SARDAR PATEL UNIVERSITY
Vallabh Vidyanagar, Gujarat
(Reaccredited with 'A' Grade by NAAC (CGPA 3.25)
Syllabus with effect from the Academic Year 2021-2022

Bachelor of Science (Computer Applications & Information Technology)
B.Sc. (CA&IT)

PROGRAMME SPECIFIC OBJECTIVE

The objective of the B.Sc. (CA & IT) programme is to prepare students for a career in software design, development and testing as well as IT support by training them in the core and emerging areas of computer applications.

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Bachelor of Science (Computer Applications & Information Technology)
Course Structure
(effective from June 2022)

B.Sc. (CA&IT) Course Structure for Semester–III

Paper code & Title	T/P	Credits	External marks	Internal marks	Total marks
SEMESTER–III					
CORE COURSES					
US03CIIT51 : Computer Programming using C++	T	4	70	30	100
US03CIIT52 : Visual Programming	T	4	70	30	100
US03CIIT53 : Relational Database Management Systems– I	T	4	70	30	100
US03CIIT54 : Operating Systems	T	4	70	30	100
US03CIIT55 : Practicals-I	P	4	100	-	100
US03CIIT56 : Practicals-II	P	4	100	-	100
ABILITY ENHANCEMENT COURSES					
US03AIIT57 : Operations Research-I	P	2	50	-	50
SKILL ENHANCEMENT COURSES (ANY ONE)					
US03SIIT58 : Software Testing **US03SIIT59** : Management Information Systems	T	2	50	-	50
TOTAL CREDITS		28	580	120	700

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Course Structure
(effective from June 2022)

B.Sc. (CA&IT) Course Structure for Semester–IV

SEMESTER–IV					
Paper code & Title	**T/P**	**Credits**	**External marks**	**Internal marks**	**Total marks**
CORE COURSES					
US04CIIT51 : OOPS Technology -I	T	4	70	30	100
US04CIIT52 : Relational Database Management Systems-II	T	4	70	30	100
US04CIIT53 : Software Engineering	T	4	70	30	100
US04CIIT54 : Advanced Data & File Structure	T	4	70	30	100
US04CIIT55 : Practicals-I	P	4	100	-	100
US04CIIT56 : Practicals-II	P	4	100	-	100
ABILITY ENHANCEMENT COURSES					
US04AIIT57 : Operations Research-II	P	2	50	-	50
SKILL ENHANCEMENT COURSES (ANY ONE)					
US04SIIT58 : R Programming **US04SIIT59** : Business Information Systems	T	2	50	-	50
TOTAL CREDITS		28	580	120	700

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B.Sc. (CA&IT) Semester III

Course Code	US03CIIT51	Title of the Course	**Computer Programming using C++**
Total Credits of the Course	4	Hours per Week	4

Course Objectives:	1. To study the fundamental concepts and constructs of the C++ programming language 2. To learn the basic concepts of object-oriented programming using C++.

Course Content		
Unit	Description	Weightage* (%)
1.	**Object Oriented Programming (OOP) Concepts and Introduction to C++** – Structured programming vs. object oriented programming – Basic OOP concepts : objects , classes , encapsulation, data hiding, inheritance, polymorphism – Introduction to C++: structure of a C++ program , data types, variables, constants, expressions, statements and operators – Usage of header files – Control flow statements : if else, for loop, while loop, do while loop, switch, break and continue	
2.	**Input/Output, Arrays and Working with Classes** – Basic I/O in C++ – Arrays in C++ : introduction, declaration, initialization of one, two and multidimensional arrays, operations on arrays – Working with strings : introduction, declaration, string manipulation and arrays of string – Classes and objects in C++ – Constructors : default, parameterized, copy, constructor overloading and destructor – Access specifiers, implementing and accessing class members – Working with objects : constant objects, nameless objects, live objects, arrays of objects	
3.	**Functions, Function Overloading and Inheritance**	

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	– Introduction to functions, library and user-defined functions, parameters passing, default arguments – Functions overloading , inline functions, friend functions and virtual functions – Inheritance: Introduction, derived class declaration, forms of inheritance and member access ability, constructor and destructor in derived class, construction invocation and data member initialization.	
4.	**Operator Overloading, Pointers and Files** – Operator overloading : Introduction, overloaded operators, unary operator overloading, operator keyword, operator return values, binary operators overloading, overloading with friend function – Dynamic memory allocation – Files : introduction and applications – File operations : open, read, write, seek and close	

Teaching-Learning Methodology	Multiple teaching approaches: lecture and discussion, exploration and inquiry, cooperative group work, demonstrations, and presentations

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.	apply the knowledge of the fundamental concepts and constructs of the C++ programming language.
2.	carry out object-oriented programming using C++.

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Suggested References:

Sr. No.	References
1.	E Balagurusamy : Object Oriented Programming in C++, Tata McGraw-Hill Publishing Co. Ltd.
2.	Robert Lafore : Object Oriented Programming in Turbo C++, Guide, Galgotia Pub. (P) Ltd.
3.	Barkakati N. : Object Oriented Programming in C++, PHI. OOP's using C++ for Dummies.

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B.Sc. (CA&IT) Semester III

Course Code	US03CIIT52	Title of the Course	Visual Programming
Total Credits of the Course	4	Hours per Week	4

Course Objectives:	1. To enable students to develop graphical programs using the .NET framework and the VB .NET programming language. 2. To learn how to access databases and files in .NET programs.

Course Content		
Unit	Description	Weightage* (%)
1.	**Introduction to .NET Framework and VB.NET** − .NET Architecture, .NET Languages, Microsoft Intermediate Language (MSIL), The Just-In-Time (JIT) compiler, Working with Assemblies, The .NET framework class library − VB.NET - introduction, applications and types of project − Introduction to Visual Studio IDE − Variables, data types, constants and operators − Type casting, Boxing and Unboxing, − Working with arrays and strings − Creating simple Windows Application using VB.NET	25%
2.	**VB.NET Basics** − Use of conditional statement (if), multi branching statement (select) and With…End With statement, − Looping Statement: DO, FOR, FOR EACH...NEXT and WHILE, Working with EXIT, CONTINUE and WITH statements − Working with procedures – introduction, types, use of parameters, parameter passing, calling procedures − Working with modules, classes (partial) and namespaces − Working with Windows Forms – Introduction, life cycle, basic properties, methods and events, use of simple windows forms control. − Working with SDI and MDI forms	25%
3.	**Developing Windows Forms, Exception Handling**	25%

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	– Working with basic controls – Button, Check Box, Checked List Box, ComboBox, Date Time Picker, Group Box, HScroll Bar, Radio Button, Vscroll Bar, Label, List Box, Picture Box, Text Box and Timer controls. – Working with advanced controls – Link Label, Rich Text Box, Color Diolog, Font Dialog, Tree View and Progress bar controls – Error Handling: exception, structured exception using try…catch and final Statement	
4.	**Persisting Data Using Databases and Files** – ADO.NET – introduction and applications – ADO.NET – architecture (connected and disconnected) – Database connectivity using ADO.NET – Use of Data sources, Server Explorer and working with Data Set – Populating data in a Data Grid View – Working with files	**25%**

Teaching-Learning Methodology	Multiple teaching approaches: lecture and discussion, exploration and inquiry, cooperative group work, demonstrations, and presentations

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.	develop graphical programs using the .NET framework and the VB .NET programming language.
2.	access databases and files in .NET programs

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Suggested References:	
Sr. No.	References
1.	Steven Holzner, VB.NET Black Book by Dreamtech publication.
2.	Francesco Balena, Programming Microsoft Visual Basic.NET, Microsoft Press.
3	Bill Evjen, Billy Hollis, Bill Sheldon, Kent Sharkey and Tim McCarthy, Professional VB 2005 with .NET 3.0.

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B.Sc. (CA&IT) Semester III

Course Code	**US03CIIT53**	Title of the Course	**Relational Database Management Systems-I**
Total Credits of the Course	**4**	Hours per Week	**4**

Course Objectives:	1. To introduce the students to the relational data model and RDBMS. 2. To teach the SQL language for accessing an RDBMS.

Course Content		
Unit	Description	Weightage* (%)
1.	**Introduction to DBMS, RDBMS and Data Modeling** − DBMS : Meaning, Advantages, Disadvantage − The three-schema architecture for a Database Management System (DBMS) − Introduction to data models (hierarchical, network, relational) − The relational data model: concepts and terminology, relationships and relationship types − Codd Rules − Difference between DBMS and RDBMS	**25%**
2.	**Introduction to SQL** − SQL - introduction , advantages and disadvantages − Data types – built-in (number, char, varchar2, date, raw, long raw) − Types of SQL Statements : DDL (Data Definition Language), − DML (Data Manipulation Language), DCL (Data Control Language), TCL (Transaction Control Language) − Working with SQL*Plus – overview and basic commands like ed, start, get, save, exit, connect, set linesize, set pagesize and host − Creating table and inserting data - CREATE TABLE, INSERT, retrieving data using query – SELECT , manipulating data – DELETE and UPDATE , modifying and removing table – ALTER TABLE and DROP TABLE.	**25%**

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3.	**Data Constraints and Functions** – Pseudo columns – ROWID, ROWNUM, USER, UID, SYSDATE – Null values, TAB table, DUAL table – Operators – arithmetic, relational, logical, range searching, pattern matching and set – Data constraints – Introduction, advantages and disadvantages – Type of data constraints – NOT NULL, UNIQUE, PRIMARY KEY, FOREIGN KEY and CHECK – Modifying constraints, working with data dictionary and – use of USER_CONSTRAINTS – Functions – introduction, merits and demerits, types of functions (scalar and aggregate)	
4.	**Scalar , Conversion , Aggregate and Miscellaneous functions** – Scalar : Numeric functions (FLOOR, MOD, POWER, ROUND, SQRT and TRUNC), Character functions (CHR, ASCII, CONCAT, INITCAP, LOWER, SUBSTR,TRIM, UPPER), Date functions (ADD_MONTHS, LAST_DAY, NEXT_DAY, MONTHS_BETWEEN), – Conversion functions (TO_NUMBER, TO_CHAR and TO_DATE) – Aggregate fun : AVG, COUNT, MAX, MIN, SUM – Miscellaneous functions – NVL, DECODE, COALESCE	**25%**

Teaching-Learning Methodology	Multiple teaching approaches: lecture and discussion, exploration and inquiry, cooperative group work, demonstrations, and presentations

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%

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Course Outcomes: Having completed this course, the learner will be able to	
1.	apply the basic knowledge of the relational data model and RDBMS
2.	use the SQL language for accessing an RDBMS

Suggested References:	
Sr. No.	References
1.	An introduction to Database Systems : Bipin C. Desai, Galgotia Poblications Pvt. Ltd.
2.	Ivan Bayross : SQL,PL/SQL The programming language of Oracle, 3rd revised edition, BPB Publications.
3.	SQL/PLSQL for Oracle9i, P. S. Deshpande, dreamtech press, reprint edition 2009.
4.	Understanding Database Management Systesm : S. Parthsarthy and B.W.Khalkar, First edition – 2007, Master Academy.
5.	Orale9i The Complete Reference , Kevin Loney, George Koch, Oracle Press.

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Course Code	US03CIIT54	Title of the Course	**Operating Systems**
Total Credits of the Course	**4**	Hours per Week	**4**

Course Objectives:	1. To introduce the students to the fundamentals of operating systems. 2. To teach CPU scheduling, memory management, process synchronization and deadlocks. 3. To impart basic knowledge of the Linux commands.

Course Content		
Unit	Description	Weightage* (%)
1.	**Introduction and Scheduling** − Introduction to Operating System, Operating System Services, − Different types of Operating Systems: Real time, Time sharing, Distributed and Multiprogramming. − OS Structure – Simple Structure, Layered Approach, Microkernel. − CPU Scheduling: Introduction to process, process control block, process scheduling − FCFS Scheduling, SJF scheduling, Priority scheduling, Round Robin scheduling	25%
2.	**Memory Management** − Memory Management: Concept, Basic memory management techniques: − Swapping, Demand Paging − The Optimal Page Replacement Algorithm − The LRU Page Replacement Algorithm − The FIFO Page Replacement Algorithm	25%
3.	**Process Synchronization, Deadlocks and Introduction to Linux** − Introduction to Cooperating process − Process Synchronization, − Critical Section Problem − Two process solution − Deadlock and characterization	25%

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	– Introduction to Linux System – Features of Linux	
4.	**Basic Linux commands** – Basic Commands: login, logout, date, man, pwd, who, dir, ls, cd, mkdir, rmdir, wc, echo – Use of Wild card characters – Types of FAP, use of chmod command – Basic commands like cp, mv, rm, rev, file redirection, grep, cut, paste, find sort commands with example – Introduction to shell script: execution of it, shell script variable, expr, test commands – Control structure: if, if..else, case structure – Iteration: while, for construct, break, continue, exit commands	25%

Teaching-Learning Methodology	Multiple teaching approaches: lecture and discussion, exploration and inquiry, cooperative group work, and presentations

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.	apply the knowledge of the fundamentals of operating systems.
2.	understand the concepts like CPU scheduling, memory management, process synchronization and deadlocks.
3.	gain basic knowledge of the Linux commands.

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Suggested References:	
Sr. No.	References
1.	Andrew S. Tanenbaum: Operating System Design & Implementation, Prentice Hall International.
2.	James Peterson and Abraham Silberschatz: Operating System Concept, Addition Wesley.
3.	Bryan Pfaffenberger - Linux Commands Instant reference , BPB Publication.
4.	Sumitabha Das - UNIX , Concepts and Applications – Tata McGraw-Hill Publications.
5.	Advanced Linux Programming – Samuel, Techmedia Publications.

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B.Sc. (CA&IT) Semester III

Course Code	**US03CIIT55**	Title of the Course	**Practicals-I**
Total Credits of the Course	**4**	Hours per Week	**8**

Course Objectives:	1. To study the fundamental concepts and constructs of the C++ programming language 2. To learn the basic concepts of object-oriented programming using C++. 3. To enable students to develop graphical programs using the .NET framework and the VB .NET programming language. 4. To learn how to access databases and files in .NET programs.

Course Content		
Sr. No.	Description	Weightage* (%)
1.	Part-1 : Practical based on US03CIIT51	50
2.	Part-2 : Practical based on US03CIIT52	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. apply the knowledge of the fundamental concepts and constructs of the C++ programming language.

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2.	carry out object-oriented programming using C++.
3.	develop graphical programs using the .NET framework and the VB .NET programming language.

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Course Code	**US03CIIT56**	Title of the Course	**Practicals-II**
Total Credits of the Course	**4**	Hours per Week	**8**

Course Objectives:	1. To introduce the students to the relational data model and RDBMS. 2. To teach the SQL language for accessing an RDBMS. 3. To introduce the students to the fundamentals of operating systems. 4. To teach CPU scheduling, memory management, process synchronization and deadlocks. 5. To impart basic knowledge of the Linux commands.

Course Content		
Sr. No.	Description	Weightage* (%)
1.	Part-1 : Practical based on US03CIIT53	50
2.	Part-2 : Practical based on US03CIIT54	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. apply the basic knowledge of the relational data model and RDBMS

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2.	use the SQL language for accessing an RDBMS
3.	apply the knowledge of the fundamentals of operating systems.
4.	understand the concepts like CPU scheduling, memory management, process synchronization and deadlocks.
5.	gain basic knowledge of the Linux commands.

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B.Sc. (CA&IT) Semester III

Course Code	**US03SIIT57**	Title of the Course	**Operations Research - I**
Total Credits of the Course	**2**	Hours per Week	**2**

Course Objectives:	1. To study the fundamentals of operations research. 2. To learn the linear programming problems and transportation problems and how to solve them.

Course Content		
Unit	Description	Weightage* (%)
1.	**Operations Research (OR)** – History, meaning and application of OR. – Introduction to LPP, General and standard form of LPP. – Solution of LPP using Graphical Method.	25%
2.	**Linear Programming Problem (LPP)** – Solution of LPP using Simplex method and Big-m method – Duality in LPP (concept only)	25%
3.	**Transportation problem** – Introduction – Mathematical model of Transportation problem – Initial basic feasible solution by North-west corner rule, Least-cost method, Vogel's approximation method.	25%
4.	**Modified Distribution Method** – Modified Distribution Method for finding Optimum Solution of TP, Unbalanced TP, Degenerate and non- Degenerate TP.	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.	gain knowledge of the fundamentals of operations research.
2	understand the linear programming problems and transportation problems and knowledge of how to solve them.

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)
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Course Code	**US03SIIT58**	Title of the Course	**Software Testing**
Total Credits of the Course	**2**	Hours per Week	**2**

Course Objectives:	To impart knowledge of software testing fundamental.

Course Content		
Unit	Description	Weightage* (%)
1.	**Software Testing** – Quality Revolution – Software Quality – Role of Testing – Verification and Validation Failure, Error, Fault, and Defect – Notion of software reliability – Objectives of Testing – Concept of Complete Testing – Central Issue in Testing – Testing Activities	25%
2.	**Testing Fundamentals** – Examining the specification – Testing the software with blinders – Examining the code	25%
3.	**Applying your testing skills** – Configuration testing Compatibility testing Usability testing – Testing the documentation	25%
4.	**Testing Tools, Test Recording and Reporting** – Automated testing and test tools Writing and tracking test cases Reporting what you find	25%

Teaching-	Multiple teaching approaches: lecture and discussion, exploration and

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Learning Methodology	inquiry, cooperative group work, demonstrations, and presentations

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 fundamental knowledge of software testing.

Suggested References:	
Sr. No.	References
1.	Ron Patton "Software Testing", Techmedia publication, 2000.
2.	Kshirasagar Naik and Priyadarshi Tripathy "Software Testing and Quality Assurance" Wiley Publications, Student edition,2013.
3.	Dr. K. V. K. K. Prasad ,"Software Testing Tools", Dreamtech, 2006.
4.	Andreas Spillner, Tilo Linz, Hans Schaefer ,"Software Testing Foundations" , Shoff Publishers and Distributors,2nd Edition, 2007.
5.	Srinivas D and Gopalswamy R "Software Testing : Principles and Practices", Pearson Education, 2006.

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Course Code	**US03SIIT59**	Title of the Course	**Management Information System**
Total Credits of the Course	**2**	Hours per Week	**2**

Course Objectives:	1. Management Information System (MIS) and information communication. 2. planning, decision making and elements of control.

Course Content		
Unit	Description	Weightage* (%)
1.	**MIS- Introduction** − Introduction to MIS, Function of MIS, Problems with MIS, Knowledge − requirements for MIS(7 areas) − Introduction to Information, Data − Information & management, Information Classifications − Definition: Data and Information, Data Characteristics.	25
2.	**Information Communication** − What is Information? Functions performed by information − Characteristics of information. − Communication System, Information in an organization. − System Concepts - Structure and elements, Objectives & types	25
3.	**Planning and Decision Making** − Planning and Planning terms, Objectives, Policies, Levels of Planning, Planning Problems. − Type and Sources of Planning Information − Tools of planning − Decision Making, Programmed and Non-Programmed decisions, Levels of Decision Making	25
4.	**Elements of Control** − Concept of control in management, Control cycle, Different Feedback loops, − Control in Organizations, Multiple control factors, Scope of	25

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	management control − Total Quality Control (TQC) − Total Quality Management(TQM)	

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 understand	
1.	Management Information System (MIS) and information communication.
2.	Planning, decision making and elements of control.

Suggested References:	
Sr. No.	References
1.	Management Information Systems, T. Lucey, BPB Publication.
2.	Management Information Systems, WS Jawadekar.
3.	Management Information Systems, Kenneth C. Laudon, Jane P. Laudon.
4.	Management Information Systems, James A. O' Brien, George M. Markas.
5.	Management Information Systems, Ramesh Behl.

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

Course Code	US04CIIT51	Title of the Course	OOPS Technology - I
Total Credits of the Course	4	Hours per Week	4

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

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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 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)	25
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%

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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.

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	US04CIIT52	Title of the Course	**Relational Database Management Systems - II**
Total Credits of the Course	**4**	Hours per Week	**4**

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	25

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	– Error Handling : introduction, advantages of exceptions, types of exceptions – Working with user-defined exceptions – declaration, RAISE_APPLICATION_ERROR, Pragma EXCEPTION_INIT, SQLCODE and SQLERRM	
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:

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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.
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	US04CIIT53	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

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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) – Introduction: Detailed Design, Module Specification (Specifying Functional Module, Specifying Classes) – Verification- Design Walkthrough, Critical Design, review, Consistency checkers	25
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

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	planning, software design, coding and testing.

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	**US04CIIT54**	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	25

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	– Searching – Introduction, Applications of searching – Techniques - Sequential search and Binary search – Sorting vs. Searching	
4.	**File Organization** – 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	25

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

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	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 III

Course Code	**US04CIIT55**	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.

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

Course Code	**US04CIIT56**	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.

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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	US04AIIT57	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-	Blended learning approach incorporating both traditional classroom

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Learning Methodology	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 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	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,	25

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	– 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 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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B.Sc. (CA&IT) Semester IV

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	25

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	– Approaches to Managerial Decision Making – Decision Making Environment. – Implications for Information System.	
4.	**Planning for IT Infrastructure** – Introduction to Planning for IT Infrastructure. – Portfolio Approach. – Identifying IT applications. – Techniques of Evaluating IT Investments. – Assessing Risk In Realization of Benefits.	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.	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.

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2.	Introduction to Information Technology, Turban, Rainer, Potter, John Wiley & Sons Inc., 2000

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