PROGRAMMING IN JAVA [As per Choice Based Credit System (CBCS) scheme] (Effective from the academic year 2020 -2021 onwards)	
Semester: II	**CIE Marks: 50**
Course Code:20MCA21	**SEE Marks: 50**
Contact Periods (L:T:P):4:0:0	**Exam Hours: 3**
Total Number Of Lecture Hrs: 50	
CREDITS 04	

Course Objectives:

1. Understand fundamentals of programming such as variables, conditional and iterative execution, methods, etc.
2. Understand fundamentals of object-oriented programming in Java, including defining classes, invoking methods, using class libraries, etc.
3. Be aware of the important topics and principles of software development.
4. Have the ability to write a computer program to solve specified problems.
5. Be able to use the Java SDK environment to create, debug and run simple Java programs.

Module-1	**Teaching hours**
Java Fundamentals: The History and Evolution of Java, Object-Oriented Programming Features, Java Features, Java Development Kit, Java Keywords, Java Identifiers. Data Types, Variables, and Operators: Data Types, Variables, The Scope and Lifetime of Variables, Operators, Operator Precedence, Type conversion and Casting. Control Statements: if statement, if-else statement, Nested ifs, if-else-if Ladder, switch statement, Nested switch statements, while loop, do-while loop, for loop, Enhanced for loop, Nested loops, break statement, continue statement, return statement. Arrays: Introduction, One-Dimensional Arrays, Two-Dimensional Arrays, Multidimensional Arrays. String Handling : String Constructors, Obtaining length of a string, Obtaining the characters within a string, Comparing strings, Searching strings, Modifying a string, Changing the case of characters within a string, StringBuffer class, StringBuilder class.	10
Module-2	
Classes, Objects and Methods: Class declaration, Objects declaration, Object Reference Variables, Methods declaration, Returning a value from a Method, Using Parameters in Method, Constructors, this keyword, finalize() method, Access Control, Passing Objects to Methods, Passing Arguments to Methods, Returning Objects, Recursion, Use of static keyword, Nested Classes, Inner Classes. Inheritance and Polymorphism: Inheritance Basics, Member Access and Inheritance, Using super to Call Superclass constructors, Using super to Access Superclass Members, Constructors and inheritance, Method Overloading, Constructor Overloading, Method Overriding, Abstract Classes, Using final with Inheritance.	10
Module-3	
Packages: Package Fundamentals, Access Control in Packages, Importing Packages. Interfaces: Interface Fundamentals, Creating an Interface, Implementing an Interface, Interface References, Using variables in Interfaces, Nested Interfaces, Extending interfaces. Exception Handling: Exception Handling Fundamentals,	10

Exception Types, Uncaught Exceptions, Using try and catch blocks to handle an exception, Using Multiple catch clauses, Using nested try blocks, Throwing an Exception using throw, Using throws, Using finally block, Built-in Exceptions, Creating Exception Subclasses.	
Module-4	
Multithreaded Programming: Multithreading Fundamentals, Creating a Thread, Implementing Runnable Interface, Extending Thread Class, Creating Multiple Threads, Using isAlive() method, Using join() method, Thread Priorities, Synchronization, Interthread Communication, Suspending, Resuming and Stopping Threads. Input/Output: Java I/O Classes and Interfaces, File, Stream Classes, Byte Streams, Character Streams, Console Class, StreamTokenizer.	10
Module-5	
Networking: Networking Fundamentals, Networking Classes and Interfaces, InetAddress class, Inet4Address Class, Inet6Address Class, TCP/IP Client Sockets, URL class, URLConnection Class, HttpURLConnection Class, URI Class, Cookies, TCP/IP Server Sockets, Datagrams. Collections Framework: Collections Overview, Recent Changes to Collections, Collection Interfaces, Collection Classes, Accessing a Collection via an Iterator, Storing User Defined Classes in Collections, RandomAccess Interface, Working With Maps, Comparators.	10
Course outcomes: 1. Apply the basic programming constructs of Java to develop Java programs and Illustrate the OOP's concepts to develop object oriented programs. 2. Implement the Packages and Interfaces for grouping of components and Use Exception handling mechanism to handle errors efficiently. 3. Create Multithreaded programs to handle multiple tasks and Perform Input/Output operations using I/O classes and interfaces. 4. Implement the concepts of Applets and Networking for distributed applications. 5. Apply Enumerations, Wrappers, Auto boxing, Annotations to develop effective programs. 6. Use of Collection framework to handle objects efficiently	
Question paper pattern: The question paper will have ten questions. There will be 2 questions from each module. Each question will have questions covering all the topics under a module. The students will have to answer 5 full questions, selecting one full question from each module.	
Textbooks	
1. Herbert Schildt, The Complete Reference Java, 7th Edition, Tata McGraw Hill, 2011. 2. Java 6 Programming, Black Book, KoGenT, Dreamtech Press, 2012.	
References	
1. Java Fundamentals, A comprehensive Introduction by Herbert Schildt, Dale Skrien. Tata McGraw Hill Edition 2013. 2. Java 2 Essentials, Cay Hortsmann, second edition, Wiley. 3. Java Programming by Hari Mohan Pandey, Pearson Education, 2012.	

ADVANCES IN COMPUTER NETWORKS
[As per Choice Based Credit System (CBCS) scheme]
(Effective from the academic year 2020 -2021 onwards)
SEMESTER – II

Subject Code	**20MCA22**	**CIE Marks**	**50**
Number of Lecture Hours/Week	**4**	**SEE Marks**	**50**
Total Number of Lecture Hours	**50**	**Exam Hours**	**03**

CREDITS – 04

Course objectives: This course will enable students to

- Acquire the computer networking knowledge as well as connectivity technologies and the communication process.
- Identify the key issues for the LAN/WAN/MAN network architectures.
- Establish a solid knowledge of the layered approach.
- To learn the 7-layer OSI network model (each layer and its responsibilities) and understand the TCP/IP suite of protocols and the networked applications supported by it.
- Motivate the need for network security practices in organizational units.

Module I	**Teaching Hours**
Data communications and Networking overview: A Communication model, Data communications, Data communication networking. **Protocol architecture**: The need for protocol architecture, A simple protocol architecture, OSI The TCP/IP protocol architecture.	10
Module II	
Data Communications: concepts & terminology, Analog and digital data transmission, transmission impairments, channel capacity. **Guided and wireless transmission:** Guided transmission media, Wireless transmission, **signal encoding techniques:** Digital data, Digital signals, Digital data, Analog signals, Analog data, Digital signals, Analog data,Analog signals, **Digital data communication techniques:** Asynchronous & Synchronous transmission ,Types of errors, Error detection, error correction. **data link control:** Flow control, Error control, High level data link control(HDLC). **Multiplexing:** frequency division multiplexing, synchronous time division multiplexing.	10
Module III	
Wide Area Networks: Circuit switching and packet switching, switching networks, Circuit-switching networks, Circuit-switching concepts, Control signaling. **Routing in switched networks:** Routing in circuit-switching networks, Routing in packet-switching networks. **Congestion control in switched data networks:** Effect of congestion,congestion control, congestion control in packet switching networks, Frame relay congestion control. **Local Area Networks:** Topologies and transmission media, LAN –protocol architecture, bridges, Layer2 and Layer3 switches, emergence of high speed LANS, Ethernet Token ring, Fibre channel.	10

Module IV	
Internetwork Protocols: Basic protocol functions, principles of internetworking, Connectionless internetworking, Internet protocol, IPv6, routing protocols. **Network Applications:** Client-Server interaction, example of a client and a server.	10
Module V	
Network Security: Security requirements and attacks, confidentiality with symmetric encryption, Message authentication and hash functions, public-key encryption and digital signatures, security socket layer and transport layer security, IPv4 and IPv6 security.	10

Course Outcomes

The students should be able to:

- Discuss the physical and logical characteristics of digital signals and the basic methods of data transmission.
- Identify the importance of the ISO 7-layer reference model.
- Identify and requirements hosted in communication protocols and give an overview of data communication standards.
- Figure the area of computer networks in terms of connectivity.
- Explore basic protocols involved in wired/wireless communication process. Local Area Networks (MAC-CSMA-CD/Ethernet, Token Ring,and others), and for Wide Area Networks using the TCP/IP, UDP/IP.
- Explain fundamentals and technologies of physical, data-link and network layers.
- Have a basic knowledge on the fundamentals of cryptography such as symmetric/asymmetric encryption, digital signatures, and hash functions.

Question paper pattern:

The question paper will have ten questions.
There will be 2 questions from each module.
Each question will have questions covering all the topics under a module.
The students will have to answer 5 full questions, selecting one full question from each module.

Text Books:

1. William Stallings, Data and Computer Communications, 7/e, Pearson Education.
2. Andrew S. Tanenbaum, Computer Networks, PHI

Reference Books:

1. Douglas E. Comer, Computer Networks and Internets, 2/e, Pearson Education.

WEB TECHNOLOGY
[As per Choice Based Credit System (CBCS) scheme]
(Effective from the academic year 2020 -2021 onwards)
SEMESTER – II

Subject Code	**20MCA23**	**CIE Marks**	**50**
Number of Lecture Hours/Week	**04**	**SEE Marks**	**50**
Total Number of Lecture Hours	**50**	**Exam Hours**	**03**

CREDITS – 04

Course Objectives:

- Students implement personal and interpersonal skills to prepare for a rapidly evolving workplace environment.
- Students enhance reading, writing, computing, communication, and critical thinking and apply them to the information technology environment.

Module 1	Teaching hours
HTML Language – HTML Document Structure, HTML tags and their Attributes. html, head, title, body, html Elements, table, anchor, heading, image, list, paragraph, font, text formatting tags, HTML Frames, HTML Forms.	10
Module 2	
Cascading Style Sheets (CSS):Introduction to Cascading Style Sheets,Features and Core Syntax of Style Sheets, Attaching Styles, Margins and Padding.CSS Layout,CSS Table. **CSS Properties**: Background Properties, Text Properties, Font Properties, Border Properties, List Properties. **CSS Advanced**: CSS Visibility, CSS positioning, CSS layers, CSS pseudo classes and Elements.	12
Module 3	
JavaScript: The JavaScript Programming Language - Variables, Functions, Objects and Events, Data Types and Operators, Decision Making with Control Structures and Statements. **JavaScript Frames, Forms and Security**:Windows and Frames, Working with Forms in JavaScript, Cookies and Security, Introduction to Document Object Model (DOM), Server Side JavaScript.	10

Module 4	
Introduction to XML - Introduction, Syntax, Document Structure, Document Type Definitions (DTD), Namespaces, XML Schemas, Displaying Raw XML Documents, Displaying XML Documents with CSS, XSLT Style Sheets, XML Processors. **Introduction to AJAX,SOAP and RSS**.	10
Module 5	
Web Site Design Principles – Defining Web Design – Web Design Pyramid, Medium of Web, Types of Websites, Design for the User – Usability, Common User Characteristics, Movement Capabilities, Web Design Process – Basic Web Process Model, Site Plan, Navigation Theory – Navigation, Placing Navigation.	10

Course Outcomes

On successful completion of the course, the students will be able to

- The concepts and principles of Web Programming and to design and implement complex problems.
- the students will be exposed to dynamic web programming
- the students will be programming different forms and security for web apps

Question paper pattern:

The question paper will have ten questions.
There will be 2 questions from each module.
Each question will have questions covering all the topics under a module.
The students will have to answer 5 full questions, selecting one full question from each module.

Text Books:

1. Web Design – The Complete Reference, Thomas.A.Powell, TMH.
2. HTML & CSS – The Complete Reference, Thomas.A.Powell, TMH.
3. HTML, Black Book, Dreamtech Press.

Reference Books:

1. Principles of Web Design, Joel Sklar, Web Warrior series, Thomson Learning.
2. Internet & World Wide Web-How to Program, Deitel, Deitel and Nieto, PHI.
3. JavaScript, Don Gosselin, Web Warrior Series, Thomson Learning.
4. HTML, JavaScript, and Advanced Internet Technologies, Karl Barksdale, E. Turner, Web Warrior Series, Thomson Learning.

MACHINE LEARNING
[As per Choice Based Credit System (CBCS) scheme]
(Effective from the academic year 2020 -2021 onwards)
SEMESTER – II

Subject Code	**20MCA241**	**CIE Marks**	**50**
Number of Lecture Hours/Week	**03**	**SEE Marks**	**50**
Total Number of Lecture Hours	**40**	**Exam Hours**	**03**

CREDITS – 03

Course objectives: This course will enable students to

- To introduce students to the basic concepts and techniques of Machine Learning.
- To develop skills of using recent machine learning software for solving practical problems.
- To gain experience of doing independent study and research.

Module I	**Teaching Hours**
Introduction to Machine Learning: Introduction to Machine learning-Human learning, machine learning, types, problems not to be solved using machine learning, Application, issues preparing to model: machine learning activities, basic type of data in machine learning, exploring structure of data, data quality and remediation.	12 Hours
Module II	
Modeling and evaluation: Pre-processing, selecting the model, training the model, model representation and interpretability, evaluating performance of a model, basics of feature engineering: introduction, feature transformation, feature subset selection	10 Hours
Module III	
Supervised learning Bayesian concept: Bayes theorem and concept learning-Brute force Bayesian algorithm, naive base classifier, classification: Classification model, classification learning steps, classification algorithms-k nearest neighbor(KNN), decision tree, random foresrt model, support vector machines.	10 Hours
Module IV	
Regression: Introduction, Examples of Regression, Regression Algorithms- Simple Linear Algorithms, Multiple Linear Regression, Assumption in Regression Analysis, Main Problems in Regression Analysis, **Logistic Regression Unsupervised learning :** Introduction, Unsupervised/s supervised learning, applications of Unsupervised Learning, Clustering- Clustering as a machine learning task, different types of clustering techniques, Partitioning methods, K-medoids, Hierarchical clustering, Density based Methods – DBSCAN Finding Pattering using Association Rule	10 Hours

Module V

Outlier Detection: Outliers and Outlier Analysis, Outlier Detection Methods, Statistical Approaches, Proximity Based Approaches	10 Hours

Course Outcomes

After completing the course, the students will be able to

- Understand the need of data and pre-processing, machine learning techniques for various application
- Identify and apply the appropriate techniques to process the data and solve the applications using machine learning techniques
- Implement machine learning techniques for various problems
- Evaluate the different data processing and machine learning techniques for various application

Question paper pattern:

The question paper will have ten questions.
There will be 2 questions from each module.
Each question will have questions covering all the topics under a module.
The students will have to answer 5 full questions, selecting one full question from each module.

Text Books:

1. Machine Learning, Saikat Dutt, Subramanian Chandramouli, Amit Kumar Das, 1st Edition, 2019, Pearson Publications, , ISBN 978-93-530-6669-7
2. Data Mining Concepts and Techniques, Jiawei Han, Micheline Kamber Jian Pei, 3 rd Edition, Morgan Kaufmann publications, ISBN 9780123814791

Reference Books:

1. Machine Learning, Tom M Mitchel, McGraw Hill publications,ISBN-0070428077

2. Elements of statistical learning, Data Mining, Inference and Prediction, Trevor Hastie, Robert Tibshirani, Jerome Friedman, Second Edition, Springer Series in Statistics, Springer publications.

CLOUD COMPUTING

[As per Choice Based Credit System (CBCS) scheme]
(Effective from the academic year 2020 -2021 onwards)

Semester: II	**CIE Marks:50**
Course Code:20MCA242	**SEEMarks:50**
Contact Hours (L:T:P): 3:0:0	**Exam Hours:03**
Credits- 03	

Module-1	**Teaching Hours**
Introduction: Cloud Computing at a Glance- The Vision of Cloud Computing, Defining a Cloud, A Closer Look, Cloud Computing Reference Model, Characteristics and Benefits, Challenges Ahead, **Historical Developments-** Distributed Systems, Virtualization, Web 2.0, Service-Oriented Computing, Utility-Oriented Computing**, Building Cloud Computing Environments**- Application Development, Infrastructure and System Development, Computing Platforms and Technologies, Amazon Web Services (AWS), Google App Engine, Microsoft Azure, Hadoop, Force.com and Salesforce.com, Manjrasoft Aneka **Principles of Parallel and Distributed Computing :Eras of computing, Parallel vs. distributed computing, Elements of parallel computing-** What is parallel processing?, Hardware architectures for parallel processing, Approaches to parallel programming, Levels of parallelism, Laws of caution, **Elements of distributed computing**-General concepts and definitions, Components of a distributed system, Architectural styles for distributed computing, Models for interprocess communication, **Technologies for distributed** computing-remote procedure call, Distributed object frameworks, Service-oriented computing.	**10**
Module-2	
Virtualization: Introduction, Characteristics of Virtualized, Environments Taxonomy of Virtualization Techniques, Execution Virtualization, Other Types of Virtualization, Virtualization and Cloud Computing, Pros and Cons of Virtualization, Technology. **Cloud Computing Architecture:** Introduction, Cloud Reference Model, Architecture, Infrastructure / Hardware as a Service, Platform as a Service, Software as a Service, Types of Clouds, Public Clouds, Private Clouds, Hybrid Clouds, Community Clouds, Economics of the Cloud, Open Challenges, Cloud Definition, Cloud Interoperability and Standards Scalability and Fault Tolerance Security, Trust, and Privacy Organizational Aspects. **CLOUD APPLICATION PROGRAMMING AND THE ANEKA PLATFORM** **Aneka:** Cloud Application Platform, Framework Overview, **Anatomy of the Aneka Container-** From the Ground Up: Platform Abstraction Layer, Fabric Services, foundation Services, Application Services, **Building Aneka Clouds-** Infrastructure Organization, Logical Organization, Private Cloud Deployment Mode, Public Cloud Deployment Mode, Hybrid Cloud Deployment Mode, **Cloud Programming and Management:** Aneka SDK, Management Tools	**10**
Module-3	
Concurrent Computing: Thread Programming, **Introducing Parallelism for Single Machine Computation-Programming Applications with Threads-** What is a Thread?, Thread APIs, Techniques for Parallel Computation with Threads, **Multithreading with Aneka-** Introducing the Thread Programming Model, Aneka Thread vs. Common Threads, **Programming Applications with Aneka Threads-** Aneka Threads Application Model, Domain Decomposition: Matrix Multiplication, Functional Decomposition: Sine, Cosine, and	**10**

Tangent. **High-Throughput Computing: Task Programming-** Task Computing, Characterizing a Task, Computing Categories, Frameworks for Task Computing, **Task-based Application Models-** Embarrassingly Parallel Applications, Parameter Sweep Applications, MPI Applications, Workflow Applications with Task Dependencies, Aneka **Task-Based Programming-** Task Programming Model, Developing Applications with the Task Model, Developing Parameter Sweep Application, Managing Workflows.	
Module-4	
Data Intensive Computing: Map-Reduce Programming, What is Data-Intensive Computing?, Characterizing Data-Intensive Computations, Challenges Ahead, Historical Perspective, Technologies for Data-Intensive Computing, Storage Systems, Programming Platforms, Aneka MapReduce Programming, Introducing the MapReduce Programming Model, Example Application **Industrial platforms and new developments:** **Cloud Platforms in Industry: Amazon Web Services-** Compute Services, Storage Services, Communication Services, Additional Services, **Google AppEngine-** Architecture and Core Concepts, Application Life-Cycle, Cost Model, Observations, **Microsoft Azure-** Azure Core Concepts, SQL Azure, Windows Azure Platform Appliance.	**10**
Module-5	
Cloud Applications: Scientific Applications- Healthcare: ECG Analysis in the Cloud, Business and consumer Applications- CRM and ERP, Productivity, Social Networking, Media Applications, Multiplayer Online Gaming. **Advanced Topics in Cloud Computing:** Energy efficiency in clouds, Market-based management of clouds, Federated clouds/InterCloud, Third-party cloud services.	**10**
Course Outcomes: CO1: Demonstrate the system & software models and mechanisms that support cloud computing CO2: Classify various cloud services and their providers CO3: Compare various cloud deployment models CO4: Differentiate various types of computing environments CO5: Identify enabling technologies of cloud computing.	
Question paper pattern: The question paper will have ten questions. There will be 2 questions from each module. Each question will have questions covering all the topics under a module. The students will have to answer 5 full questions, selecting one full question from each module	
Text books	
1. Rajkumar Buyya, Christian Vecchiola, and Thamarai Selvi Mastering Cloud. Computing McGraw Hill Education	
Reference books	
1. Cloud Computing for Dummies by Judith Hurwitz, R.Bloor, M. Kanfman, F.Halper (Wiley India Edition) 2. Cloud Computing: A Practical Approach by J.Vette, Toby J. Vette, Robert Elsenpeter (Tata McGraw Hill)	

Designing Computer Interface

[As per Choice Based Credit System (CBCS) scheme]
(Effective from the academic year 2020 -2021 onwards)

Semester: II	**CIE Marks:50**
Course Code:20MCA243	**SEEMarks:50**
Contact Hours (L:T:P): 3:0:0	**Exam Hours:03**
Credits- 03	

Module-1	**Teaching Hours**
Introduction: Usability of Interactive systems, Usability goals and measures, Usability Motivation, Universal Usability and Goals for our Profession. **Guidelines, Principle and Theories**: Introduction , Guidelines ,Principle and Theories	**10**
Module-2	
Design Process: **Design:** Introduction, Organizational support for design, 4 phases of Design, Design frameworks, Design Methods-Ethanographic Observation, Scenario Development. **Design tools, practices and patterns:** Design tools, Design guidelines and standards, interaction design patterns, Social impact analysis , Legal issues. **Evaluating interface design:** Introduction, Expert reviews, usability testing, survey instruments, Acceptance tests, Evaluation during active use and beyond, controlled psychologically oriented experiments.	**10**
Module-3	
Direct Manipulation and Virtual Environment: Introduction, What is Direct manipulation? , Examples of Direct manipulation, 2D and 3D Interfaces ,Tele-Operations and presence ,Augmented Reality and Virtual Reality **Fluid Navigation :** Introduction, Navigation by Selection- Task-Related Menu Organization, Single menu, Combination of multiple menu, Content organization, Small displays, Audio menus, Form filling and Dialog boxes.	**10**
Module-4	
Expressive Human(Natural Language) and Command Language: Introduction, Command-Organization functionality strategy and structures, Naming and Abbreviation, Natural language in computing. **Interaction Devices:** Introduction, Keyboards and Keypads, Pointing Devices and Displays. **Design issues:** The timely user experience- Introduction, Models of System response time (SRT) impacts, Exceptions and attitudes, User Productivity and Variability in SRT, Frustrating Experience. **Advancing User Experience:** Introduction, Error, Nonanthropomorphic Design, Display Design, Web page Design, Window (view)Management , Color	**10**

Module-5	
User Documentation and Online Help : Introduction, Online versus paper documentation, Reading from paper versus Displays, Shaping the content of the Manuals, Accessing the Documentation, Online Tutorials and animated demonstrations, Online Communities for User Assistance, The Development Process. **Information Search and Visualization** Introduction, Search in Textual Documents and Database Querying, Multimedia document searches, Advanced filtering and Search Interfaces, Information Visualization: Introduction, Data tyoe by task taxonomy, Challenges for information visualization.	**10**
Course Outcomes: At the of the course, students will be able to CO1: Analyze the new technologies that provide interactive devices and interfaces. CO2: Apply the guidelines to develop the UID and evaluate CO3: Apply the development methodologies with an analysis of the social impact and legal issues Understand Direct Manipulation and Virtual Environment CO4: Discuss the command, natural languages and issues in design for maintaining QoS CO5: Persuade user documentations and information search.	
Question paper pattern: The question paper will have ten questions. There will be 2 questions from each module. Each question will have questions covering all the topics under a module. The students will have to answer 5 full questions, selecting one full question from each module	
Text books	
1. Ben Shneiderman, Plaisant, Cohen, Jacobs: Designing the User Interface, 5th Edition, Pearson ,Education, 2010.	
Reference books	
1. Alan Dix, Janet Finalay, Gregory D AbiwdmRusselBealel: Human-Computer Interaction, III Edition, Pearson , Education, 2008. 2. Eberts: User Interface Design, Prentice Hall, 1994 3. Wilber O Galitz: The Essential Guide to User Interface Design- An Introduction to GUI Design, Principles and Techniques, Wiley-Dreamtech India Pvt Ltd, 2011	

Optimization Technique

[As per Choice Based Credit System (CBCS) scheme]
(Effective from the academic year 2020 -2021 onwards)
SEMESTER – II

Subject Code	**20MCA244**	**CIE Marks**	**50**
Number of Lecture Hours/Week	**03**	**SEE Marks**	**50**
Total Number of Lecture Hours	**40**	**Exam Hours**	**03**

CREDITS – 03

Course Objectives:

- To understand the theory of optimization methods and algorithms developed for solving various types of optimization problems.
- To develop and promote research interest in applying optimization techniques in problems of computer science
- To apply the mathematical and numerical techniques of optimization theory to solve problems.

Module 1	Teaching hours
Introduction: Operations research model, solving the OR model, art of modeling, phases of OR study. Linear Programming: Formulation of a LP model, graphical solution to LPP, LP applications, standard and canonical form of LPP, the simplex method, big M-method, two-phase simplex method, special cases in simplex method, sensitivity analysis.	12
Module 2	
Duality and Post-Optimal analysis: Definition of dual problem, primal-dual relationships, economic interpretation of duality, dual simplex method, generalized simplex algorithm, post-optimal analysis.	10
Module 3	
Transportation models: Definition of transportation model, the transportation algorithm, the assignment model-the Hungarian method; the transshipment model.	10

Module 4	
Network Models: Scope and definition of Network models, minimal spanning tree algorithm, shortest-route problem, maximal flow model, CPM and PERT. Decision Analysis and Game theory: Decision making under certainty, decision making under risk, decision under uncertainty, optimal solution of two-person zero-sum games, solution of mixed strategy games.	10
Module 5	
Decision Analysis and Game theory: Decision making under certainty, decision making under risk, decision under uncertainty, optimal solution of two-person zero-sum games, solution of mixed strategy games.	10

Course Outcomes

On successful completion of the course, the students will be able to

- Understand importance of optimization of industrial process management
- Apply basic concepts of mathematics to formulate an optimization problem
- Analyze and appreciate variety of performance measures for various optimization problems.

Question paper pattern:

The question paper will have ten questions.
There will be 2 questions from each module.
Each question will have questions covering all the topics under a module.
The students will have to answer 5 full questions, selecting one full question from each module.

Text Books:

1. Kalavathy, *Operations Research*, Vikas Publication

Reference Books:

1. Panneerselvam R., *Operations Research*, PHI.
2. Hamdy A. Taha, *Operations Research*, 8/e, Pearson Education.
3. Sharma J.K, *Operations Research, Theory and Applications*, McMillan India Ltd.
4. Gross D. and Ilaris C.M. *Fundamental of Queuing Theory*, Wiley Publication.