**Course Name:** JAVA Programming **Subject Code:** TBS 401

**Program Name:** Bachelor of Computer Science (Hons.)

**1 Contact Hours:** 45 **L** 3 **T** 0 **P** 0

**2 Examination Duration (Hrs):** **Theory** 0 3 **Practical** 0 0

**3 Relative Weightage:** **CWE:** 25 **MTE:** 25 **ETE:** 50

**4 Credits:** 0 3

**5 Semester:** ☐ **Autumn** ☑ **Spring** ☐ **Both**

**6 Pre-Requisite:** Knowledge of programming

**7 Subject Area:** **Java 16 or JDK 16** released on March, 16th 2021

**8 Objective:** To familiarize students with object-oriented concepts and the power of Java language , enrich them with robust tools of Java language**.**

**9 Course Outcome:**

**CO 1** Apply and characterize the Java programming features to develop programs for demonstrate the same.

**CO 2** Make use of object oriented concepts to develop applications using servlets.
**CO 3** Classify exceptions and demonstrate applications for file handling and multithreading.
**CO 4** Evaluate and select the most reliable approaches for developing applications using proper exception handling techniques using several networking classes.
**CO 5** Compare and utilize collection framework to create programming applications by describing and developing applications for GUI.

**CO 6** Design and describe applications by deploying for event handling and accessing databases using Java features.

**10 Details of the Course:**

| Unit No. | CONTENT | CONTACT HOURS |
|---|---|---|
| 1 | **Introduction to Java :**Importance and features of Java, Concepts of Java Virtual machine (JVM) Keywords, Constants, Variables and data types, operators and expressions, Control statements, Conditional statements, loops and iterations.<br>**Object Oriented Programming concepts:** Inheritance, super classes, multilevel hierarchy, abstract and final classes, overloading and overriding . | 9 |

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|---|---|---|
| | **String and Arrays**:Defining arrays, Object Array,2-D arrays, String ,StringBuffer ,Command Line arguments ,Wrapper classes, Upcasting and Downcasting | |
| **2** | **Packages and interfaces**: Packages, Defining Packages, Using Packages, import and static import, Access protection.<br>**Interface:** Defining Interfaces, abstract methods declarations, implementing interfaces, extended interfaces.<br>**Exception handling:** Exception Types, Exception class, RuntimeException Class, Error Class, Checked and uncheced Exceptions, Defining new exceptions; Handling: try, catch and finally; throw statement, throws clause. | **8** |
| **3** | **Multithreaded programming:** Java thread model, Thread synchronization, messaging, thread class, Runnable interface, inter thread communication.<br>**Object Lifetime:** Garbage Collection, Reachable Objects.<br>**I/O:** File, Character and Byte Stream, Object Serialization<br>**Collection and Generic Framework:** Introduction to Collection and Generic Framework: Interfaces Iterator, List, Set, ArrayList .Jar Utilities. | **10** |
| **4** | **Applet and Swings** : Applet basics, Applet Architecture, Applet Life cycle; Event Handling: Event handling mechanisms, the Delegation Event Model, Event classes, sources of events, Event Listener Interfaces, Adapter classes<br>**Event Handling:**Event delegation model, classes, Event Listener Interfaces, Adapter classes.<br>**Networking:** Networking Basics, Java and the Net, TCP/IP Client sockets, URL, URLConnection, TCP/IP Server sockets, Datagram | **8** |
| **5** | **JDBC:** Concept of JDBC, JDBC Driver Types, JDBC Packages, Database Connection, Associating the JDBC/ODBC Bridge with the Database, JDBC URL, Statement Objects, ResultSet, Transaction Processing, commit, savepoint, rollback, ResultSetMetadata, DatabaseMetadata, Data Types, SQLException, Prepared Statement, CallableStatement, Batch updates. Storing and Retrieving images via JDBC.<br>**Java Servlets:** Servlet basics, Servlet API basic, Life cycle of a Servlet, Running Servlet, HTTP Redirects, Cookies, Session Management, Introduction to Java Server pages (JSP), Use of Bean in JSP. | **10** |

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|---|---|---|
| | . | **45** |

## 11 Suggested Books:


**1.** Patrick Naughton and Herbert Schildt, “Java 2 The Complete Reference”, 9th edition, McGraw Hill Education, 2017.
**2.** Bruce Eckel, “Thinking in Java”, 4th edition,Pearson Education India, 2008
**3.** E. Balaguruswamy, “Programming with Java a Primer”, 4thedition, Tata McGraw Hill, 2009.


**Reference Books:**


**1.** Cay S Horstmann and Gary Cornell, “Core Java Volume –I and II”, Standard edition, Sun Microsystems, 2001
**2.** Harvey Deitel and Paul Deitel, “Java How to Program” , 4thedition, PHI Learning, 2004

**Course Name:** Data Warehousing and Mining **Subject Code:** TBS 402

**Program Name:** Bachelor of Science (Hons.) in Computer Science

**1 Contact Hours:** 48 **L** 3 **T** 1 **P** 0

**2 Examination Duration(Hrs):** **Theory** 0 3 **Practical** 0 0

**3 Relative Weightage:** **CWE:** 25 **MTE:** 25 **ETE:** 50

**4 Credits:** 0 4

**5 Semester:** ☐ **Autumn** ☑ **Spring** ☐ **Both**

**6 Pre-Requisite:** **Knowledge of DBMS**

**7 Subject Area:** **Computer Applications**

**8 Objective:** **To familiarize students with Data Warehousing and Data Mining.**

**9 Course Outcomes:** A student who successfully fulfills the course requirements will be able to:

Co 1. Discuss the role of data warehousing and enterprise intelligence in industry and government.

Co.2 Summarize the dominant data warehousing architectures and their support for quality attributes.

Co.3 Apply suitable pre-processing and visualization techniques for data analysis

Co.4 Taking cognizance of the contribution of paradigms from the fields of Artificial Intelligence and Machine learning.

Co.5 Compare and contrast the dominant data mining algorithms.

Co.6 Recognize and describe at least three computational approaches to data clustering.

**10 Details of the Course:**

| Unit No. | CONTENT | CONTACT HOURS |
|---|---|---|
| 1 | **Introduction to Data Mining and Data Warehouse**<br>Fundamentals of data mining, Data Mining Functionalities, Classification of Data Mining systems, Major issues in Data Mining. | 10 |

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|---|---|---|
| | Data Warehousing: Overview, Definition, Data Warehousing Components, Building a Data Warehouse, Mapping the Data Warehouse to a Multiprocessor Architecture, Difference between Database System and Data Warehouse, Multi Dimensional Data Model, Data Cubes, Stars, Snow Flakes, Fact Constellations, Concept hierarchy, Process Architecture, 3 Tier Architecture, Data warehouse Measures, their categorization and computation, Operations in OLAP, Advantages of OLAP over OLTP. | |
| **2** | **Data Preprocessing**<br>Need for preprocessing Descriptive data summarization, Data Cleaning: Missing Values, Noisy Data,(Binning, Clustering, Regression, Computer and Human inspection),Inconsistent Data, Data Integration and Transformation. | 10 |
| **3** | **Introduction to Data Mining**<br>Introduction – Data – Types of Data – Data Mining Functionalities – Interestingness of Patterns – Classification of Data Mining Systems – Data Mining Task Primitives – Integration of a Data Mining System with a Data Warehouse – Issues.<br>**Data Mining Techniques :** Association rules: Association rules from transaction database & relational database, Apriori algorithm and correlation analysis. | 8 |
| **4** | **Data Mining Techniques**<br>Classification and predication, Issues related to classification & prediction, decision tree induction, Bayesian classification. Classification methods K-nearest neighbor classifiers.<br>Introduction to Clustering techniques, Data types in cluster analysis, categories of clustering techniques: partition method, and Hierarchical method. | 12 |
| **5** | **Overview of Advanced Features of Data Mining**<br>Mining complex data objects, Spatial databases, Multimedia databases, Time series and Sequence data; mining Text Databases and mining Word Wide Web. | 8 |
| | **TOTAL** | **48** |

**11 Suggested Books:**

| Sl. NO. | NAME OF AUTHERS/BOOKS/PUBLISHERS | YEAR OF PUBLICATION/REPRINT |
|---|---|---|
| **1** | Alex Berson and Stephen J. Smith, " Data Warehousing, Data Mining & OLAP", TataMcGraw – Hill Edition | 2007 |
| **2** | Jiawei Han and Micheline Kamber, "Data Mining Concepts and Techniques",Third Edition, Elsevier | 2012 |

**NAME OF DEPARTMENT:** Computer Applications

**Subject Name:** Fundamentals of Algorithms **Subject Code:** TBS-403

**Course Name:** Bachelor of Science (Hons.) in Computer Science

**1 Contact Hours:** 48 **L** 3 **T** 1 **P** 0

**2 Examination Duration(Hrs):** **Theory** 0 3 **Practical** 0 0

**3 Relative Weightage:** **CWE:** 25 **MTE:** 25 **ETE:** 50

**4 Credits:** 0 4

**5 Semester:** ☐ **Autumn** ☑ **Spring** ☐ **Both**

**6 Pre-Requisite:** Elementary knowledge of Data structure.

**7 Subject Area:** Computer Science.

**8 Objective:** To understand designing and analysis of algorithm. Development of new algorithms for problem solving.

**9 Learning Outcome:**

A student who successfully fulfills the course requirements will be able to:

1. Understand the concepts of algorithms.
2. To understand basic principles of algorithm design and why algorithm analysis is important
3. To understand the basics of complexity of algorithms.
4. To understand how to implement algorithms in C/C++.
5. To understand how to transform new problems into algorithmic problems with efficient solutions
6. To develop the ability to design the algorithm.

**10 Details of the Course:**

| Unit No. | CONTENT | CONTACT HOURS |
|---|---|---|
| 1 | Introduction to algorithm: Algorithm, algorithm complexities, Rate of Growth, Asymptotic Notations, Recurrence relations, Divide and Conquer, metods to solve Recurrance relations, Masters Theorem and applications. | 9 |
| 2 | Linear search, Binary Search,, Insertion Sort, Heap sort ,Quick sort and Merge sort and their analysis, Advantages of Divide and Conquer, Disadvantages of Divide and Conquer, Amortized Analysis. | 9 |
| 3 | Introduction of graphs , Applications of Graphs, Graph Traversals, Representation of Graph in Computer, DFS and BFS. Backtracking approach –Simple applications. Branch and Bound techniques. | 10 |

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|---|---|---|
| **4** | Understanding Greedy Technique, Shortest Path Algorithms, Minimal Spanning Tree ,Kruskals and Prims Algorithms, fractional Knapsack problem. Dynamic Programming: Introduction, Dynamic Programming approach, Properties of Dynamic Programming Strategy, 0/1 knapsack Problem, Chain Matrix Multiplication problem. Optimal binary search tree, | 11 |
| **5** | Flow network, Max flow problem. String matching algorithms, Chinese remainder theorem, approximation algorithms, Class P, NP, NP hard and NP complete problems with examples. | 9 |
| | **TOTAL** | **48** |

## 11 Suggested Books:

| Sl. NO. | NAME OF AUTHERS/BOOKS/PUBLISHERS | YEAR OF PUBLICATION |
|---|---|---|
| **1** | Data Structure and Algorithmic Thinking with Python, Narasimha Karumanchi , Career Monk Publications, | **2015** |
| **2** | Introduction to Algorithm, Thomas H Cormen, The MIT Press Cambridge, Massachusetts London, England | **2009** |
| **3** | Fundamentals of Computer Algorithms, Sartaj Sahni and Sanguthevar Rajasekaran Ellis Horowitz, Computer Science Press An imprint of W. H. Freeman and Company New York | **1998** |

**Program Name:** Bachelor of Science (Hons.) in Computer Science.

**Course Name:** Database Management System **Subject Code:** TBS 404

**1 Contact Hours:** 42 **L** 3 **T** 0 **P** 0

**2 Examination Duration(Hrs):** **Theory** 0 3 **Practical** 0 0

**3 Relative Weightage:** **CWE:** 25 **MTE:** 25 **ETE:** 50

**4 Credits:** 0 4

**5 Semester:** ☐ **Autumn** ☑ **Spring** ☐ **Both**

**6 Pre-Requisite:** Basic knowledge of computer fundamentals

**7 Subject Area:** Computer Applications

**8 Objective:** Understand and implement concepts of DBMS.

**9 Course Outcome:** A student who successfully fulfills the course requirements will be able to-

- **CO 1** Understand and evaluate the role of database management systems in information technology applications within organizations;
- **CO 2** Recognize and use contemporary logical design methods and tools for databases;
- **CO 3** Implement a database solution to an information technology problem;
- **CO 4** Understand the SQL data definition and SQL query languages;
- **CO 5** Understand transactions and concurrency control techniques.
- **CO 6** Examine the importance of recovery management in databases and solve deadlock related problems.

**10 Details of the Course:**

| Unit No. | CONTENT | CONTACT HOURS |
|---|---|---|
| 1 | **Introduction to DBMS:** An overview of database management system, Database System Vs File System, Database system concepts, data models. Advantages of DBMS, Schema and instances, Three schema architecture, data independence. Data base languages and interfaces, Disadvantages of DBMS. **Data modeling using the Entity Relationship Model:** ER model concepts, notation for ER diagram, mapping constraints, keys, Concepts of Super Key, candidate key, primary key, Generalization, aggregation, reduction of an ER diagrams to tables, extended ER model, relationships of higher degree. | 9 |

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| **2** | **Relational Data Model and Relational Algebra:** Relational data model concepts, integrity constraints: entity integrity, referential integrity, Key constraints, Domain constraints. Relational algebra, Operations of relational algebra, queries in relational algebra. | 9 |
| **3** | **Introduction to SQL:** Characteristics of SQL, Advantages of SQL, SQL data types and literals, Types of SQL commands, SQL operators and their procedure, Tables, views and indexes, Insert, update and delete operations, Queries and sub queries, Scalar and Aggregate functions, Joins, Unions, Intersection, Minus. | 8 |
| **4** | **High Level Data Base Design & Normalization:** Functional dependencies, normal forms, first, second, third normal forms, BCNF, inclusion dependencies, loss less join decompositions, normalization using FD, MVD, and JDs. | 8 |
| **5** | **Transaction processing concepts:** Transaction system, Testing of seralizability, Seralizability or schedules, conflict and view seralizable schedule, recoverability, Recovery from transaction failures, deadlock handling.<br>Concurrency Control Techniques: Concurrency control, locking Techniques for concurrency control. | 8 |
| | **TOTAL** | **42** |

**11 Suggested Books:**

| Sl. NO. | NAME OF AUTHERS/BOOKS/PUBLISHERS | YEAR OF PUBLICATION |
|---|---|---|
| **1** | Elmasri and Navathe: Fundamentals of Database Systems, 5th Edition, Pearson Education. | 2007 |
| **2** | Silberschatz, Korth and Sudharshan: Data base System Concepts,5th Edition, Mc-GrawHill. | 2006 |
| **3** | C.J. Date, A. Kannan, S. Swamynatham: A Introduction to Database Systems, 8th Edition, Pearson education. | 1996 |
| **4** | Raghu Ramakrishnan and Johannes Gehrke: Database Management Systems, 3rd Edition, McGraw-Hill. | 2003 |
| **5** | Paul Beynon Davis, "Database Systems" Palgrave Macmillan | 2005 |

**NAME OF DEPARTMENT:** Computer Applications

**Course Name:** Bachelor of Science (Hons.) in Computer Science.

**Subject Name:** System Simulation and Modeling **Subject Code:** TBS 405(3)

**1 Contact Hours:** 45 **L** 3 **T** 0 **P** 0

**2 Examination Duration (Hrs):** **Theory** 0 3 **Practical** 0 0

**3 Relative Weightage:** **CWE:** 25 **MTE:** 25 **ETE:** 50

**4 Credits:** 0 3

**5 Semester:** ☐ **Autumn** ☑ **Spring** ☐ **Both**

**6 Pre-Requisite:** Basic Mathematics

**7 Subject Area:** Computer Science

**8 Objective:** To teach Simulation Techniques and its Applications**.**

**9 Course Outcome:** A student who successfully fulfills the course requirements will be able to-

1. Describe the role of important elements of simulation and modeling paradigm.
2. Analyze and design Monte Carlo simulation algorithms.
3. Analyze and design discrete-event simulation algorithms.
4. Analyses outputs of discrete-event simulation algorithms.
5. Design and Modeling techniques for event systems.
6. understand the simulation languages and their applications.

**10 Details of the Course:**

| Unit No. | CONTENT | CONTACT HOURS |
|---|---|---|
| 1 | System definition and components, stochastic activities, continuous and discrete Systems, System modeling, types of models, static and dynamic physical models, Static and dynamic mathematical models, Full corporate model. | 10 |
| 2 | System simulation, Basic nature of simulation, technique of simulation, comparison of simulation and analytical methods, types of system simulation, real time simulation, Computer based simulation of pure-pursuit problem, single-server queuing system and an inventory problem, Distributed Lag models, Cobweb model. | 10 |

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|---|---|---|
| **3** | Simulation of water reservoir, servo system, Discrete system Simulation, Fixed time-step vs. event-to-event model,<br>generation of random numbers, Test for randomness, Generalization of non-uniformly distributed random numbers, generation of continuous random variates and discrete random variates, Monte-Carlo computation vs. stochastic simulation | 8 |
| **4** | System dynamics, Exponential growth Models, Exponential Decay Models, Modified exponential growth models, Logistic curves, Generalization of growth models, System Dynamics diagrams, Host- Parasite Model, World Model. | 7 |
| **5** | Simulation of PERT networks, flow chart for backward pass and forward pass, uncertaintities in Activity duration, Resource allocation and consideration.<br>Simulation software and Simulation languages, continuous and discrete simulation language. | 10 |
| | **TOTAL** | **45** |

**11 Suggested Books:**

| **Sl. NO.** | **NAME OF AUTHERS/BOOKS/PUBLISHERS** | **YEAR OF PUBLICATION** |
|---|---|---|
| **1** | Geoftrey Gordon, "System Simulation", PHI, 2 Edition | 2002 |
| **2** | Narsingh Deo, "System Simulation with digital computer", PHI, 2 Edition | 2004 |
| **3** | Averill M. Law, W. David Kelton, "Simulation Modeling and Analysis", TMH, 3 Edition | 2001 |

**Course Name:** Artificial Intelligence **Subject Code:** TBS 405(4)

**Program Name:** Bachelor of Science (Hons.) in Computer Science.

**1 Contact Hours:** 45 **L** 3 **T** 0 **P** 0

**2 Examination Duration(Hrs):** **Theory** 0 3 **Practical** 0 0

**3 Relative Weightage:** **CWE:** 25 **MTE:** 25 **ETE:** 50

**4 Credits:** 0 3

**5 Semester:** ☐ **Autumn** ☑ **Spring** ☐ **Both**

**6 Pre-Requisite:** knowledge of Data structures, and discrete mathematics

**7 Subject Area:** Computer Applications

**8 Objective:** To enable the student to apply the artificial intelligence techniques in applications which involve perception, reasoning and learning.

**9 Learning Outcome:** A student who successfully fulfills the course requirements will be able to

**1** Identify problems that are amenable to solution by AI methods
**2** Understand and implement solutions for pattern recognition.
**3** Implement basic AI algorithms (e.g. , standard search algorithms or dynamic programming)
**4** Understand and define solutions for searching problem
**5** Define supervised and unsupervised learning

**10 Details of the Course:**

| Unit No. | CONTENT | CONTACT HOURS |
|---|---|---|
| **1** | Introduction*:* Introduction to Artificial Intelligence, Foundations and History of Artificial Intelligence, Applications of Artificial Intelligence, Intelligent Agents, Structure of Intelligent ,Agents. Computer vision, Natural Language Possessing. | 10 |
| **2** | Introduction to Search: Searching for solutions, Uniformed search strategies, Informed search, strategies, Local search algorithms and optimistic problems, Adversarial Search, Search for games, Alpha - Beta pruning. | 8 |
| **3** | Knowledge Representation & Reasoning: Propositional logic, Theory of first order logic,<br>Inference in First order logic, Forward & Backward chaining, Resolution, Probabilistic reasoning, Utility theory, Hidden Markov Models (HMM), Bayesian Networks. | 10 |
| **4** | Machine Learning : Supervised and unsupervised learning, Decision | 10 |

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|---|---|---|
| | trees, Statistical learning models, Learning with complete data - Naive Bayes models, Learning with hidden data – EM algorithm, Reinforcement learning, | |
| **5** | Pattern Recognition : Introduction, Design principles of pattern recognition system, Statistical Pattern recognition, Parameter estimation methods - Principle Component Analysis (PCA) and Linear Discriminant Analysis (LDA), Classification Techniques – Nearest Neighbor (NN) Rule, Bayes Classifier, Support Vector Machine (SVM), K – means clustering. | 7 |
| | **TOTAL** | **45** |

## 11 Suggested Books:

| Sl. NO. | NAME OF AUTHERS/BOOKS/PUBLISHERS | YEAR OF PUBLICATION |
|---|---|---|
| **1** | Nils J. Nilsson, "Artificial Intelligence: A new Synthesis", Harcourt Asia Pvt. Ltd. | 2007 |
| **2** | Elaine Rich and Kevin Knight, "Artificial Intelligence", 2nd Edition, Tata McGraw-Hill. | 2009 |
| **3** | George F. Luger, "Artificial Intelligence-Structures And Strategies For Complex Problem Solving", Pearson Education / PHI. | 2007 |

**Course Name:** Career Skills - II **Subject Code:** TBS 406

**Program Name:** BSc (Cs)

**1 Contact Hours:** 30 **L** 2 **T** 0 **P** 0

**2 Examination Duration (Hrs):** **Theory** 0 2 **Practical** 0 0

**3 Relative Weightage:** **CWE:** 25 **MTE:** 25 **ETE:** 50

**4 Credits:** 0 3

**5 Semester:** ☐ **Autumn** ☑ **Spring** ☐ **Both**

**6 Pre-Requisite:** Basic concepts of Logic and application

**7 Subject Area:** Quantitative Aptitude

**8 Objective:** Prepare the students for the quantitative aptitude part for campus placement and competitive exams

**9 Course Outcomes:** A student who successfully fulfills the course requirements will be able to:

CO 1. Apply the properties of numbers and the other concepts to solve different problems on number theory.
CO 2. Understand the concepts of profit loss and simple interest and compound interest to solve different types of problems.
CO 3. Apply the concepts of Ratio and Proportion to solve the different types of questions in mixtures and solutions.
CO 4. Analyze the relation between speed, distance and time to effectively solve the problems of relative speed, boats and streams and trains.
CO 5. Understand the concept of Permutation, Combination and Probability to apply and practice the different types of questions.

**10 Details of the Course:**

| Unit No. | CONTENT | CONTACT HOURS |
|---|---|---|
| 1 | Classification of numbers, rules of divisibility, properties of remainders, LCM-HCF and their applications, concept of the last digit, concept of alpha numerals. Practice of questions based on number system concepts. | 7 |

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|---|---|---|
| | Concept of percentage and percentage equivalent of fractions, multiplication factor, importance and understanding of the base in calculations, concept and application of the successive percentage change rule | |
| **2** | Concept of profit, loss and discount and its application. Understanding and practice of questions based on addition of impurity and unequal quantity buying and selling concept.<br>Concept and understanding of simple and compound interest and their difference, understanding CI as an application of the successive percentage change rule, concept of effective rate of interest and practice of all the types of problems in SI and CI. | 6 |
| **3** | Concept of ratio proportion and its application. Concept, understanding and practice of mixtures and solutions including alligation and replacement of part of a solution.<br>Concept and understanding of average, weighted average and its application. Practice of problem based on age related concepts. | 5 |
| **4** | Concepts of time, speed and distance, understanding the direct and inverse relations in the topic, average speed and its application. Understanding the concept and application of relative speed and practice of problems based on trains and boats and streams.<br>Concepts of time and work and its application based problems using the LCM method for individual efficiencies and practice of problems based on group efficiencies. | 6 |
| **5** | Concept, understanding and practice of questions based on permutation and combination, difference in the approach for different things and identical things.<br>Concept, understanding and practice of questions based on probability. | 6 |
| | **TOTAL** | **30** |

## 11 Suggested Books:

| Sl. NO. | NAME OF AUTHERS/BOOKS/PUBLISHERS | YEAR OF PUBLICATION |
|---|---|---|
| **1** | R.S.Aggarwal, Quantitative Aptitude for Competitive Exams, S.Chand, 20th Edition. | 2013 |
| **2** | P.A.Anand, Quantitative Aptitude for Competitive Exams, Wiley Publication, First Edition. | 2015 |