SARDAR PATEL UNIVERSITY
Vallabh Vidyanagar, Gujarat
(Reaccredited with 'A' Grade by NAAC (CGPA 3.25)
Syllabus with effect from the Academic Year 2022-2023

Bachelor of Science (Computer Application & Information Technology)
B.Sc. (CA&IT) Semester IV

Course Code	**US04AIIT51**	Title of the Course	**Operations Research - II**
Total Credits of the Course	**2**	Hours per Week	**2**
Course Objectives:	To impart knowledge of assignment problems, game theory, job sequencing and project management by PERT and CPM.		

Course Content		
Unit	**Description**	**Weightage* (%)**
1.	**Assignment Problem** – Introduction to Assignment Problem – Mathematical formulation of AP. – Hungarian method for finding optimal solution to AP. – Unbalanced AP.	25
2.	**Game Theory** – Elements of game theory: two person zero sum game concept – Saddle point, game without saddle point. – Mixed strategies (without proof) – Graphical solution of 2 X n and n X 2 games.	25
3.	**Job Sequencing** – Job sequencing: introduction. Solution of Johnson's algorithm for solution of sequencing. – Problem with n job through 2 machines and n job through 3 machines.	25
4.	**Project Evaluation and Review Technique (PERT) and Critical Path Method (CPM)** – Project management by PERT and CPM. – Introduction to PERT and CPM. – Advantages and Assumption. – Rules for network construction. Critical path calculation, – Total float, Free float.	25

Teaching-Learning Methodology	Blended learning approach incorporating both traditional classroom teaching as well as usage of ICT tools

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Evaluation Pattern

Sr. No.	Details of the Evaluation	Weightage
1.	Internal Written / Practical Examination (As per CBCS R.6.8.3)	15%
2.	Internal Continuous Assessment in the form of Practical, Viva-voce, Quizzes, Seminars, Assignments, Attendance (As per CBCS R.6.8.3)	15%
3.	University Examination	70%

Course Outcomes: Having completed this course, the learner will be able to	
1.	Understand the basics of assignment problems, game theory, job sequencing and project management by PERT and CPM.

Suggested References:	
Sr. No.	References
1.	Taha H. A. : Operations Research, Macmillan, New York (1987).
2.	Sharma S.D. : Operations Research. Kedar Nath Ram Nath & Co. Meerut , 1988-89.
3.	Gillett B. E.: Introduction to Operations Research - a computer oriented algorithmic approach, McGraw-Hill, 1976.
4.	Bronson Richard : Operations Research, Schaum's outline Series, 1983.
5.	Kapoor V K : Problems and solutions in Operations Research, Sultan Chand & sons,1996.

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Bachelor of Science (Computer Application & Information Technology)
B.Sc. (CA&IT) Semester IV

Course Code	US04CIIT52	Title of the Course	OOPS Technology - I
Total Credits of the Course	**4**	Hours per Week	**4**
Course Objectives:			

Course Objectives:	1. To study the fundamental programming concepts and constructs using Java. 2. To learn the basic concepts of object-oriented programming using Java. 3. To understand the basics of applet programming and JDBC.

Course Content		
Unit	Description	Weightage* (%)
1.	**Introduction** − History of Java, features, the Java environment, the Java Virtual Machine (JVM) − Structure of a Java program, a simple Java program, implementing a Java program − Tokens, comments, constants, variables and data types − Scope of variables, type casting − Operators: arithmetic, relational, logical, assignment, increment/decrement, conditional, ternary operator & special operators − Decision making: if statement, if…else statement, nesting of if…else, the else if ladder, switch statement − Looping: while, do…while, for, for each loop, jumps in loops, labeled loops − Arrays: one, two dimensional arrays	25
2.	**Classes, Objects, Interfaces and Inheritance** − Defining a class, members of a class: variables and methods, creating objects, constructors, accessing class members − Static members v/s instance members − Introduction to inheritance, super keyword − Interfaces: introduction − Final variables, methods and classes, abstract methods and classes − Introduction to method overloading and overriding	25
3.	**Exception Handling, I/O Management and Packages** − Managing errors & exceptions: introduction, types of errors, exceptions, syntax of exception handling construct, multiple catch statements, the finally clause, defining and throwing user-defined	25

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	exceptions, the throw statement − Managing I/O files : introduction, concept of streams, Character stream classes − Introduction to the concept of package, Java API packages, using the System package − Using java.lang (String, Math)	
4.	**Applet Programming and JDBC** − Applet architecture and skeleton − java.awt package (Button, CheckBox, CheckBoxGroup, Choice, Color, Label, List, TextArea, TextField) − HTML applet tag, display techniques (DrawString, Lines, Rectangle, Ellipses, Circles, Arcs, Polygons, Color) − Introduction to event handling − Introduction to JDBC, types of drivers, java.sql package − Retrieving, inserting, deleting and updating data though Java	25

Teaching-Learning Methodology	Blended learning approach incorporating both traditional classroom teaching as well as usage of ICT tools

Evaluation Pattern		
Sr. No.	Details of the Evaluation	Weightage
1.	Internal Written / Practical Examination (As per CBCS R.6.8.3)	15%
2.	Internal Continuous Assessment in the form of Practical, Viva-voce, Quizzes, Seminars, Assignments, Attendance (As per CBCS R.6.8.3)	15%
3.	University Examination	70%

Course Outcomes: Having completed this course, the learner will be able to	
1.	Understand the fundamental programming concepts and constructs using Java.
2.	Describe the basic concepts of object-oriented programming using Java.
3.	Understand the basics of applet programming and JDBC.

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Suggested References:	
Sr. No.	References
1.	Programming with Java- A Primer by E. Balaguruswami, 3rd Edition, TMH Publication.
2.	The Complete Reference – Java 2 7th Edition Herbert Schildt. TMH Publication.
3.	Saba Zame , Handbook of Object technology, CRC Press, Washington DC, 1999.
4.	Mary Campion and Kathy Walrath, Java tutorial, Second Edition, Addison Wesley Pun. 1998.
5.	Java 2 Programming Black Book, Steven Holzner.

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Bachelor of Science (Computer Application & Information Technology)
B.Sc. (CA&IT) Semester IV

Course Code	**US04CIIT53**	Title of the Course	**Relational Database Management Systems - II**
Total Credits of the Course	**4**	Hours per Week	**4**
Course Objectives:			

Course Objectives:	1. To learn the concepts of relational database design. 2. To understand the basics of PL/SQL including cursors, exception handling, stored subprograms, database triggers and packages.

Course Content		
Unit	Description	Weightage* (%)
1.	**Relational Database Design** – Entity-relationship modeling (different types of entities, attributes, relationships and their representation in the E-R diagram) – Case studies of data modeling using E-R modeling – Consequences of poor Data base Design – Normalization, 1st Normal Form, 2nd Normal Form, 3rd Normal Form, Boyce-Codd Normal Form – Examples of normalization	25
2.	**Basics of PL/SQL** – PL/SQL - Introduction and advantages – Understanding PL/SQL Block structure – Fundamentals of PL/SQL Language - data types (BOOLEAN, CHAR, NUMBER, DATE, VARCHAR2), variables, constants and expressions (CASE expression) – Operators – Conditional statement – IF and CASE statements – Controlling loop iterations – LOOP, EXIT, EXITWHEN, WHILE, FOR – Sequential control statement – GOTO and NULL	25
3.	**Cursors and Exception Handling** – SELECT..INTO statement – Working with cursor : introduction, types, attributes and processing (i.e. declaring, opening, fetching and closing), using parameterized cursor, using cursor FOR loop – Error Handling : introduction, advantages of exceptions, types of exceptions – Working with user-defined exceptions – declaration, RAISE_APPLICATION_ERROR, Pragma EXCEPTION_INIT, SQLCODE and SQLERRM	25

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4.	**Stored Subprograms, Database Triggers and Packages** – Stored procedures – introduction, creating, modifying, executing and dropping procedures – Stored functions – introduction, creating, modifying, executing and dropping functions – Database triggers – introduction, creating, modifying and dropping triggers, types of triggers – Packages – meaning, advantages, creating, modifying and dropping	25

Teaching-Learning Methodology	Blended learning approach incorporating both traditional classroom teaching as well as usage of ICT tools

Evaluation Pattern		
Sr. No.	Details of the Evaluation	Weightage
1.	Internal Written / Practical Examination (As per CBCS R.6.8.3)	15%
2.	Internal Continuous Assessment in the form of Practical, Viva-voce, Quizzes, Seminars, Assignments, Attendance (As per CBCS R.6.8.3)	15%
3.	University Examination	70%

Course Outcomes: Having completed this course, the learner will be able to	
1.	Understand the concepts of relational database design.
2.	Gain basic knowledge of PL/SQL including cursors, exception handling, stored subprograms, database triggers and packages.

Suggested References:	
Sr. No.	References
1.	Ivan Bayross : SQL, PL/SQL The programming language of Oracle, 3rd revised edition, BPB Publications.
2.	Database Management Systems, Raghu Ramkrishnan & Johannes, Mc Graw Hill, 3rd Edition.

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3	SQL/PLSQL for Oracle9i, P. S. Deshpande, Dreamtech press, reprint edition 2009.
4	Understanding Database Management Systems : S. Parthsarthy and B.W.Khalkar, First edition – 2007, Master Academy.
5	Oracle9i PL/SQL : A developer's guide, Buluksu Lakshman, A press, edition 2003.

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Bachelor of Science (Computer Application & Information Technology)
B.Sc. (CA&IT) Semester IV

Course Code	**US04CIIT54**	Title of the Course	**Software Engineering**
Total Credits of the Course	**4**	Hours per Week	**4**
Course Objectives:	1. To learn the fundamental concepts of software engineering. 2. To study the concepts related to software requirements specifications, project planning, software design, coding and testing.		

Course Content		
Unit	**Description**	**Weightage* (%)**
1.	**Introduction** – Defining Software & Introduction to Software Engineering – Characteristics of Software – Activities of Software Process – Umbrella Activities – Process Flow (Linear, Iterative, Evolutionary, Parallel) – Process Model: Waterfall, Prototype, Iterative, Enhancement, Spiral (Overview) – CMM	25
2.	**System Requirement Specification and Software Project Planning** – Introduction to System Requirement Specification and need of SRS – Requirement Specifications, Characteristics & Components of SRS – Overview of Specification Languages (Structured English, Regular Expressions & Decision Tables) – Structure and Validation of SRS – Introduction to Software Project Planning and list of major issue of project plan – Overview Cost Estimation (Uncertainties in Cost Estimation, Building Cost ,Estimation Models, On Size Estimation, COCOMO model) – Project Monitoring Plan (Time sheets, Reviews, Cost-Schedule-Milestone, Earned Value Method, Unit Development Folder – Quality Assurance Plans – Overview of Risk Management	25
3.	**System Design and Detail Design** – Introduction to System Design, Design Principles (Problem Partitioning & Hierarchy, Abstraction, Modularity, Top-Down and Bottom-up strategy – Module Level Concepts (Coupling & Cohesion)	25

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	– Introduction: Detailed Design, Module Specification (Specifying Functional Module, Specifying Classes) – Verification- Design Walkthrough, Critical Design, review, Consistency checkers	
4.	**System Coding & Testing** – Introduction: Coding, coding process (Top Down & Bottom Up approach for coding), Structured Programming, Information Hiding, Programming Style, Internal Documentation – Verification with code reading. – Introduction: Testing, Error, Fault, Failure & Reliability, Testing Process (Top down and bottom up approach for testing) – Levels of Testing – Functional Testing v/s Structural Testing	25

Teaching-Learning Methodology	Blended learning approach incorporating both traditional classroom teaching as well as usage of ICT tools

Evaluation Pattern		
Sr. No.	Details of the Evaluation	Weightage
1.	Internal Written / Practical Examination (As per CBCS R.6.8.3)	15%
2.	Internal Continuous Assessment in the form of Practical, Viva-voce, Quizzes, Seminars, Assignments, Attendance (As per CBCS R.6.8.3)	15%
3.	University Examination	70%

Course Outcomes: Having completed this course, the learner will be able to	
1.	Understand the fundamental concepts of software engineering.
2.	Gain knowledge of the concepts related to software requirements specifications, project planning, software design, coding and testing.

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Suggested References:	
Sr. No.	References
1.	Software Engineering a practitioner's approach by Roger S. Pressman, Tata McGraw-Hill, Seventh Edition.
2.	An Integrated Approach to Software Engineering by Pankaj Jalote, Narosa Publishing House, Second Edition,1997.

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Bachelor of Science (Computer Application & Information Technology)
B.Sc. (CA&IT) Semester IV

Course Code	**US04CIIT55**	Title of the Course	**Advanced Data & File Structure**
Total Credits of the Course	**4**	Hours per Week	**4**

Course Objectives:	To impart the basic knowledge of data structures and file structures.

Course Content		
Unit	Description	Weightage*(%)
1.	**Arrays, Stack & Graphs** − Introduction to arrays, one and two-dimensional arrays − Representation of arrays in memory : row-major and column-major order − Address calculation of elements of one and two-dimensional arrays − Sparse array, Applications of arrays − Stack - Prefix, Infix and Postfix expressions, Utility and conversion of these expressions from one to another − The concept of a graph and basic terminology	25
2.	**Trees and Binary Tree** − Introduction to trees − Definitions of basic terms : Tree, Directed Tree, Root, Leaf, Branch, Level, Node, Forest − Applications of a tree − Binary trees : Introduction, Linear and Linked Representations − Traversal of a binary tree: Preorder, Inorder and Postorder − Insertions and deletions in a lexically ordered binary tree − Types of Binary Tree : Full Binary Tree, Complete Binary Tree, Binary Search Tree, Heap Tree, Height Balanced Tree (AVL Tree), B-Tree	25
3.	**Sorting and Searching techniques** − Sorting – Introduction, Applications of sorting − Techniques - Bubble sort, Insertion sort, Selection Sort, Quick sort, Merge sort − Searching – Introduction, Applications of searching − Techniques - Sequential search and Binary search − Sorting vs. Searching	25

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4.	**File Organization**	25
	− Terminology, definitions and concepts in file organization − The structure of sequential files, Processing sequential files, Direct files, Processing direct files − Hashing Functions: The Division Method, The Midsquare Method, The Folding Method, Digit Analysis, The length-Dependent Method − The structure of indexed sequential files (IBM Only), Processing indexed sequential files	

Teaching-Learning Methodology	Use of ICT Tools, Class room teaching, Project based learning methods.

Evaluation Pattern

Sr. No.	Details of the Evaluation	Weightage
1.	Internal Written / Practical Examination (As per CBCS R.6.8.3)	15%
2.	Internal Continuous Assessment in the form of Practical, Viva-voce, Quizzes, Seminars, Assignments, Attendance (As per CBCS R.6.8.3)	15%
3.	University Examination	70%

Course Outcomes: Having completed this course, the learner will be able to
1. Gain the basic knowledge of data structures and file structures.

Suggested References:	
Sr. No.	References
1.	Tremblay J. & Sorenson P. G.: An Introduction to Data Structures with Applications, 2nd Edition, Tata McGraw-Hill Edition, 1991.
2.	Singh Bhagat& Naps Thomas: Introduction to Data Structures, Tata McGraw-Hill Publishing Co.Ltd.,1985.
3.	R. B. Patel: Data Structure using C – Khanna Publications. ISBN: 81-87522-41-0.
4.	D. Samanta - Classis Data Structures, 2nd Edition – PHI Publication.
5.	G. S. Baluja - Data Structures through C, 4th Edition – Dhanpat Rai & Co.

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Bachelor of Science (Computer Application & Information Technology)
B.Sc. (CA&IT) Semester IV

Course Code	**US04CIIT56**	Title of the Course	**Practicals-I**
Total Credits of the Course	**4**	Hours per Week	**8**

Course Objectives:	1. To study the fundamental programming concepts and constructs using Java. 2. To learn the basic concepts of object-oriented programming using Java. 3. To understand the basics of applet programming and JDBC. 4. To learn the concepts of relational database design. 5. To understand the basics of PL/SQL including cursors, exception handling, stored subprograms, database triggers and packages.

Course Content		
Sr.No.	Description	Weightage*(%)
1.	Part-1 : Practical based on US04CIIT51	50
2.	Part-2 : Practical based on US04CIIT52	50

Teaching-Learning Methodology	Project-based learning in small groups and Hands on training through required ICT tools.

Evaluation Pattern		
Sr. No.	Details of the Evaluation	Weightage
1.	University Examination	100%

Course Outcomes: Having completed this course, the learner will be able to	
1.	understand the fundamental programming concepts and constructs using Java.
2.	describe the basic concepts of object-oriented programming using Java.
3.	understand the basics of applet programming and JDBC.
4.	understand the concepts of relational database design.
5.	gain basic knowledge of PL/SQL including cursors, exception handling, stored subprograms, database triggers and packages.

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B.Sc. (CA&IT) Semester IV

Course Code	**US04CIIT57**	Title of the Course	**Practicals-II**
Total Credits of the Course	**4**	Hours per Week	**8**

Course Objectives:	1. To learn the fundamental concepts of software engineering. 2. To study the concepts related to software requirements specifications, project planning, software design, coding and testing. 3. To impart the basic knowledge of data structures and file structures.

Course Content		
Sr. No.	Description	Weightage* (%)
1.	Part-1 : Practical based on US04CIIT53	50
2.	Part-2 : Practical based on US04CIIT54	50

Teaching-Learning Methodology	Project-based learning in small groups and Hands on training through required ICT tools.

Evaluation Pattern		
Sr. No.	Details of the Evaluation	Weightage
1.	University Examination	100%

Course Outcomes: Having completed this course, the learner will be able to	
1.	understand the fundamental concepts of software engineering.
2.	gain knowledge of the concepts related to software requirements specifications, project planning, software design, coding and testing.
3.	gain the basic knowledge of data structures and file structures.

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Bachelor of Science (Computer Application & Information Technology)
B.Sc. (CA&IT) Semester IV

Course Code	**US04SIIT58**	Title of the Course	**R Programming**
Total Credits of the Course	**2**	Hours per Week	**2**
Course Objectives:	1. To learn the fundamentals of R programming. 2. To study the basics of data structures, flow control, functions and method of connecting R to external interfaces.

Course Content
Unit	Description	Weightage* (%)
1.	**Introduction to R** – History of R, Features of R, How to install R, How to run R, Comments in R, Reserved words, Identifiers, Constants, Variables – Operators: Arithmetic, Relational, Logical, Assignment, Miscellaneous, – Basic Data Types: Numeric, Integer, Complex, Logical, Character – Vectors: Creating Vectors, Combining Vectors, Accessing Vector Elements, Modifying Vectors, Deleting Vectors, Vector Arithmetic & Recycling, Vector Element Sorting, Reading Vectors	25
2.	**Data Structures in R** – Matrices: Creating Matrices, Accessing Matrix Elements, Matrix Manipulation, Matrix Operations – Arrays: Creating Arrays, Accessing Array Elements, Array Element Manipulation, Array Arithmetic – Lists: Creating Lists, Accessing List Elements, Updating List Elements, Merging Lists, List to Vector Conversion – Factors: Creating Factors, Accessing Factor Components, Merging Factors – Data Frames: Creating Data Frames, Accessing Data Frame Components, Modifying Data Frames, Aggregating Data, Sorting Data, Merging Data, Reshaping Data, Subsetting Data	25
3.	**Flow Control & Functions in R** – Decision Making: if statement, if..else statement, Nested if..else statement, switch statement, – Loops: for Loop, while Loop, repeat Loop, Loop Control Statements: break Statement, next Statement – Built-in Functions: Mathematical Functions, Character Functions, Statistical Functions, Date and Time Functions – Functions Definition, Function Calling: Function without	25

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	arguments, Functions with named arguments, Function with default arguments.	
4.	**Connecting R to External interfaces** − Packages: Installing a Package, Loading a Package − Charts and Graphs: Bar Charts, Line Graph, Pie Chart, Scatter Plots, Dot Plots − CSV Files: Reading from a CSV File, Writing to a CSV File − Microsoft Excel: Reading from a xlsx File, Writing to xlsx File − Databases: Connecting R to MySQL, Creating Tables, Inserting Rows, Updating Rows, Deleting Rows, Querying Tables, Dropping Table	25

Teaching-Learning Methodology	Blended learning approach incorporating both traditional classroom teaching as well as usage of ICT tools

Evaluation Pattern		
Sr. No.	Details of the Evaluation	Weightage
1.	Internal Written / Practical Examination (As per CBCS R.6.8.3)	15%
2.	Internal Continuous Assessment in the form of Practical, Viva-voce, Quizzes, Seminars, Assignments, Attendance (As per CBCS R.6.8.3)	15%
3.	University Examination	70%

Course Outcomes: Having completed this course, the learner will be able to	
1.	Gain knowledge of the fundamentals of R programming.
2.	Understand data structures, flow control, functions and method of connecting R to external interfaces.

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Suggested References:	
Sr. No.	References
1.	R Programing for Data Science, Roger D. Peng (2015), Leanpub publisher.
2.	Statistics Using R Purohit, G.S., Gore, S.D. and Deshmikh, S.R. (2008), Narosa Publishing House.
3.	Maindonald J. and Braum, J., "Data Analysis and Graphics Using R: An example-based approach",Second Edition, Cambridge Series in Statistical and Probabilistic Mathematics, 2007.
4.	An R Companion to Linear Statistical Models , Hey-Jahans, C.(2012), CRC Press.

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Course Code	US04SIIT59	Title of the Course	Business Information Systems
Total Credits of the Course	2	Hours per Week	2

Course Objectives:	1. To learn Business Information System (BIS), its feature and component. 2. To learn strategy of IT Infrastructure and corporate Environment. 3. To understand of Business Functions and Information Needs of Business. 4. To introduce Managerial Process with Implications for Information System. 5. To introduce planning for IT Infrastructure for best Business. 6. To identify IT applications and Assessing Risk In Realization of Benefits.

Course Content		
Unit	Description	Weightage* (%)
1.	**Business Information System** − Introduction to BIS − Features of BIS − Users of BIS. − Component of BIS. − Characteristics Features of new IT Infrastructure − Changing the corporate Environment.	25
2.	**Business Functions and Information Needs of Business** − Introduction to Basic Business Functions. − Marketing Function and Information Needs. − Finance Function and Information Needs. − Production Function and Information Needs. − Human Resource Management and Information Needs. − Information Management as Business Function.	25
3.	**Information System and Managerial Process** − Introduction to Managerial Process. − Managerial Decision Making − Approaches to Managerial Decision Making − Decision Making Environment. − Implications for Information System.	25

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4.	**Planning for IT Infrastructure**	25
	− Introduction to Planning for IT Infrastructure. − Portfolio Approach. − Identifying IT applications. − Techniques of Evaluating IT Investments. − Assessing Risk In Realization of Benefits.	

Teaching-Learning Methodology	Blended learning approach incorporating both traditional classroom teaching as well as usage of ICT tools

Evaluation Pattern		
Sr. No.	Details of the Evaluation	Weightage
1.	University Examination	100%

Course Outcomes: Having completed this course, the learner will be able to	
1.	the basic concepts related to Business Information Systems.
2.	various business functions and information needs of a business.
3.	various managerial processes and information systems.
4.	necessary planning for IT infrastructure.

Suggested References:	
Sr. No.	References
1.	Business Information System, Muneesh Kumar, Publisher : Vikas Publishing House Pvt Ltd.
2.	Introduction to Information Technology, Turban, Rainer, Potter, John Wiley & Sons Inc., 2000

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