about its task.
5. Know various supervised and unsupervised learning algorithms

**Course Outcomes**

At the end of the course, student would be able to

1. Illustrate basic principles of AI in solutions that require problem solving, search, inference
2. Demonstrate understanding of steps involved in building of intelligent agents, expert systems, Bayesian networks
3. Differentiate between learning paradigms to be applied for an application
4. Demonstrate Expert system its utilization
5. Illustrate AI application machine learning & its types.

**Unit-I:**

**Introduction to Artificial Intelligence**: Foundations of artificial intelligence (AI), Intelligent Systems, History of AI, Subareas of AI, Applications, Structure of Agents, Types of agents, AI problems, Agents and Environments.

**UNIT -II:**

**Basic Search Strategies**: Problem Spaces, Uninformed Search (Breadth-First, Depth First Search, Depth-first with Iterative Deepening), Heuristic Search (Hill Climbing, Generic Best-First, A*), Constraint Satisfaction (Backtracking, Local Search)

**UNIT-III:**

**Advanced Search:** Constructing Search Trees, Stochastic Search, A* Search Implementation, Minimax Search, Alpha-Beta Pruning.

**UNIT-IV**

**Reasoning**: Knowledge based agent, Propositional Logic, Inference, Predicate logic (first order logic), Inference, Resolution, Frames, Semantic Nets

**UNIT-V**

**Uncertainty**: Basic probability, Bayes rule, Naive Bayes, Belief networks, Inference in Bayesian Network.

**Expert System and Applications:** Introduction, Phases in Building Expert Systems, Expert System Architecture, Applications.

**Suggested Readings:**

1. Artificial Intelligence – A Modern Approach, Stuart Russell and Peter Norvig, Pearson Education Press. Fourth Edition.
2.Artificial Intelligence, Saroj Kaushik, Cengage Learning, 2011.
3.Artificial Intelligence, Kevin Knight, Elaine Rich, B. Nair, McGraw Hill, 3rd Edition, 2008.

| Course Code | Course Title | | | | | | Core/Elective |
|---|---|---|---|---|---|---|---|
| U23IT811 | INTRODUCTION TO CLOUD COMPUTING | | | | | | Open Elective-IV |
| Prerequisite | Contact Hours Per Week | | | | CIE | SEE | Credits |
| Operating System | L | T | D | P | | | |
| | 3 | - | - | - | 40 | 60 | 3 |

**Course Objectives**

Develop ability to

1. Understand basic concepts of cloud computing & enabling Technologies
2. Perform Auto Scaling, capacity planning and load balancing in cloud
3. Understand security, privacy and compliance issues in clouds
4. Introduce cloud management standards and programming models
5. Work with the load balancing techniques

**Course Outcomes**

At the end of the course, student would be able to

1. Understand the architecture and concept of different cloud models: IaaS, PaaS, SaaS
2. Create virtual Machine images and deploy them on cloud
3. Identify Security and compliance issues in clouds
4. Analyze the various service provides and the security issues with service models.
5. Work with the cloud management and the enterprise applications.

**UNIT – I**

Computing Paradigms: High-Performance Computing, Parallel Computing, Distributed Computing, Cluster Computing, Grid Computing, Cloud Computing, Bio computing, Mobile Computing, Quantum Computing, Optical Computing, Nano computing.

**UNIT – II**

Introduction, Benefits and challenges, Cloud computing services, Resource Virtualization, Resource pooling sharing and provisioning Scaling in the Cloud, Capacity Planning, Load Balancing, File System and Storage

**UNIT- III**

Cloud Computing Architecture and Management: Cloud architecture, Layer, Anatomy of the Cloud, Network Connectivity in Cloud Computing,

**UNIT – IV**

Applications: Managing the Cloud, Managing the Cloud Infrastructure Managing the Cloud application, Migrating Application to Cloud, Phases of Cloud Migration Approaches for Cloud Migration.

**UNIT – V**

Cloud Service Models: Infrastructure as a Service, Characteristics of IaaS. Suitability of IaaS, Pros and Cons of IaaS, Summary of IaaS Providers, Platform as a Service, Characteristics of PaaS, Suitability of PaaS, Pros and Cons of PaaS.

**Suggested Readings:**

1. Essentials of cloud Computing: K. Chandrasekhran, CRC press, 2014
2. Cloud Computing – Sandeep Bhowmik, Cambridge University Press, 2017.
3. Enterprise Cloud Computing – Technology, Architecture, Applications by Gautam Shroff, Cambridge University Press, 2016.

| Course Code | Course Title | | | | | | Core / Elective |
|---|---|---|---|---|---|---|---|
| U23ME708 | Renewable Energy Resources | | | | | | Elective |
| Prerequisite | Contact Hours Per Week | | | | CIE | SEE | Credits |
| | L | T | D | P | | | |
| Basic Electrical Engineering | 3 | - | - | - | 40 | 60 | 3 |

**Course Objectives:**

The objective of the course is to:

1. Understand the concept of various forms of Renewable energy resources and Non-Renewable energy resources.
2. Outline division aspects and utilization of renewable energy sources for both domestics and industrial applications.
3. Identify Wind energy as alternate form of energy and to know how it can be tapped
4. Make the students understand the advantages and disadvantages of different renewable energy resources
5. Know the concepts of thermo and bio-chemical process along with novel technologies to conversion of biomass to Bio fuel.

**Course Outcomes:**

After completing the course, the student will be able to:

1. Summarize the renewable and non-renewable sources of energy
2. Acquire the knowledge of various components, principle of operation and present scenario of different conventional and non-conventional sources.
3. Explain the use of solar energy and the various components used in the energy production with respect to applications
4. Design wind turbine blades and know about applications of wind energy for water pumping and electricity generation
5. Relate the concept of Biomass energy resources and their classification, types of biogas Plants-applications and summarize the knowledge of Ocean energy, tidal energy, and geothermal energy.

**Unit-I**

**Introduction:** Classification of Energy Resources, Conventional Energy Resources, Non-Conventional Energy Resources, Alternative Energy Resources, World energy status, Current energy scenario in India, Environmental aspects of energy utilization, Energy and sustainable development. Energy policies in India

**Unit-II**

**Solar energy:** solar energy basic concepts, Solar cells, Solar collectors, Solar Thermal Applications-Heating, Cooling, Distillation, Desalination, Drying, Cooking, Solar pumping, Solar photo voltaic systems. Solar PV Applications, Government schemes and policies.

**Unit-III**

**Wind energy:** Principles of wind energy conversion systems - Nature of wind - Power in the Wind-Basic components of WECS -Classification of WECS -Site selection considerations - Advantages and disadvantages of WECS -Wind energy collectors -Wind electric generating and control systems - Applications of Wind energy -Environmental aspects.

**UNIT-IV**

**Energy from the Oceans:** Ocean Thermal Electric Conversion (OTEC) methods - Principles of tidal power generation -Advantages and limitations of tidal power generation -Ocean waves - Wave energy conversion devices -Advantages and disadvantages of wave energy - Geo-thermal Energy - Types of Geo-thermal Energy Systems - Applications of Geo-thermal Energy.

**Unit-V**

**Energy from Biomass:** Biomass conversion technologies / processes - Photosynthesis - Photosynthetic efficiency - Biogas generation - Selection of site for Biogas plant - Classification of Biogas plants - Details of commonly used Biogas plants in India - Advantages and disadvantages of Biogas generation -Thermal gasification of biomass -Biomass gasifiers. Bio fuels- Bioethanol, Biobutanol, Biodiesel production

**Suggested Readings:**

1. Non-Conventional Sources of Energy, Rai G.D, Khandala Publishers, New Delhi, 1999.
2. Power Plant Technology, M.M.El-Wakil, McGraw Hill, 1984.
3. Solar Energy, Sukhatme S.P., Tata McGraw Hill, 1984
4. Renewable Energy Engineering and Technology, Kishore V V N, Teri Press, New Delhi,2012.
5. Wind Energy Conversion Systems, Freris. L.L., Prentice Hall, UK, 1990.