R.P. Gogate College of Arts & Science and
R.V. Jogalekar College of Commerce
(Autonomous), Ratnagiri



# Bachelor of Science
# In Information Technology
# (B.Sc. I.T.)

Three Year Integrated Programme
Six Semesters Course Structure
Revised Scheme of Examination

Faculty of Science
(Under-graduate Programme)

Choice Based Credit System (CBCS)
**Academic Year- 2024-25**

# R.E. Society's
# R. P. Gogate College of Arts & Science and
# R. V. Jogalekar College of Commerce(Autonomous), Ratnagiri
# Board of Studies in Information Technology
# Academic Year 2024-25

| No. of Courses | Semester III | Credits | No. of Courses | Semester IV | Credits |
|---|---|---|---|---|---|
| | *Discipline Specific Course (DSC)* | | | *Discipline Specific Course (DSC)* | |
| | *Major* | | | *Major* | |
| USIT301 | Core Java | 2 | USIT401 | Advanced Java | 2 |
| USIT302 | Database Management Systems | 2 | USIT402 | Software Engineering | 2 |
| USIT303 | Computer Networks | 2 | USIT403 | Data Structures | 2 |
| USIT304 | Programming Practical 3 | 2 | USIT404 | Programming Practical 4 | 2 |
| | *Minor* | | | *Minor* | |
| USIT305 | Applied Mathematics | 2 | USIT405 | Statistical Techniques | 2 |
| USIT306 | M3 Practical | 2 | USIT406 | M4 Practical | 2 |
| | *Skill Enhancement Course (SEC)* | | | *Vocational  Skill Course (VSC)/Skill Enhancement Course (SEC)* | |
| USITS307 | Computer skills -3 Practical | 2 | USITS407 | Computer Skills - 4 Practical | 2 |
| | *Generic / Open Elective* | | | *Generic / Open Elective* | |
| | Select any one from OE list | **2** | | Select any one from OE list | **2** |
| | Select any one from OE list | **2** | | | |
| | *Ability Enhancement Course (AEC)* | | | *Ability Enhancement Course (AEC)* | |
| | Marathi: Communication  Skill-I | **02** | | Marathi: Communication Skill-II | **02** |
| | Hindi: Communication Skill-I | | | Hindi: Communication Skill-II | |

| | Sanskrit: Communication Skill-I | | | Sanskrit: Communication Skill-II | |
|---|---|---|---|---|---|
| | Urdu: Communication Skill-I | | | Urdu: Communication Skill-II | |
| | *Co-Curricular* | | | *Co-Curricular* | |
| | Any one course from the CC Basket | 02 | | Any one course from the CC Basket | 02 |
| | | | | Community Engagement Programme(CEP) | 02 |
| **Total Credits** | | **22** | **Total Credits** | | **22** |

**Table 1. Open Electives (Offered by Science & Commerce faculty)**

| Semester III | | Semester IV | |
|---|---|---|---|
| USOEMT301 | Commercial Mathematics (2 credit) | USOEMT401 | Financial Mathematics (2 credit) |
| USOEBCH302 | Nutrition and diet management (2 credit) | USOEMT402 | Research Analyst in Stock Market (2 credit) |
| USOEPH303 | Physics in everyday Life I (4 credit) | USOEPH403 | Physics in everyday Life II (2 credit) |
| USOEZO304 | Global Environmental Issues (2 credit) | USOEZO404 | Neurobiology and behaviour (2 credit) |
| USOECS305 | Multimedia and Digital Marketing (2 credit) | USOECS405 | Cyber Safety (2 credit) |
| USOECS306 | Office Automation (2 credit) | USOEPH406 | General Physics (2 credit) |
| USOEBT307 | Entrepreneurship Development (2 credit) | UCOEBE401 | Business Economics (2 credit) |
| USOEBT308 | Research Methodology (2 credit) | | |

## Table 2. Skill enhancement courses for Science, IT, BT, CS Faculty

| *Skill Enhancement Courses* | | *Skill Enhancement Courses* | |
|---|---|---|---|
| USCHS307 | Skills in Classical Methods of Analysis II | USCHS407 | Industrial Organic Chemistry |
| USZOS307 | Haematological techniques | USZOS407 | Beekeeping |
| USBOTS307 | Propagation of Horticultural Plants -II | USBOTS407 | Propagation of Horticultural Plants -III |
| USPHS307 | Digital Computer Electronics and Microprocessor 8085- I | USPHS407 | Digital Computer Electronics and Microprocessor 8085 -II |
| USMTS307 | Set theory & logic | USMTS407 | Computational Geometry |
| USMBS307 | Microbiology Skills I | USMBS407 | Microbiology Skills II |
| USBCHS307 | Clinical Biochemistry | USBCHS407 | Soil and water analysis |
| USCSS307 | Web Designing | USCSS407 | Net Technologies |
| USITS307 | Computer Skills-3 practical | USITS407 | Computer Skills-4 practical |
| USBTS307 | Molecular Diagnostics | | |

## Table 3: Co-curricular Course

| Course Code | Semester III | Course Code | Semester IV |
|---|---|---|---|
| GJCC301 | National Social Service (NSS) | GJCC401 | National Social Service (NSS) |
| GJCC302 | National Cadet Corps (NCC) | GJCC402 | National Cadet Corps (NCC) |
| GJCC303 | Sports & Yoga | GJCC403 | Sports & Yoga |
| GJCC304 | Cultural | GJCC404 | Cultural |
| GJCC305 | Career Katta | GJCC405 | Career Katta |
| GJCC306 | Life Long Learning | GJCC406 | Life Long Learning |
| GJCC307 | Shodhvedh / Avishkar Projects | GJCC407 | Shodhvedh / Avishkar Projects |
| GJCC308 | Science Association | GJCC408 | Science Association |
| GJCC309 | Film Club | GJCC409 | Film Club |
| GJCC310 | Infotech Courses | GJCC410 | Infotech Courses |

# SEMESTER III

## Syllabus for Bachelor of Science in Information Technology for the year 2024-25

| Nomenclature of the Course | Core Java |
|---|---|
| Class | S.Y.B.Sc(IT) |
| Semester | III |
| Course Code | USIT301 |
| No. of Credits | 2(2 Hours Per Week) |
| Nature | Theory |
| Type | Major(Mandatory) |

| | |
|---|---|
| **Course Outcomes:** | |

On the successful completion of this course, the learner will be able to

CO1:  Learn the architecture and development environment of java.
CO2:  Identify java programming fundamentals like data types, operators, control and looping statements and write java programs.
CO3:  Design and implement java classes and methods.
CO4:  Apply OOP principles such as Inheritance, Polymorphism, Interface.
CO5:  Design and implement user defined packages.
CO6:  Implement arrays, vectors and strings.

**Syllabus:**

| Unit No. | Unit Title | Subtitles (Learning Points) |
|---|---|---|
| I | Introduction | History, Architecture and its Components, Java Class File, Java Runtime Environment, Java Virtual Machine, JVM components, Java API, Java Platform, Java Development Kit(JDK), Java Features, Setting the Path Environment Variable, Java Compiler and Interpreter |
| | Programming Fundamentals | Java Program Structure, Identifiers, Keywords, Comments, Braces and Code Blocks,Variables and Naming Rules, Data Types, Operators, Input/Output using Java Packages, Statements, Control and Looping Statements. |
| II | Classes | Class Object and its Attributes, Class Methods, Accessing a Method, Method Overloading, Instantiating |

| | | Objects from a Class, Constructors, this Keyword, super Keyword, Types of Classes, Scope Rules, Access Modifier, Constants, Static Members of a Class, Garbage Collection. |
|---|---|---|
| | **Inheritance, Interface** | Use and Benefits of Inheritance, Types of Inheritance in Java, Overriding Superclass Methods, Use of super Keyword, Polymorphism in Inheritance, Use of Interface, Implementing Interface |
| **III** | **Packages** | Creating Packages, Default Package, Importing Packages, Using a Package. |
| | **Arrays, Vectors and Strings** | Arrays and its Types, Vectors, Adding Elements to a Vector, Accessing vector elements, Searching for elements in a vector, Working with the size of the vector, String and Operations on strings. |

**Prescribed Text/s (If any):**
- Core Java 8 for Beginners - Vaishali Shah, Sharnam Shah, SPD,1st Edition, 2015
- Java: The Complete Reference - Herbert Schildt, McGraw Hill, 9th Edition, 2014
- Core Java: An Integrated Approach - R. Nageswara Rao, DreamTech, 1st Edition, 2008

**Other Learning Resources recommended:**
- **https://www.w3schools.com/java/**

**Teaching Plan:**

| Unit No. | Unit Title | Teaching Methods | No. of Lectures |
|---|---|---|---|
| I | Introduction, Programming Fundamentals | Chalk and board, Audio – Visual aids, Problem solving sessions | 10 |
| II | Classes, Inheritance, Interface | Chalk and board, Audio – Visual aids, Problem solving sessions | 10 |
| III | Packages, Arrays, Vectors and Strings | Chalk and board, Audio – Visual aids, Problem solving sessions | 10 |

**Evaluation Pattern**

### A) Continuous Internal Evaluation: Maximum Marks: 20

| Method | Marks |
|---|---|
| Unit Test (MCQ / Descriptive – Based on Theory and/or Problems Online/Offline | **10** |
| Assignments | **05** |
| Attendance and active participation in classroom | **05** |

### B) Semester End Examination: Maximum Marks: 30

| Question No. and Sub questions (If any) | Unit and sub unit (with number and title) | Type of Question (Essay / short note / Objective / Diagram, etc.) | Marks |
|---|---|---|---|
| Q.1) A) | Unit 1(Introduction, Programming Fundamentals) | Short Note / Diagram | 06 |
| Q.1) B) | Unit 1(Introduction, Programming Fundamentals) | Short Note / Diagram | 04 |
| Q.2) A) | Unit 2(Classes, Inheritance, Interface) | Short Note / Diagram | 06 |
| Q.2) B) | Unit 2(Classes, Inheritance, Interface) | Short Note / Diagram | 04 |
| Q.3) A) | Unit 3(Packages, Arrays, Vectors and Strings) | Short Note / Diagram | 06 |
| Q.3) B) | Unit 3(Packages, Arrays, Vectors and Strings) | Short Note / Diagram | 04 |

| Nomenclature of the Course | Database Management Systems |
|---|---|
| Class | S.Y.B.Sc(IT) |
| Semester | III |
| Course Code | USIT302 |
| No. of Credits | 2(2 Hours Per Week) |
| Nature | Theory |
| Type | Major(Mandatory) |

| | |
|---|---|
| **Course Outcomes:** | |

On the successful completion of this course, the learner will be able to

CO1: Define and describe the fundamental elements of relational database
management systems.
CO2: Relate the basic concepts of relational data model, entity-relationship model,
relational database design, relational algebra and SQL.
CO3: Design ER-models to represent simple database application scenarios.
CO4: Transform the ER-model to relational tables, populate relational database
CO5: Improve the database design by normalization.
CO6: Understand basics of transaction management, database concurrency control
techniques and recovery techniques.

**Syllabus:**

| Unit No. | Unit Title | Subtitles (Learning Points) |
|---|---|---|
| I | **Database System** | Database system- concept and Architecture, Relational model and Relational database constraints, Relational Algebra. |
| II | **Conceptual Modeling and Database Design** | Data modeling using the Entity Relationship model (ER), Types of entity relationships. Relational database design by ER and EER model. Introduction to UML diagrams. |
| III | **Database Design Theory and Normalization** | Basics of functional dependencies and normalization for relational databases. Relational database design and further dependencies. |

| | **Transaction management and concurrency control and recovery** | Introduction to transaction processing concepts and theory. Concurrency control techniques. Database recovery techniques. |
| --- | --- | --- |

**Prescribed Text/s (If any):**
- Fundamentals of Database systems - Ramez Elmasri, Shamkant B Navathe, Pearson, 6th Edition
- Database Systems: Design implementation and management - Carlos Coronel, Steven Morris, Peter Rob,Cengage Learning, 9th Edition, 2010

**Other Learning Resources recommended:**
- **https://www.tutorialspoint.com/dbms/**

**Teaching Plan:**

| Unit No. | Unit Title | Teaching Methods | No. of Lectures |
| --- | --- | --- | --- |
| I | Database System | Chalk and board, Audio – Visual aids, Problem solving sessions | **10** |
| II | Conceptual Modeling and Database Design | Chalk and board, Audio – Visual aids, Problem solving sessions | **10** |
| III | Database Design Theory and Normalization Transaction management and concurrency control and recovery | Chalk and board, Audio – Visual aids, Problem solving sessions | **10** |

**Evaluation Pattern**

A) **Continuous Internal Evaluation: Maximum Marks: 20**

| Method | Marks |
| --- | --- |
| Unit Test (MCQ / Descriptive – Based on Theory and/or Problems Online/Offline | **10** |

| | |
|---|---|
| Assignments | **05** |
| Attendance and active participation in classroom | **05** |

### B) Semester End Examination: Maximum Marks: 30

| Question No. and Sub questions (If any) | Unit and sub unit (with number and title) | Type of Question (Essay / short note / Objective / Diagram, etc.) | Marks |
|---|---|---|---|
| Q.1) A) | Unit 1(Database System) | Short Note / Diagram | 06 |
| Q.1) B) | Unit 1(Database System) | Short Note / Diagram | 04 |
| Q.2) A) | Unit 2(Conceptual Modeling and Database Design) | Short Note / Diagram | 06 |
| Q.2) B) | Unit 2(Conceptual Modeling and Database Design) | Short Note / Diagram | 04 |
| Q.3) A) | Unit 3(Database Design Theory and Normalization Transaction management and concurrency control and recovery) | Short Note / Diagram | 06 |
| Q.3) B) | Unit 3(Database Design Theory and Normalization Transaction management and concurrency control and recovery) | Short Note / Diagram | 04 |

| Nomenclature of the Course | Computer Networks |
|---|---|
| Class | S.Y.B.Sc(IT) |
| Semester | III |
| Course Code | USIT303 |
| No. of Credits | 2(2 Hours Per Week) |
| Nature | Theory |
| Type | Major(Mandatory) |

**Course Outcomes:**

On the successful completion of this course, the learner will be able to

CO1: Understand IPv4 addressing and protocol.
CO2: Assign IP addresses and routing to the network as per requirement.
CO3: Troubleshoot the network connectivity problems
CO4: Understand the working of the transport layer.
CO5: Understand and differentiate between the Transport layer protocols.
CO6: Understand and use application layer protocols.
CO7: Manage network as administrator.

**Syllabus:**

| Unit No. | Unit Title | Subtitles (Learning Points) |
|---|---|---|
| I | **Network Layer** | IPv4 Addresses, IPv4 Protocol, ARP, ICMP,   Mobile IP, IPv6 |
| | **Routing** | Unicast routing protocols- RIP, OSPF, BGP |
| II | **Transport Layer** | UDP, TCP, SCTP |
| III | **Application Layer** | WWW, HTTP, DNS, SMTP, POP3, MIME, IMAP,DHCP, TELNET, SSH, FTP, SNMP |

**Prescribed Text/s (If any):**
- TCP/IP Protocol Suite - Behrouz A.Forouzan, Tata McGraw Hill, Fourth Edition, 2010
- Computer Networks - Andrew Tanenbaum, Pearson, Fifth Edition, 2013

| Other Learning Resources recommended: <br> ● https://www.tutorialspoint.com/data_communication_computer_network/ |
|---|

**Teaching Plan:**

| Unit No. | Unit Title | Teaching Methods | No. of Lectures |
|---|---|---|---|
| I | Network Layer,Routing | Chalk and board, Audio – Visual aids, Problem solving sessions | 10 |
| II | Transport Layer | Chalk and board, Audio – Visual aids, Problem solving sessions | 10 |
| III | Application Layer | Chalk and board, Audio – Visual aids, Problem solving sessions | 10 |

**Evaluation Pattern**

### A) Continuous Internal Evaluation: Maximum Marks: 20

| Method | Marks |
|---|---|
| Unit Test (MCQ / Descriptive – Based on Theory and/or Problems Online/Offline | 10 |
| Assignments | 05 |
| Attendance and active participation in classroom | 05 |

### B) Semester End Examination: Maximum Marks: 30

| Question No. and Sub questions (If any) | Unit and sub unit (with number and title) | Type of Question (Essay / short note / Objective / Diagram, etc.) | Marks |
|---|---|---|---|
| Q.1) A) | Unit 1(Network Layer,Routing) | Short Note / Diagram | 06 |
| Q.1) B) | Unit 1 (Network Layer,Routing) | Short Note / Diagram | 04 |

| Q.2) A) | Unit 2(Transport Layer) | Short Note / Diagram | 06 |
|---|---|---|---|
| Q.2) B) | Unit 2(Transport Layer) | Short Note / Diagram | 04 |
| Q.3) A) | Unit 3(Application Layer) | Short Note / Diagram | 06 |
| Q.3) B) | Unit 3(Application Layer) | Short Note / Diagram | 04 |

| Nomenclature of the Course | Programming Practical 3 |
|---|---|
| Class | S.Y.B.Sc(IT) |
| Semester | III |
| Course Code | USIT304 |
| No. of Credits | 2(4 Hours Per Week) |
| Nature | Practical |
| Type | Major(Mandatory) |
| | |

| Section I: Core Java |
|---|
| **Course Outcomes:** |
| On the successful completion of this course, the learner will be able to<br><br>CO1 **:** Execute programs using java language.<br>CO2 **:** Performed various String,vector operations.<br>CO3 **:** Design small desktop applications using command line.<br>CO4 **:** Configure and manage network devices.<br>CO5 **:** Implement and analyze network protocols.<br>CO6 **:** Design and simulate network topologies.<br>CO7 **:** Ensure network security and troubleshoot issues.<br>CO8 **:** Collaborate on network projects and apply knowledge in real-world scenarios. |
| |

| Section I: Core Java |
|---|
| **Syllabus:** |

| Unit No. | Unit Title | Subtitles (Learning Points) |
|---|---|---|
| 1 | **Java Basics** | a.Write a Java program that takes a number as input and prints its multiplication table upto 10.<br>b.Write a Java program to display the following pattern.<br>  \*\*\*\*\*<br>  \*\*\*\*<br>  \*\*\*<br>  \*\*<br>  \*<br>c.Write a Java program to print the volume of cylinder, cube, sphere. |

| 2 | **Use of Operators,Control, Loops** | a.Write a Java program to add two binary numbers.<br>b.Check whether a year is Leap Year or not.<br>c.Write a Java Menu driven program:<br>    1.Print Palindrome Number<br>    2.Print Armstrong Number |
|---|---|---|
| 3 | **Methods and Constructors** | a.Designed a class SortData that contains the method asec() and desc().<br>b. Designed a class that demonstrates the use of constructor and destructor.<br>c.Write a program to create a class and implement the concepts of Method Overloading. |
| 4 | **Inheritance** | a. Write a java program to implement the concept of Inheritance.<br>b. Write a java program to implement method overriding. |
| 5 | **Interface** | a. Write a java program to implement the concept of Interface<br>b. Write a java program to demonstrate the implementation of abstract class. |
| 6 | **Packages** | a. Create a package, Add the necessary classes and import the package in java class.<br>b. Create a sub-package, Add the necessary classes and import the package in java class. |
| 7 | **1D-Arrays** | a. Write a java program to perform searching operations on a 1D array.<br>b. Write a java program to perform sorting operations on a 1D array. |
| 8 | **2D-Arrays** | a. Write a java program to add two matrices and print the resultant matrix.<br>b. Write a java program for multiplying two matrices and print the product for the same. |
| 9 | **Vectors** | a. Write a java program to implement the vectors |
| 10 | **Strings** | a. Write a java program to implement any five string methods in java. |

**Note :** This is a sample Practical list. Course instructor may change the practical as per the syllabus.

**Teaching Plan:**

| Unit No. | Unit Title | Teaching Methods | No. of Lectures |
|---|---|---|---|

| 1 | Java Basics | Practical | 2 |
|---|---|---|---|
| 2 | Use of Operators, Control, Loops | Practical | 2+2 |
| 3 | Methods and Constructors | Practical | 2 |
| 4 | Inheritance | Practical | 2+2 |
| 5 | Interface | Practical | 2+2 |
| 6 | Packages | Practical | 2 |
| 7 | 1D-Arrays | Practical | 2+2 |
| 8 | 2D-Arrays | Practical | 2+2 |
| 9 | Vectors | Practical | 2 |
| 10 | Strings | Practical | 2 |
| | | | |

**Section II: Computer Network**

**Syllabus:**

| Unit No. | Unit Title | Subtitles (Learning Points) |
|---|---|---|
| **1** | **Colour code for crimping LAN (Cat5/6/7) cable** | a. Study of Different color codes<br>b. Study of different connecting devices and their differences<br>c. Crimping LAN Cable |
| **2** | **Configuring LAN setup** | a. Planning and Setting IP networks<br>b. Configuring subnet<br>c. Study of basic network command and Network configuration commands.<br>ipconfig, netstat, ARP, ping,<br>trace route etc.<br>d. Basic network troubleshooting.<br>e. Configuration of TCP/IP Protocols in Windows / Linux.<br>f. Implementation of Drive/file sharing and printer sharing. |

| 3 | IPv4 Addressing and Subnetting | a. Given an IP address and network mask, determine other information about the IP address such as:<br>● Network address<br>● Network broadcast address<br>● Total number of host bits<br>● Number of hosts<br>b. Given an IP address and network mask, determine other information about the IP address such as:<br>● The subnet address of this subnet<br>● The broadcast address of this subnet<br>● The range of host addresses for this subnet<br>● The maximum number of subnets for this subnet mask<br>● The number of hosts for each subnet<br>● The number of subnet bits<br>● The number of this subnet |
|---|---|---|
| 4 | Designing and configuring a network topology-I | a. Configure IP static routing<br>b. Configure IP routing using RIP |
| 5 | Designing and configuring a network topology-II | Configuring Simple and multi-area OSPF |
| 6 | Configuring server and client-I | a. Configure DHCP<br>b. Configure DNS<br>c. Configure Mail |
| 7 | Configuring server and client-II | a. Configure Telnet<br>b. Configure FTP<br>c. Configure HTTP |
| 8 | Network Security | Configure basic security features for networks |
| 9 | Packet Analysis | Packet capture and header analysis by wire-shark (TCP, UDP, IP etc.) |
| 10 | Network Design | Planning and Design a corporate network for a given scenario. |

**Note :** This is a sample Practical list. Course instructor may change the practical as per the syllabus.

| Teaching Plan: | | | |
|---|---|---|---|
| Sr.No. | Title | Teaching Methods | No. of Lectures |
| 1 | Colour code for crimping LAN (Cat5/6/7) cable | Practical | 2 |
| 2 | Configuring LAN setup | Practical | 2 |
| 3 | IPv4 Addressing and Subnetting | Practical | 2 |
| 4 | Designing and configuring a network topology-I | Practical | 2+2 |
| 5 | Designing and configuring a network topology-II | Practical | 2+2 |
| 6 | Configuring server and client-I | Practical | 2 |
| 7 | Configuring server and client-II | Practical | 2+2 |
| 8 | Network Security | Practical | 2+2 |
| 9 | Packet Analysis | Practical | 2 |
| 10 | Network Design | Practical | 2+2 |

**Evaluation Pattern**

**A) Continuous Internal Evaluation: Maximum Marks: 20**

| Method | Marks |
|---|---|
| Certified Journal (section I & II) | 10 |
| Attendance and active participation in both Laboratory | 10 |

**B) Semester End Examination: Maximum Marks: 30***

Section I: (30 Marks - 2 Hours)

| Question No | Unit | Marks |
|---|---|---|
| 1 | Program 1 | 10 |
| 2 | Program 2 | 15 |
| 3 | Viva | 05 |

Section II:(30 Marks - 2 Hours)

| Question No | Unit | Marks |
|---|---|---|
| 1 | Program 1 | 10 |
| 2 | Program 2 | 15 |
| 3 | Viva | 05 |

**(*Addition of marks of both the sections will be converted to marks out of 30)**

| Nomenclature of the Course | Applied Mathematics |
|---|---|
| Class | S.Y.B.Sc(IT) |
| Semester | III |
| Course Code | USIT305 |
| No. of Credits | 2(2 Hours Per Week) |
| Nature | Theory |
| Type | Minor |
| | |

| Course Outcomes: |
|---|
| On the successful completion of this course, the learner will be able to |
| CO1: Apply Knowledge of matrices to solve the problems.<br>CO2: Solve and analyze the differential equations and its applications.<br>CO3: Understand various techniques of Laplace transform and inverse Laplace Transform. |
| |

**Syllabus:**

| Unit No. | Unit Title | Subtitles (Learning Points) |
|---|---|---|
| I | Matrices | Properties of matrices, Inverse of a matrix, Rank of Matrix, Echelon or Normal Matrix, Linear dependence and linear independence of vectors, Linear Equations, Linear transformation, Characteristics roots and characteristics vectors, Caley-Hamilton Theorem |
| II | Equation of the first order and of the first degree | Separation of variables, Equations homogeneous in x and y, Exact differential Equation, Integrating Factor, Linear Equation and equation reducible to this form |
| | Linear Differential Equations with Constant Coefficients | The Differential Operator, Linear Differential Equation f(D) y = 0, Different cases depending on the nature of the root of the equation f(D) = 0, Linear differential equation f(D) y = X, Complementary Function, Particular integral : Short methods |
| III | The Laplace Transform | Introduction, Definition of the Laplace Transform, Theorems on Important Properties of Laplace |

| | | Transformation, First Shifting Theorem, Second Shifting Theorem, The Convolution Theorem, Laplace Transform of an Integral and Derivatives |
|---|---|---|
| | **Inverse Laplace Transform** | Shifting Theorem, Partial fraction Methods, Use of Convolution Theorem |

**Prescribed Text/s (If any):**
- A text book of Applied Mathematics Vol I - P. N. Wartikar and J. N. Wartikar, Pune Vidyarthi Griha
- Applied Mathematics II - P. N. Wartikar and J. N. Wartikar, Pune Vidyarthi Griha

**Other Learning Resources recommended:**
- Higher Engineering Mathematics - Dr. B. S. Grewal, Khanna Publications

**Teaching Plan:**

| Unit No. | Unit Title | Teaching Methods | No. of Lectures |
|---|---|---|---|
| I | Matrices | Chalk and board, Audio – Visual aids, Problem solving sessions | **10** |
| II | Equation of the first order and of the first degree, Linear Differential Equations with Constant Coefficients | Chalk and board, Audio – Visual aids, Problem solving sessions | **10** |
| III | The Laplace Transform, Inverse Laplace Transform | Chalk and board, Audio – Visual aids, Problem solving sessions | **10** |

**Evaluation Pattern**

   **A) Continuous Internal Evaluation: Maximum Marks: 20**

| Method | Marks |
|---|---|
| Unit Test (MCQ / Descriptive – Based on Theory and/or Problems Online/Offline | **10** |
| Assignments | **05** |

| Attendance and active participation in classroom | **05** |
|---|---|

### B) Semester End Examination: Maximum Marks: 30

| Question No. and Sub questions (If any) | Unit and sub unit (with number and title) | Type of Question (Essay / short note / Objective / Diagram, etc.) | Marks |
|---|---|---|---|
| Q.1) A) | Unit 1(Matrices) | Short Note / Diagram | 06 |
| Q.1) B) | Unit 1(Matrices) | Short Note / Diagram | 04 |
| Q.2) A) | Unit 2(Equation of the first order and of the first degree, Linear Differential Equations with Constant Coefficients) | Short Note / Diagram | 06 |
| Q.2) B) | Unit 2(Equation of the first order and of the first degree, Linear Differential Equations with Constant Coefficients) | Short Note / Diagram | 04 |
| Q.3) A) | Unit 3(The Laplace Transform, Inverse Laplace Transform) | Short Note / Diagram | 06 |
| Q.3) B) | Unit 3(The Laplace Transform, Inverse Laplace Transform) | Short Note / Diagram | 04 |

| Nomenclature of the Course | M3 Practical |
|---|---|
| Class | S.Y.B.Sc(IT) |
| Semester | III |
| Course Code | USIT306 |
| No. of Credits | 2(4 Hours Per Week) |
| Nature | Practical |
| Type | Minor |

| | |
|---|---|

| Course Outcomes: |
|---|
| Learners will be able to:<br><br>CO1: Design database schema for a given application and apply normalization.<br>CO2: Acquire skills in using SQL Commands for data Definition and data manipulation.<br>CO3: Understand the basics of PL/SQL.<br>CO4: Use of the control and conditional statement in PL/SQL.<br>CO5: Apply sequences and cursor in PL/SQL.<br>CO6: Know the concept of stored procedure and functions<br>CO7: Create the triggers and packages in PL/SQL.<br>CO8: Implement the concept of Exception handling. |

| | |
|---|---|

| Syllabus:SQL Programming |
|---|

| Unit No. | Unit Title | Subtitles (Learning Points) |
|---|---|---|
| 1 | E-R diagram and relation table | Draw E-R diagram and convert entities and relationships to relation table for a given scenario-Bank, College |
| 2 | Relational algebra queries | Write relational algebra queries for a given set of relations |
| 3 | Defining data | Using CREATE statement, ALTER statement, DROP statement, TRUNCATE statement, RENAME statement |
| 4 | Manipulating data | Using INSERT statement, UPDATE statement, DELETE statement, SELECT statement |

| 5 | **Creating and managing the tables** | Creating table with constraints: NOTNULL, UNIQUE, PRIMARY KEY, FOREIGN KEY |
|---|---|---|
| 6 | **Restricting and sorting data** | Using DISTINCT, IN, AS, SORT, LIKE, ISNULL, OR, Group By, Having clause, Order By clause |
| 7 | **Aggregate and Mathematical functions** | AVG, MIN, MAX, SUM, COUNT, ABS, SQRT, ROUND, TRUNCATE, SIGN, POWER, MOD, FLOOR, CEIL |
| 8 | **Views and Joins: For a given set of relation tables perform the following** | Creating view, Dropping view, Selecting from a view |
| 9 | **Database trigger** | Using CREATE OR REPLACE TRIGGER |
| 10 | **Index** | Create index, Drop index |
| 11 | **PL/SQL Basics** | Use of variables, Write an executable statement, Interacting with Oracle Server, Create anonymous PL/SQL block |
| 12 | **Control Structure in PL/SQL .** | Using while loop, DO loop For loop, Goto statement |
| 13 | **conditional statement using PL/SQL** | Create conditional statement using if ,ifelse,else-if ladder, case statements |
| 14 | **Sequence in PL/SQL** | Creation of Sequence in PL/SQL |
| 15 | **Cursor in PL/SQL** | Create cursor-Implicit,Explicit,Parameterized cursor,Cursor for loop |
| 16 | **Procedures in PL/SQL** | Creation of Procedures in PL/SQL |
| 17 | **Functions in PL/SQL** | Compute and returns the maximum value, Compute factorial of given number. |
| 18 | **Creation of Trigger** | Create Row level trigger, Statement level trigger, instead of trigger |
| 19 | **Handling exceptions** | Creation of user defined exception and system defined exception. |
| 20 | **Package in PL/SQL** | Creation of Package in PL/SQL |

**Note :** This is a sample Practical list. Course instructor may change the practical as per the syllabus.

**Prescribed Text/s (If any):**
- Fundamentals of Database systems-Ramez Elmasri, Shamkant B Navathe, Pearson, 6th Edition
- Oracle PL/SQL Programming-Steven Feuerstein, Bill Pribyl, O'Reilly Media, Sixth Edition

**Other Learning Resources recommended:**
- **https://www.tutorialspoint.com/plsql/index.htm**
- **https://www.javatpoint.com/pl-sql-tutorial**

**Teaching Plan:**

| Unit No. | Unit Title | Teaching Methods | No. of Lectures |
|----------|-----------|------------------|-----------------|
| 1 | E-R diagram and relation table | Practical | 2 |
| 2 | Relational algebra queries | Practical | 2 |
| 3 | Defining data | Practical | 2 |
| 4 | Manipulating data | Practical | 2 |
| 5 | Creating and managing the tables | Practical | 2+2 |
| 6 | Restricting and sorting data | Practical | 2 |
| 7 | Aggregate and Mathematical functions | Practical | 2+2 |
| 8 | Views and Joins: For a given set of relation tables perform the following | Practical | 2+2 |
| 9 | Database trigger | Practical | 2+2 |
| 10 | Index | Practical | 2 |
| 11 | PL/SQL Basics | Practical | 2+2 |
| 12 | Control Structure in PL/SQL | Practical | 2 |

| 13 | conditional statement using PL/SQL | Practical | 2+2 |
|----|-----------------------------------|-----------|-----|
| 14 | Sequence in PL/SQL | Practical | 2 |
| 15 | Cursor in PL/SQL | Practical | 2+2 |
| 16 | Procedures in PL/SQL | Practical | 2+2 |
| 17 | Functions in PL/SQL | Practical | 2 |
| 18 | Creation of Trigger | Practical | 2+2 |
| 19 | Handling exceptions | Practical | 2 |
| 20 | Package in PL/SQL | Practical | 2+2 |

**Evaluation Pattern**

**A) Continuous Internal Evaluation: Maximum Marks: 20**

| Method | Marks |
|--------|-------|
| Certified Journal | 10 |
| Attendance and active participation in both Laboratory | 10 |

**B) Semester End Examination: Maximum Marks: 30\***
Duration: 3 Hours

| Question No | Unit | Marks |
|-------------|-----------|-------|
| 1 | Program 1 | 20 |
| 2 | Program 2 | 15 |
| 3 | Program 3 | 15 |
| 4 | Viva | 10 |

**(\*Total marks obtained will be converted to marks out of 30)**

| Nomenclature of the Course | Computer skills -3 Practical |
|---|---|
| Class | S.Y.B.Sc(IT) |
| Semester | III |
| Course Code | USITS307 |
| No. of Credits | 2(4 Hours Per Week) |
| Nature | Practical |
| Type | SEC |

**Course Outcomes:**

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

CO1: Aware of the variables, expressions, looping and conditions used in Python programming.
CO2: Implement functions, strings, lists, tuples and directories.
CO3: Implement the Object-Oriented Programming concepts such as encapsulation, inheritance and polymorphism as used in Python.
CO4: Create Modules, GUI forms and add widgets.
CO5: Handle Python database connectivity.
CO6: Apply the programming skills learnt here into various domains by having advance programming skillset of Python and usage of libraries.
CO7: Learn Networking basics.

**Syllabus:**

| Sr. No. | Title | Subtitles (Learning Points) |
|---|---|---|
| 1 | Introduction to Python and Python IDLE | a. Installation of python and execution of first python program.<br>b. Introduction to python shell commands. |
| 2 | I/O functions and Conditional statements | a. Create a program that asks the user to enter their name and their age. Print out a message addressed to them that tells them the year that they will turn 100 years old.<br>b. Enter the number from the user and depending on whether the number is even or odd, print out an appropriate message to the user. |
| 3 | Loops | a. Write a program to generate the Fibonacci series.<br>b. Enter the year from the user and print whether it is |

| | | leap or not. |
|---|---|---|
| 4 | Functions Implementation-I | a. Write a function to find out the highest number amongst three numbers.<br>b. Write a function that reverses the user defined value.<br>c. Write a function to check if the input value is armstrong or not. |
| 5 | Functions Implementation-II | a. Write a function that takes a character (i.e. a string of length 1) and returns True if it is a vowel, False otherwise.<br>b. Define a function that computes the length of a given list or string. |
| 6 | Recursive function | a. Write a function for Palindrome.<br>b. Write a recursive function to print the factorial for a given number |
| 7 | Strings | a. Write a program to slice a string into two parts.<br>b. Write a program to demonstrate built in string methods. |
| 8 | Lists | a. Write a program to swap the first and last element of a list.<br>b. Write a program to multiply all values in the list using list traversal.<br>c. Take a list, say for example this one:<br>a = [1, 1, 2, 3, 5, 8, 13, 21, 34, 55, 89]<br>and write a program that prints out all the elements of the list that are less than 5. |
| 9 | List operations and Tuple | a. Write a program that takes two lists and returns True if they have at least one common member.<br>b. Write a program to print a specified list after removing the 0th, 2nd, 4th and 5th elements.<br>c. Write a program to clone or copy a list.<br>d. Write a program to implement tuple. |
| 10 | Dictionaries | a. Write a Python script to sort (ascending and descending) a dictionary by value.<br>b. Write a Python script to concatenate the following dictionaries to create a new one.<br>Sample Dictionary :<br>dic1={1:10, 2:20}<br>dic2={3:30, 4:40}<br>dic3={5:50, 6:60}<br>Expected Result : {1: 10, 2: 20, 3: 30, 4: 40, 5: 50, 6: 60}<br>c. Write a Python program to sum all the items in a dictionary. |

| 11 | Files and File operations | a. Write a Python program to read an entire text file.<br>b. Write a Python program to append text to a file and display the text.<br>c. Write a Python program to read the last n lines of a file |
|---|---|---|
| 12 | Exception Handling | Write a program to implement exception handling. |
| 13 | Classes and Methods | Create a class called Numbers, which has a single class attribute called MULTIPLIER, and a constructor which takes the parameters x and y (these should all be numbers).<br>i. Write a method called add which returns the sum of the attributes x and y.<br>ii. Write a class method called multiply, which takes a single number parameter a and returns the product of a and MULTIPLIER.<br>iii. Write a static method called subtract, which takes two number parameters, b and c, and returns b - c. |
| 14 | OOP concepts | a. Implement the concept of inheritance using python.<br>b. Implement the concept of polymorphism using python. |
| 15 | Modules | Open a new file in IDLE ("New Window" in the "File" menu) and save it as geometry.py in the directory where you keep the files you create for this course. Then copy the functions you wrote for calculating volumes and areas in the "Control Flow and Functions" exercise into this file and save it.<br>Now open a new file and save it in the same directory. You should now be able to import your own module like this: import geometry<br>Try and add print dir(geometry) to the file and run it.<br>Now write a function pointyShapeVolume(x, y, squareBase) that calculates the volume of a square pyramid if squareBase is True and of a right circular cone if squareBase is False. x is the length of an edge on a square if squareBase is True and the radius of a circle when squareBase is False. y is the height of the object.<br>First use squareBase to distinguish the cases. Use the circleArea and squareArea from the geometry module to calculate the base areas. |
| 16 | GUI-Widgets | a. Try to configure the widget with various options like: bg="red", family="times", size=18<br>b. Try to change the widget type and configuration options to experiment with other widget types like |

| | | | Message, Button, Entry, Checkbutton, Radiobutton, Scale etc. |
|---|---|---|---|
| 17 | Database Handling-I | | Design a simple database application that stores the records and retrieves the same. |
| 18 | Database Handling-II | | a. Design a database application to search the specified record from the database.<br>b. Design a database application that allows the user to add, delete and modify the records. |
| 19 | Mini application | | a. Mini application in python- GUI Designing<br>b. Mini application in python- Database connectivity and smooth execution of it. |
| 20 | Networking | | Write a python program to create client-server and exchange basic information. |

**Note :** This is a sample Practical list. Course instructor may change the practical as per the syllabus.

**Prescribed Text/s (If any):**
- Think Python - Allen Downey, O'Reilly, 1st Edition, 2012
- An Introduction to Computer Science using Python 3 - Jason Montojo, Jennifer Campbell, Paul Gries, SPD, 1st Edition, 2014
- Python: The Complete Reference - Martin C.Brown, McGraw Hill, 2018

**Other Learning Resources recommended:**
- https://www.w3schools.com/python

**Teaching Plan:**

| Sr.No. | Title | Teaching Methods | No. of Lectures |
|---|---|---|---|
| 1 | Introduction to Python and Python IDLE | Practical | 2 |
| 2 | I/O functions and Conditional statements | Practical | 2 |
| 3 | Loops | Practical | 2 |
| 4 | Functions Implementation-I | Practical | 2 |
| 5 | Functions Implementation-II | Practical | 2+2 |
| 6 | Recursive function | Practical | 2 |

| 7 | Strings | Practical | 2+2 |
|---|---|---|---|
| 8 | Lists | Practical | 2 |
| 9 | List operations and Tuple | Practical | 2 |
| 10 | Dictionaries | Practical | 2 |
| 11 | Files and File operations | Practical | 2+2 |
| 12 | Exception Handling | Practical | 2 |
| 13 | Classes and Methods | Practical | 2+2 |
| 14 | OOP concepts | Practical | 2 |
| 15 | Modules | Practical | 2+2 |
| 16 | GUI-Widgets | Practical | 2+2 |
| 17 | Database Handling-I | Practical | 2+2 |
| 18 | Database Handling-II | Practical | 2+2 |
| 19 | Mini application | Practical | 2+2+2 |
| 20 | Networking | Practical | 2 |

## Evaluation Pattern

### A) Continuous Internal Evaluation: Maximum Marks: 20

| Method | Marks |
|---|---|
| Certified Journal | 10 |
| Attendance and active participation in both Laboratory | 10 |

**B) Semester End Examination: Maximum Marks: 30***

Practical Exam: (30 Marks - 2 Hours)

| Question No | Unit | Marks |
|---|---|---|
| 1 | Program 1 | 10 |
| 2 | Program 2 | 15 |
| 3 | Viva | 05 |

Project Presentation: (30 Marks - 2 Hours)

| Question No | Unit | Marks |
|---|---|---|
| 1 | User Interaction | 05 |
| 2 | Python Syllabus Coverage | 05 |
| 3 | Running Application | 15 |
| 4 | Viva | 05 |

**(*Addition of marks of both the sections will be converted to marks out of 30)**

# SEMESTER IV

| Nomenclature of the Course | Advanced Java |
|---|---|
| Class | S.Y.B.Sc(IT) |
| Semester | IV |
| Course Code | USIT401 |
| No. of Credits | 2(2 Hours Per Week) |
| Nature | Theory |
| Type | Major ( Mandatory) |
| | |

| Course Outcomes: |
|---|

On the successful completion of this course, the learner will be able to

CO1**:** Utilize exception handling mechanism to manage runtime errors.
CO2: Understand and implement multithreading concepts in java to create concurrent and efficient programs.
CO3: Build GUI programs.
CO4: Create event driven programs using different layouts in java.
CO5: Enable to build interactive and user friendly applications using advanced swing controls.
CO6: Understand the JDBC architecture, execute SQL statements using JDBC and retrieve results.

| Syllabus: |
|---|

| Unit No. | Unit Title | Subtitles (Learning Points) |
|---|---|---|
| I | **Java Exception Handling** | Catching java exceptions, catching run-time exceptions, handling multiple exceptions, the finally clause, the throws clause |
| | **Multithreading** | thread control methods, thread life cycle, the main thread, creating a thread, extending the thread class. |
| II | **Introduction to JFC and Swing** | Features of the java foundation classes, swing API components, JComponent class, containers and panels, swing components. |

| | | **Layouts and Event Handling** | flow layout, grid layout, border layout, delegation event model, events, event classes, event listener interfaces, adapter classes. |
|---|---|---|---|
| III | | **Advanced Swing Controls** | JScrollPane, Lists and Combo Boxes, Colors and File Choosers, Tables and Trees, JTabbedPane. |
| | | **JDBC** | Introduction, JDBC Architecture, JDBC Drivers, java.sql package, Statement, PreparedStatement, CallableStatement, ResultSet |

**Prescribed Text/s (If any):**
- Java: The Complete Reference - Herbert Schildt, McGraw Hill, 9th Edition, 2014.
- Murach's beginning Java with Net Beans - Joel Murach, Michael Urban, SPD, 1st Edition, 2016.

**Other Learning Resources recommended:**
- Core Java, Volume I:Fundamentals - Hortsman, Pearson, 9th Edition, 2013.

**Teaching Plan:**

| Unit No. | Unit Title | Teaching Methods | No. of Lectures |
|---|---|---|---|
| I | Java Exception Handling, Multithreading | Chalk and board, Audio – Visual aids, Problem solving sessions | 10 |
| II | Introduction to JFC and Swing, Layouts and Event Handling | Chalk and board, Audio – Visual aids, Problem solving sessions | 10 |
| III | Advanced Swing Controls, JDBC | Chalk and board, Audio – Visual aids, Problem solving sessions | 10 |

**Evaluation Pattern**

**A) Continuous Internal Evaluation: Maximum Marks: 20**

| Method | Marks |
|---|---|
| Unit Test (MCQ / Descriptive – Based on Theory and/or Problems Online/Offline | **10** |
| Assignments | **05** |

| Attendance and active participation in classroom | **05** |
|---|---|

**B) Semester End Examination: Maximum Marks:  30**

| Question No. and Sub questions (If any) | Unit and sub unit (with number and title) | Type of Question (Essay / short note / Objective / Diagram, etc.) | Marks |
|---|---|---|---|
| Q.1) A) | Unit 1(Java Exception Handling,  Multithreading) | Short Note / Diagram | 06 |
| Q.1) B) | Unit 1(Java Exception Handling, Multithreading) | Short Note / Diagram | 04 |
| Q.2) A) | Unit 2(Introduction to JFC and Swing, Layouts and Event Handling) | Short Note / Diagram | 06 |
| Q.2) B) | Unit 2(Introduction to JFC and Swing, Layouts and Event Handling) | Short Note / Diagram | 04 |
| Q.3) A) | Unit 3(Packages, Arrays, Vectors and Strings) | Short Note / Diagram | 06 |
| Q.3) B) | Unit 3(Advanced Swing Controls, JDBC) | Short Note / Diagram | 04 |

| Nomenclature of the Course | Software Engineering |
|---|---|
| Class | S.Y.B.Sc(IT) |
| Semester | IV |
| Course Code | USIT402 |
| No. of Credits | 2(2 Hours Per Week) |
| Nature | Theory |
| Type | Major ( Mandatory) |

| | |
|---|---|

| Course Outcomes: |
|---|

On the successful completion of this course, the learner will be able to

CO1: Understand software engineering.
CO2: Apply software engineering principles.
CO3: Discuss various approaches to verification and validation of software including testing, measurements and estimation of software products.
CO4: Create software using different software development models.

| | |
|---|---|

| Syllabus: |
|---|

| Unit No. | Unit Title | Subtitles (Learning Points) |
|---|---|---|
| I | Introduction | Introduction: What is software engineering? Software Development Life Cycle, Requirements Analysis, Software Design, Coding, Testing, Maintenance etc. |
| | Software Requirements | Software Requirements: Functional and Non-functional requirements, User Requirements, System Requirements, Interface Specification, Documentation of the software requirements. |
| | Software Processes | Software Processes: Process and Project, Component Software Processes. |
| II | Software Development Process Models | Software Development Process Models.<br>• Waterfall Model.<br>• Prototyping.<br>• Iterative Development. |

| | | | • Rational Unified Process.<br>• The RAD Model<br>• Time boxing Model. |
|---|---|---|---|
| | | **Agile software development** | Agile software development: Agile methods, Plan-driven and agile development, Extreme programming, Agile project management, Scaling agile methods. |
| | | **Socio-technical system** | Socio-technical system: Essential characteristics of socio technical systems, Emergent System Properties, Systems Engineering, Components of system such as organization, people and computers, Dealing Legacy Systems. |
| | | **Critical system** | Critical system: Types of critical system, A simple safety critical system, Dependability of a system, Availability and Reliability, Safety and Security of Software systems. |
| III | | **System Models** | System Models: Models and its types, Context Models, Behavioural Models, Data Models, Object Models, Structured Methods. |
| | | **Architectural Design** | Architectural Design: Architectural Design Decisions, System Organisation, Modular Decomposition Styles, Control Styles,Reference Architectures. |
| | | **User Interface Design** | User Interface Design: Need of UI design, Design issues, The UI design Process, User analysis, User Interface Prototyping, Interface Evaluation. |
| | | **Software Cost Estimation** | Software Cost Estimation: Software Productivity, Estimation Techniques, Algorithmic Cost Modelling, Project Duration and Staffing |
| | | **Service Oriented Software Engineering** | Service Oriented Software Engineering: Services as reusable components, Service Engineering, Software Development with Services. |
| | | **Software reuse** | Software reuse: The reuse landscape, Application frameworks,Software product lines, COTS product reuse. |
| | | **Distributed software engineering** | Distributed software engineering: Distributed systems issues, Client–server computing, Architectural patterns for distributed systems,Software as a service |

**Prescribed Text/s (If any):**
- Software Engineering - Ian Somerville, Pearson Education, 9th Edition.
- Software Engineering - Pankaj Jalote, Narosa Publication.

- Software engineering, a practitioner's approach - Roger Pressman, Tata Mcgraw-hill, 7th Edition.
- Software Engineering principles and practice - WS Jawadekar, Tata Mcgraw-hill

**Other Learning Resources recommended:**
- Software Engineering-A Concise Study - S.A Kelkar, PHI India.
- Software Engineering Concept and Applications - Subhajit Datta, Oxford Higher Education
- Software Design - D.Budgen, Pearson education, 2nd Edition.
- Software Engineering - KL James, PHI, EEE, 2009.

**Teaching Plan:**

| Unit No. | Unit Title | Teaching Methods | No. of Lectures |
|---|---|---|---|
| I | Introduction, Software Requirements, Software Processes | Chalk and board, Audio – Visual aids, Problem solving sessions | 10 |
| II | Software Development Process Models, Agile software development, Socio-technical system, Critical system, Software reuse | Chalk and board, Audio – Visual aids, Problem solving sessions | 10 |
| III | System Models, Architectural Design, User Interface Design, Software Cost Estimation, Service Oriented Software Engineering | Chalk and board, Audio – Visual aids, Problem solving sessions | 10 |

**Evaluation Pattern**

**A) Continuous Internal Evaluation: Maximum Marks: 20**

| Method | Marks |
|---|---|
| Unit Test (MCQ / Descriptive – Based on Theory and/or Problems Online/Offline | **10** |
| Assignments | **05** |
| Attendance and active participation in classroom | **05** |

**B) Semester End Examination: Maximum Marks: 30**

| Question No. and Sub questions (If any) | Unit and sub unit (with number and title) | Type of Question (Essay / short note / Objective / Diagram, etc.) | Marks |
|---|---|---|---|
| Q.1) A) | Unit 1(Introduction, Software Requirements, Software Processes) | Short Note / Diagram | 06 |
| Q.1) B) | Unit 1(Introduction, Software Requirements, Software Processes) | Short Note / Diagram | 04 |
| Q.2) A) | Unit 2(Software Development Process Models, Agile software development, Socio-technical system, Critical system, Software reuse) | Short Note / Diagram | 06 |
| Q.2) B) | Unit 2(Software Development Process Models, Agile software development, Socio-technical system, Critical system, Software reuse) | Short Note / Diagram | 04 |
| Q.3) A) | Unit 3(System Models,Architectural Design, User Interface Design, Software Cost Estimation,Service Oriented Software Engineering) | Short Note / Diagram | 06 |
| Q.3) B) | Unit 3(System Models,Architectural Design, User Interface Design, Software Cost Estimation, Service Oriented Software Engineering) | Short Note / Diagram | 04 |

| Nomenclature of the Course | Data Structures |
|---|---|
| Class | S.Y.B.Sc(IT) |
| Semester | IV |
| Course Code | USIT403 |
| No. of Credits | 2(2 Hours Per Week) |
| Nature | Theory |
| Type | Major ( Mandatory) |
| | |

| Course Outcomes: |
|---|
| On the successful completion of this course, the learner will be able to

CO1: Identify and distinguish data structure classification, data types, their complexities.
CO2: Understand array, array operations and its types.
CO3: Compare various sorting and searching techniques.
CO4: Understand linked list, its types and perform operations on linked list.
CO5: Understand stack and its operations and applications.
CO6: Understand queue and its operations and applications.
CO7: Understand the basics of trees, heaps and graphs.
CO8: Study advanced tree structures.
CO9: Understand hashing and various hashing techniques. |
| |

**Syllabus:**

| Unit No. | Unit Title | Subtitles (Learning Points) |
|---|---|---|
| I | Introduction | Data and Information, Data Structure, Classification of Data Structures, Operations on Data Structure, Algorithm, Importance of Algorithm Analysis, Complexity of an Algorithm, Asymptotic Analysis and Notations. |
| | Array | Introduction, One Dimensional Array, Memory Representation of One Dimensional Array, Traversing, Insertion, Deletion, Searching, Sorting, Merging of Arrays, Multidimensional Arrays, Memory |

| | | Representation of Two Dimensional Arrays, General Multi- Dimensional Arrays, Sparse Arrays, Sparse Matrix, Advantages and Limitations of Arrays |
|---|---|---|
| | **Sorting and Searching Techniques** | Sorting: Bubble, Selection, Insertion, Merge Sort. Searching: Sequential, Binary |
| II | **Linked List** | Introduction, Representation and Operations of Linked Lists-insertion,deletion, Search,Merge, Singly Linked List, Doubly Linked List, Circular Linked List, And Circular Doubly Linked List.Implementing other Data Structures |
| | **Stack** | Introduction, Operations on the Stack, Memory Representation of Stack, Array Representation of Stack, Applications of Stack-Evaluation of Arithmetic Expression, Matching Parenthesis, infix and postfix operations, Recursion.. |
| | **Queue** | Introduction, Queue, Operations on the Queue, Memory Representation of Queue, Array representation of queue, Linked List Representation of Queue, Circular Queue, Some special kinds of queues, Deque, Applications of Queues. |
| III | **Tree** | Tree, Binary Tree, Properties of Binary Tree, Heaps and operations on heap,Introduction of graph |
| | **Advanced Tree Structures** | Red Black Tree, Operations Performed on Red Black Tree, AVL Tree, Operations performed on AVL Tree. |
| | **Hashing Techniques** | Hashing Concepts, Hash functions: Division Method, Middle Square Method, Folding Method. |

**Prescribed Text/s (If any):**
- A Simplified Approach to Data Structures - Lalit Goyal, Vishal Goyal, Pawan Kumar, SPD, 1st Edition,  2014
- An Introduction to Data Structure with Applications - Jean – Paul Tremblay and Paul Sorenson, Tata MacGraw Hill, 2nd Edition, 2007
- Data Structure and Algorithm - Maria Rukadikar, SPD, 1st Edition, 2017
- Schaum's Outlines Data structure - Seymour Lipschutz, Tata McGraw Hill, 2nd Edition, 2005

**Other Learning Resources recommended:**
- **https://www.tutorialspoint.com/data_structures_algorithms/**

**Teaching Plan:**

| Unit No. | Unit Title | Teaching Methods | No. of Lectures |
|---|---|---|---|
| I | Introduction, Array, Sorting and Searching Techniques | Chalk and board, Audio – Visual aids, Problem solving sessions | 10 |
| II | Linked List, Stack, Queue | Chalk and board, Audio – Visual aids, Problem solving sessions | 10 |
| III | Tree, Advanced Tree Structure, Hashing Techniques | Chalk and board, Audio – Visual aids, Problem solving sessions | 10 |

**Evaluation Pattern**

### A) Continuous Internal Evaluation: Maximum Marks: 20

| Method | Marks |
|---|---|
| Unit Test (MCQ / Descriptive – Based on Theory and/or Problems Online/Offline | **10** |
| Assignments | **05** |
| Attendance and active participation in classroom | **05** |

### B) Semester End Examination: Maximum Marks: 30

| Question No. and Sub questions (If any) | Unit and sub unit (with number and title) | Type of Question (Essay / short note / Objective / Diagram, etc.) | Marks |
|---|---|---|---|
| Q.1) A) | Unit 1(Introduction, Array, Sorting and Searching Techniques) | Short Note / Diagram | 06 |
| Q.1) B) | Unit 1(Introduction, Array, Sorting and | Short Note / Diagram | 04 |

| | Searching Techniques) | | |
|---|---|---|---|
| Q.2) A) | Unit 2(Linked List, Stack, Queue) | Short Note / Diagram | 06 |
| Q.2) B) | Unit 2(Linked List, Stack, Queue) | Short Note / Diagram | 04 |
| Q.3) A) | Unit 3(Tree, Advanced Tree Structure, Hashing Techniques) | Short Note / Diagram | 06 |
| Q.3) B) | Unit 3(Tree, Advanced Tree Structure, Hashing Techniques) | Short Note / Diagram | 04 |

| Nomenclature of the Course | Programming Practical 4 |
|---|---|
| Class | S.Y.B.Sc(IT) |
| Semester | IV |
| Course Code | USIT404 |
| No. of Credits | 2(4 Hours Per Week) |
| Nature | Practical |
| Type | Major ( Mandatory) |
| | |

| Course Outcomes: |
|---|

On the successful completion of this course, the learner will be able to

CO1: Performed practicals using advanced java concepts.
CO2: Build GUI programs
CO3: Handles different events occurs during program execution
CO4: Implement fundamental data structures efficiently.
CO5: Analyze and compare data structures for performance.
CO6: Solve real-world problems using data structures and algorithms.
CO7: Optimize code and troubleshoot errors in implementations.

## Section I: Advanced Java

**Syllabus:**

| Sr.No | Title | Subtitles (Learning Points) |
|---|---|---|
| 1 | **Exception Handling** | a. Write a java program to implement exception handling.<br>b.Write a program to define user defined exception and raise them as per the requirements. |
| 2 | **Multithreading** | a.Write a java program to implement multithreading.<br>b.Write a java application to demonstrate 5 bouncing balls of different colors using threads. |
| 3 | **Swing** | a.Design a Swing program to print the factorial for an input value. |

| | | b.Design a calculator based on Swing application. |
|---|---|---|
| 4 | **Layouts** | Write programs for the following layouts:<br>a.Flow Layout<br>b.Grid Layout<br>c.Border Layout |
| 5 | **Events** | Write programs to demonstrate the following events:<br>a.ActionEvent<br>b.MouseEvent<br>c.KeyEvent<br>d.FocusEvent |
| 6 | **Advanced Swing Controls** | a.Design Swing application to generate a result marks sheet.<br>b.Create a swing application that randomly changes color on button click. |
| 7 | **Adapter class** | a.Demonstrate the use of Adapter class in Event Handling |
| 8 | **Anonymous Inner Class** | a.Demonstrate the use of Anonymous Inner Class in Event Handling |
| 9 | **JDBC Connection** | a.Write a java program to demonstrate the JDBC connection(Mysql/Oracle). |
| 10 | **JDBC Programs** | a.Design Swing application that contains the interface to add student information into the table and display the same from the table.<br>b.Design Swing application to accept roll no from user and display all the details of that student from the result marks table. |

**Note :** This is a sample Practical list. Course instructor may change the practical as per the syllabus.

**Prescribed Text/s (If any):**
- Java: The Complete Reference - Herbert Schildt, McGraw Hill, 9th Edition, 2014.
- Murach's beginning Java with Net Beans - Joel Murach, Michael Urban, SPD, 1st Edition, 2016.

**Other Learning Resources recommended:**
- **https://www.javatpoint.com/what-is-advance-java**

**Teaching Plan:**

| Sr.No. | Title | Teaching Methods | No. of Lectures |
|---|---|---|---|
| 1 | Exception Handling | Practical | 2 |
| 2 | Multithreading | Practical | 2 |
| 3 | Swing | Practical | 2+2 |
| 4 | Layouts | Practical | 2+2 |
| 5 | Events | Practical | 2+2 |
| 6 | Advanced Swing Controls | Practical | 2 |
| 7 | Adapter class | Practical | 2 |
| 8 | Anonymous Inner Class | Practical | 2 |
| 9 | JDBC Connection | Practical | 2+2 |
| 10 | JDBC Programs | Practical | 2+2 |

**Section II: Data Structures**

**Syllabus:**

| Sr. No. | Title | Subtitles (Learning Points) |
|---|---|---|
| 1 | **Programs using Arrays** | Implement the following: a. Read the two arrays from the user and merge them and display the elements in sorted order. b. Write a program to perform the Matrix addition,Multiplication and Transpose Operation. |
| 2 | **Programs on Linked List** | Implement the following for Linked List: a. Write a program to create a singly linked list.Also display the node elements in reverse order and search the element in the linked list b. Write a program to create a doubly linked list and sort the elements in the linked list. |
| 3 | **Programs on Stack** | Implement the following for Stack: a. Write a program to implement the concept of Stack with Push, Pop, Display and Exit operations. b. Write a program to convert an infix expression to postfix and prefix conversion. |

| | | c. Write a program to implement the Tower of Hanoi problem. |
|---|---|---|
| 4 | **Programs on Queue** | Implement the following for Queue:<br>a. Write a program to implement the concept of Queue with Insert, Delete, Display and Exit operations.<br>b. Write a program to implement the concept of Circular Queue<br>c. Write a program to implement the concept of Deque. |
| 5 | **Programs on Sorting** | Implement the following sorting techniques:<br>a. Write a program to implement selection sort.<br>b. Write a program to implement insertion sort.<br>c. Write a program to implement merge sort. |
| 6 | **Programs on Searching Techniques** | Implement the following data structure techniques:<br>a. Write a program to search the element using sequential search.<br>b. Write a program to search the element using binary search. |
| 7 | **Programs on Tree** | Implement the following data structure techniques:<br>a. Write a program to create the binary tree and display the elements.<br>b. Write a program for inorder, postorder and preorder traversal of tree. |
| 8 | **Programs on Advanced Tree Structures** | Implement the following data structure techniques:<br>a. Write a program to insert the element into the maximum heap.<br>b. Write a program to insert the element into the minimum heap |
| 9 | **Program on Hashing Techniques** | Write a program to implement the hashing technique. |
| 10 | **Program on Graph** | Write a program to generate the adjacency matrix. |

**Note :** This is a sample Practical list. Course instructor may change the practical as per the syllabus.

**Prescribed Text/s (If any):**
- A Simplified Approach to Data Structures - Lalit Goyal, Vishal Goyal, Pawan Kumar, SPD, 1st Edition, 2014
- An Introduction to Data Structure with Applications - Jean – Paul Tremblay and Paul Sorenson, Tata MacGraw Hill, 2nd Edition, 2007
- Data Structure and Algorithm - Maria Rukadikar, SPD, 1st Edition, 2017
- Schaum's Outlines Data structure - Seymour Lipschutz, Tata McGraw Hill, 2nd Edition, 2005

**Other Learning Resources recommended:**
- **https://www.tutorialspoint.com/data_structures_algorithms/**

**Teaching Plan:**

| Sr.No. | Title | Teaching Methods | No. of Lectures |
|---|---|---|---|
| 1 | Programs using Arrays | Practical | 2 |
| 2 | Programs on Linked List | Practical | 2+2 |
| 3 | Programs on Stack | Practical | 2 |
| 4 | Programs on Queue | Practical | 2 |
| 5 | Programs on Sorting | Practical | 2 |
| 6 | Programs on Searching Techniques | Practical | 2+2 |
| 7 | Programs on Tree | Practical | 2 |
| 8 | Programs on Advanced Tree Structures | Practical | 2+2 |
| 9 | Program on Hashing Techniques | Practical | 2+2 |
| 10 | Program on Graph | Practical | 2+2 |

**Evaluation Pattern**

**A) Continuous Internal Evaluation: Maximum Marks: 20**

| Method | Marks |
|---|---|
| Certified Journal (section I & II) | **10** |
| Attendance and active participation in both Laboratory | **10** |

**B) Semester End Examination: Maximum Marks: 30\***

Section I: (30 Marks - 2 Hours)

| Question No | Unit | Marks |
|---|---|---|
| 1 | Program 1 | 10 |
| 2 | Program 2 | 15 |
| 3 | Viva | 05 |

Section II:(30 Marks - 2 Hours)

| Question No | Unit | Marks |
|---|---|---|
| 1 | Program 1 | 10 |
| 2 | Program 2 | 15 |
| 3 | Viva | 05 |

**(\*Addition of marks of both the sections will be converted to marks out of 30)**

| Nomenclature of the Course | Statistical Techniques |
|---|---|
| Class | S.Y.B.Sc(IT) |
| Semester | IV |
| Course Code | USIT405 |
| No. of Credits | 2(2 Hours Per Week) |
| Nature | Theory |
| Type | Minor |

| | |
|---|---|

| Course Outcomes: |
|---|

On the successful completion of this course, the learner will be able to

CO1**:** Calculate and apply measures of central tendencies -grouped and ungrouped data cases.
CO2: Calculate and apply measures of dispersion --grouped and ungrouped data cases.
CO3: Calculate the moments, skewness and kurtosis by various methods.
CO4: Apply discrete and continuous probability distributions.
CO5: Perform Test of Hypothesis for a population parameter and understand the concept of p-values.
CO6: Perform non parametric Tests of Hypothesis.

| | |
|---|---|

**Syllabus:**

| Unit No. | Unit Title | Subtitles (Learning Points) |
|---|---|---|
| I | **Measures of Central Tendency** | Averages or Measures of Central Tendency: Arithmetic Mean, Weighted Arithmetic Mean, Median, Mode, Geometric Mean, Harmonic Mean, The Relation Between the Arithmetic, Geometric, and Harmonic Means, Root Mean Square, Quartiles, Deciles, and Percentiles |
| | **Measures of Dispersion** | Dispersion or Variation: Range, Mean Deviation, Semi-Interquartile Range, 10–90 Percentile Range, Standard Deviation, Variance, Sheppard's Correction for Variance, Empirical Relations Between Measures of Dispersion, Absolute and Relative Dispersion |

| II | Moments, Skewness, and Kurtosis | Moments, Relations Between Moments, Moments in Dimensionless Form, Skewness, Kurtosis |
|---|---|---|
| | Elementary Probability Theory | Discrete and Continuous random variables, Probability density function, Probability distribution of random variables, Expected value, Variance. Distributions: Discrete distributions: Uniform, Binomial, Poisson, Continuous distributions: uniform distributions, exponential, Normal distribution |
| III | Statistical Decision Theory | Statistical Decisions, Statistical Hypotheses, Tests of Hypotheses and Significance or Decision Rules, Type I and Type II Errors, Level of Significance, Two-Tailed and One-Tailed Tests, Special Tests, p-Values for Hypotheses Tests, Tests Involving Sample Differences |
| | Small Sampling Theory | Small Samples, Degrees of Freedom, Tests of Hypotheses and Significance, The Chi-Square Distribution, The F Distribution. |
| | The Chi-Square Test | Definition of chi-square, Significance Tests, The Chi-Square Test for Goodness of Fit, Contingency Tables, Yates' Correction for Continuity, Simple Formulas for Computing chi-square |

**Prescribed Text/s (If any):**
- Statistics - Murray R.Spiegel, Larry J. Stephens,McGraw –Hill International, 4th Edition
- Fundamental of Mathematical Statistics - S.C.Gupta and V. K.Kapoor, Sultan Chand and Sons, 11th Revised Edition, 2011.

**Other Learning Resources recommended:**
- Mathematical Statistics - J. N. Kapur and H.C.saxena, S.Chand, 20th Revised Edition, 2005.

**Teaching Plan:**

| Unit No. | Unit Title | Teaching Methods | No. of Lectures |
|---|---|---|---|
| 1 | Measures of Central Tendency and Dispersion | Chalk and board, Audio – Visual aids, Problem solving sessions | 10 |

| 2 | Moments, Skewness, and Kurtosis, Elementary Probability Theory | Chalk and board, Audio – Visual aids, Problem solving sessions | 10 |
|---|---|---|---|
| 3 | Statistical Decision Theory, Small Sampling Theory, The Chi-Square Test | Chalk and board, Audio – Visual aids, Problem solving sessions | 10 |

**Evaluation Pattern**

### A) Continuous Internal Evaluation: Maximum Marks: 20

| Method | Marks |
|---|---|
| Unit Test (MCQ / Descriptive – Based on Theory and/or Problems Online/Offline | **10** |
| Assignments | **05** |
| Attendance and active participation in classroom | **05** |

### B) Semester End Examination: Maximum Marks: 30

| Question No. and Sub questions (If any) | Unit and sub unit (with number and title) | Type of Question (Essay / short note / Objective / Diagram, etc.) | Marks |
|---|---|---|---|
| Q.1) A) | Unit 1(Measures of Central Tendency and Dispersion) | Short Note / Diagram | 06 |
| Q.1) B) | Unit 1(Measures of Central Tendency and Dispersion) | Short Note / Diagram | 04 |
| Q.2) A) | Unit 2(Moments, Skewness, and Kurtosis, Elementary Probability Theory) | Short Note / Diagram | 06 |

| Q.2) B) | Unit 2(Moments, Skewness, and Kurtosis, Elementary Probability Theory) | Short Note / Diagram | 04 |
|---------|--------------------------------------------------------------------------|----------------------|----|
| Q.3) A) | Unit 3(Statistical Decision Theory, Small Sampling Theory, The Chi-Square Test) | Short Note / Diagram | 06 |
| Q.3) B) | Unit 3(Statistical Decision Theory, Small Sampling Theory, The Chi-Square Test) | Short Note / Diagram | 04 |

| Nomenclature of the Course | M4 Practical |
|---|---|
| Class | S.Y.B.Sc(IT) |
| Semester | IV |
| Course Code | USIT406 |
| No. of Credits | 2(4 Hours Per Week) |
| Nature | Practical |
| Type | Minor |

| | |
|---|---|
| **Course Outcomes:** | |

On the successful completion of this course, the learner will be able to

CO1: Enter and edit data.
CO2: Format data and cells.
CO3: Construct formulas, including the use of built-in functions
CO4: Present statistical findings visually through graphs and charts.
CO5: Apply statistical methods to analyze and interpret data sets.
CO6: Understand and implement various statistical techniques for hypothesis
     testing and regression analysis.

**Section I: Excel**

**Syllabus:**

| Sr.No. | Title | Subtitles (Learning Points) |
|---|---|---|
| 1 | **Create Worksheets and Workbooks** | a. Create and save new workbooks<br>b. Close and open workbooks<br>c. Import Data<br>d. Add a worksheet to an existing workbook<br>e. Copy and move a worksheet |
| 2 | **Format Worksheets and Workbooks** | a. Rename a worksheet<br>b. Change worksheet order and colour<br>c. Insert and delete columns or rows<br>d. Change workbook themes<br>e. Adjust row height and column width<br>f. Hide or unhide worksheets<br>g. Hide or unhide rows and columns |

| 3 | **Apply Custom Data Formats and Validation** | a. Create custom number formats<br>b. Populate cells by using advanced Fill Series options<br>c. Configure data validation |
|---|---|---|
| 4 | **Apply Advanced Conditional Formatting** | a. Create custom conditional formatting rules<br>b. Create conditional formatting rules that use formulas<br>c. Manage conditional formatting rules |
| 5 | **Data Filtering** | a. Use AutoFilters<br>b. Apply a custom AutoFilter<br>c. Create advanced filters<br>d. Copy filtered results to a new location<br>e. Use database functions |
| 6 | **Create and Manage Tables** | a. Create an Excel table from a cell range<br>b. Convert a table to a cell range<br>c. Add or remove table rows and columns<br>d. Apply styles to tables<br>e. Configure table-style options<br>f. Insert total rows |
| 7 | **Filter and Sort a Table** | a. Filter records<br>b. Sort by multiple columns<br>c. Change sort order<br>d. Remove Duplicate records |
| 8 | **Summarise Data by using Functions** | a. Perform calculations by using the SUM function<br>b. Perform calculations by using MIN and MAX functions<br>c. Perform calculations by using the COUNT function<br>d. Perform calculations by using the AVERAGE function |
| 9 | **Perform Conditional Operations by using Functions** | a. Perform logical operations by using the IF, SUMIF and AVERAGEIF functions<br>b. Perform statistical operations by using the COUNTIF function |
| 10 | **Format and Modify Text by using Functions** | a. Format text by using RIGHT, LEFT, and MID functions<br>b. Format text by using UPPER, LOWER, and |

| | | PROPER functions<br>c. Format text by using the CONCATENATE function |
|---|---|---|
| **11** | **Create and Format Charts** | a. Create a new chart<br>b. Add additional data series<br>c. Switch between rows and columns in the source data<br>d. Analyze data<br>e. Resize charts<br>f. Add and modify chart elements<br>g. Apply chart layouts and styles<br>h. Move charts to a chart sheet |
| 12 | **Look up data by using Functions** | a. Look up data by using the VLOOKUP function<br>b. Look up data by using the HLOOKUP function |
| 13 | **Create and Manage PivotTables** | a. Create PivotTables<br>b. Modify field selections and options<br>c. Create slicers<br>d. Group PivotTable data<br>e. Add calculated fields<br>f. Format data |
| 14 | **Create and Manage Pivot Charts** | a. Create PivotCharts<br>b. Manipulate options in existing PivotCharts<br>c. Apply styles to PivotCharts<br>d. Drill down into PivotChart details |
| 15 | **Security Features** | a. Unlocking cells<br>b. Worksheet protection<br>c. Workbook protection<br>d. Password-protecting Excel files |

**Note :** This is a sample Practical list. Course instructor may change the practical as per the syllabus.

**Prescribed Text/s (If any):**
- **https://www.w3schools.com/EXCEL/index.php**

**Teaching Plan:**

| Sr.No. | Title | Teaching Methods | No. of Lectures |
|---|---|---|---|
| 1 | Create Worksheets and Workbooks | Practical | 2 |
| 2 | Format Worksheets and Workbooks | Practical | 2 |
| 3 | Apply Custom Data Formats and Validation | Practical | 2 |
| 4 | Apply Advanced Conditional Formatting | Practical | 2 |
| 5 | Data Filtering | Practical | 2 |
| 6 | Create and Manage Tables | Practical | 2 |
| 7 | Filter and Sort a Table | Practical | 2 |
| 8 | Summarise Data by using Functions | Practical | 2 |
| 9 | Perform Conditional Operations by using Functions | Practical | 2 |
| 10 | Format and Modify Text by using Functions | Practical | 2 |
| 11 | Create and Format Charts | Practical | 2 |
| 12 | Look up data by using Functions | Practical | 2 |
| 13 | Create and Manage PivotTables | Practical | 2 |
| 14 | Create and Manage Pivot Charts | Practical | 2 |
| 15 | Security Features | Practical | 2 |

**Section II: R Programming**

| Sr.No. | Title | Subtitles (Learning Points) |
|---|---|---|

| | | |
|---|---|---|
| 1 | **R-Objects** | Using R execute the basic commands, vectors, matrices, arrays, lists and frames. |
| 2 | **R-Charts and graphs** | Using R draw Line Graphs, Bar Chars, Histograms, Boxplots, Scatterplots, Pie Charts |
| 3 | **R-Matrices** | Create a Matrix using R and Perform the operations addition, inverse, transpose and multiplication operations. |
| 4 | **Measures of Central Tendency** | Using R Execute the statistical functions: mean, median, mode, quartiles, range, inter quartile range |
| 5 | **Measures of Central Tendency using Excel** | Using R import the data from Excel / .CSV file and execute the statistical functions: mean, median, mode, quartiles, range, inter quartile range |
| 6 | **Measures of Dispersion** | Using R import the data from Excel / .CSV file and Calculate the standard deviation, variance, co-variance |
| 7 | **Skewness and Kurtosis** | Using R import the data from Excel / .CSV file and draw the skewness and Kurtosis |
| 8 | **Distributions** | Using R perform the binomial and normal distribution on the data. |
| 9 | **Regression** | Perform the Linear ,Multiple Regression and Time Series analysis using R. |
| 10 | **Hypothetical Testing** | Import the data from Excel and perform the hypothesis testing and Chi-squared Test. |

**Note :** This is a sample Practical list. Course instructor may change the practical as per the syllabus

**Prescribed Text/s (If any):**
- A Practical Approach using R - R.B. Patil, H.J. Dand and R. Bhavsar, SPD, 1st Edition, 2017

**Other Learning Resources recommended:**
- **https://www.tutorialspoint.com/r/index.htm**

**Teaching Plan:**

| Sr.No. | Title | Teaching Methods | No. of Lectures |
|---|---|---|---|
| 1 | R-Objects | Practical | 2+2 |

| 2 | R-Charts and graphs | Practical | 2+2 |
|---|---|---|---|
| 3 | R-Matrices | Practical | 2 |
| 4 | Measures of Central Tendency | Practical | 2 |
| 5 | Measures of Central Tendency using Excel | Practical | 2 |
| 6 | Measures of Dispersion | Practical | 2 |
| 7 | Skewness and Kurtosis | Practical | 2 |
| 8 | Distributions | Practical | 2+2 |
| 9 | Regression | Practical | 2+2 |
| 10 | Hypothetical Testing | Practical | 2+2 |

**Evaluation Pattern**

### A) Continuous Internal Evaluation: Maximum Marks: 20

| Method | Marks |
|---|---|
| Certified Journal (section I & II) | 10 |
| Attendance and active participation in both Laboratory | 10 |

### B) Semester End Examination: Maximum Marks: 30*
Section I: (30 Marks - 2 Hours)

| Question No | Unit | Marks |
|---|---|---|
| 1 | Program 1 | 10 |
| 2 | Program 2 | 15 |
| 3 | Viva | 05 |

Section II: (30 Marks -  2 Hours)

| Question No | Unit | Marks |
|---|---|---|

| | | |
|---|---|---|
| 1 | Program 1 | 10 |
| 2 | Program 2 | 15 |
| 3 | Viva | 05 |

**(*Addition of marks of both the sections will be converted to marks out of 30)**

| | |
|---|---|
| **Nomenclature of the Course** | **Computer Skills - 4 Practical** |
| **Class** | **S.Y.B.Sc(IT)** |
| **Semester** | **IV** |
| **Course Code** | **USITS407** |
| **No. of Credits** | **2(4 Hours Per Week)** |
| **Nature** | **Theory** |
| **Type** | **VSC** |
| | |

**Course Outcomes:**

On the successful completion of this course, the learner will be able to

CO1 : Apply software development methodologies to manage and execute projects effectively.
CO2 : Design and implement software systems following industry best practices and standards.
CO3 : Collaborate in teams to develop and maintain software products.
CO4 : Utilize software testing techniques to ensure the quality and reliability of software.
CO5 : Develop mobile applications for various platforms.
CO6 : Utilize mobile development frameworks and tools effectively.
CO7 : Implement user interfaces and user experience (UI/UX) design principles.
CO8 : Integrate mobile applications with backend services and databases.
CO9 : Test, debug, and deploy mobile applications on real devices.

**Section I: Software Engineering**

**Syllabus:**

| Sr. No. | Title | Subtitles (Learning Points) |
|---|---|---|
| **1** | **Class Diagrams** | Study and implementation of class diagrams. |
| **2** | **Use Case Diagrams** | Study and implementation of Use Case Diagrams. |
| **3** | **Entity Relationship Diagrams** | Study and implementation of Entity Relationship Diagrams. |

| 4 | **Sequence Diagrams** | Study and implementation of Sequence Diagrams. |
|---|---|---|
| 5 | **State Transition Diagrams** | Study and implementation of State Transition Diagrams. |
| 6 | **Data Flow Diagrams** | Study and implementation of Data Flow Diagrams. |
| 7 | **Collaboration Diagrams** | Study and implementation of Collaboration Diagrams. |
| 8 | **Activity Diagrams** | Study and implementation of Activity Diagrams. |
| 9 | **Component Diagrams** | Study and implementation of Component Diagrams. |
| 10 | **Deployment Diagrams** | Study and implementation of Deployment Diagrams |

**Note :** This is a sample Practical list. Course instructor may change the practical as per the syllabus.

**Prescribed Text/s (If any):**
- Object - Oriented Modeling and Design - Michael Blaha, James Rumbaugh, Pearson, 2011.
- Learning UML 2. 0 - Kim Hamilton, Russ, Miles, O'Reilly Media, 2006.
- The unified modeling language user guide - Grady Booch, James Rumbaugh, IvarJacobson, Addison-Wesley, 2005.

**Other Learning Resources recommended:**
- UML A Beginners Guide - Jason T. Roff, McGraw Hill Professional, 2003.

**Teaching Plan:**

| Sr. No. | Unit Title | Teaching Methods | No. of Lectures |
|---|---|---|---|
| 1 | Class Diagrams | Practical | 2 |
| 2 | Use Case Diagrams | Practical | 2+2 |
| 3 | Entity Relationship Diagrams | Practical | 2+2 |
| 4 | Sequence Diagrams | Practical | 2+2 |
| 5 | State Transition Diagrams | Practical | 2+2 |
| 6 | Data Flow Diagrams | Practical | 2 |
| 7 | Collaboration Diagrams | Practical | 2 |

| 8 | Activity Diagrams | Practical | 2+2 |
|---|---|---|---|
| 9 | Component Diagrams | Practical | 2 |
| 10 | Deployment Diagrams | Practical | 2 |

**Section II: Mobile Programming**

**Syllabus:**

| Unit No. | Unit Title | Subtitles (Learning Points) |
|---|---|---|
| 1 | **Introduction to PhoneGAP** | Setting up Flutter, PhoneGAP Project and environment. |
| 2 | **Features of Dart** | Program to demonstrate the features of Dart language. |
| 3 | **Widgets** | Designing the mobile app to implement different widgets. |
| 4 | **Layouts** | Designing the mobile app to implement different Layouts. |
| 5 | **Gestures** | Designing the mobile app to implement Gestures. |
| 6 | **Themes and Styles** | Designing the mobile app to implement the theming and styling. |
| 7 | **Routing** | Designing the mobile app to implement the routing. |
| 8 | **Animation** | Designing the mobile app to implement the animation. |
| 9 | **State Management** | Designing the mobile app to implement the state management. |
| 10 | **SQLite** | Designing the mobile app working with SQLite Database. |
| 11 | **FireBase** | Designing the mobile app working with Firebase. |

**Note :** This is a sample Practical list. Course instructor may change the practical as per the syllabus.

**Prescribed Text/s (If any):**
- Flutter for Beginners - Alessandro Biessek, Packt Publishing, 2019.
- PhoneGap By Example - Andrey Kovalenko, Packt Publishing, 1st, 2015.

**Teaching Plan:**

| Unit No. | Unit Title | Teaching Methods | No. of Lectures |
|---|---|---|---|
| 1 | Introduction to PhoneGAP | Practical | 2+2 |
| 2 | Features of Dart | Practical | 2 |
| 3 | Widgets | Practical | 2 |
| 4 | Layouts | Practical | 2+2 |
| 5 | Gestures | Practical | 2 |
| 6 | Themes and Styles | Practical | 2 |
| 7 | Routing | Practical | 2 |
| 8 | Animation | Practical | 2+2 |
| 9 | State Management | Practical | 2+2 |
| 10 | SQLite | Practical | 2+2 |

**Evaluation Pattern**

**Continuous Internal Evaluation: Maximum Marks: 20**

| Method | Marks |
|---|---|
| Certified Journal (section I & II) | 10 |
| Attendance and active participation in both Laboratory | 10 |

**A) Semester End Examination: Maximum Marks: 30\***
   Section I: (30 Marks - 2 Hours)

| Question No | Unit | Marks |
|---|---|---|
| 1 | Program 1 | 10 |
| 2 | Program 2 | 15 |
| 3 | Viva | 05 |

   Section II:(30 Marks -  2 Hours)

| Question No | Unit | Marks |
|---|---|---|
| 1 | Program 1 | 10 |
| 2 | Program 2 | 15 |
| 3 | Viva | 05 |

**(*Addition of marks of both the sections will be converted to marks out of 30)**

## Field Project (FP)

| Nomenclature of the Course | Field Project |
| --- | --- |
| Class | SYBScIT |
| Semester | IV |
| Course Code | USITF408 |
| No. of Credits | 02 |
| Nature | Project |
| Type | Elective Course |

**Course Outcomes**:

After successful completion of this course the learner will be able to

CO1: Show the capability to identify and address complex problems within the realm of IT, proposing innovative solutions and evaluating their effectiveness.

CO2: Exhibit proficiency in technical skills required for projects such as software development methodologies, database management, requirement analysis etc.

CO3: Recognize and address ethical issues related to the project such as privacy concerns, data security and intellectual property rights.

CO4: Present oneself in a professional manner throughout the project, adhering to deadlines, collaborating effectively with team members and maintaining integrity in reporting.

CO5: Enhance their employability by acquiring practical skills and experiences valued by employers in IT fields, preparing them for future careers or further studies

CO5: Communicate findings, methodologies and results effectively through both written documents and oral presentations

### Guidelines for Field Project

This course requires learners to participate in field based learning projects generally under the supervision of faculty.

**Learner has to work 60 hours in a semester for a Field Project.**

**30 hours for classroom activities**

- Classroom activities include preparation for field activity, independent reading and study, analysis of data and preparation of report etc.

**30 hours for Field work**

- Field work includes implementation of the planned activities according to the programme schedule, collection of data
- Engagement activities may include events, workshops, meetings or door-to-door outreach.

In rare cases field visits may be included in the Field project. In such a case, field visits need to be arranged meticulously so that there is a graded sequence and the submission is a compliance of all visits to make it a unified activity.

**Evaluation Pattern**

**Continuous Internal Evaluation: Maximum Marks (20):**

| Method | Marks |
|---|---|
| Field Project Report | 10 |
| Viva-voce | 10 |

**Semester End Examination: Maximum Marks (30):**

| Method | Marks |
|---|---|
| Field work | 15 |
| Presentation | 15 |

## Community Engagement Project (CEP)

| Nomenclature of the Course | Community Engagement and Service |
|---|---|
| Class | SYBScIT |
| Semester | IV |
| Course Code | USITC408 |
| No. of Credits | 02 |
| Nature | Project |
| Type | Elective Course |
| | |

| |
|---|
| **Course Outcomes**: <br> After successful completion of this course the learner will be able to <br> CO1: Contribute positively to the community by addressing local needs and challenges through science-based activities such as conservation of environment, promotion of good health and STEM education initiatives. <br> CO2: Develop a sense of social responsibility and civic engagement by actively participating in community-based projects and understanding the importance of giving back to society. <br> CO3: Gain interdisciplinary perspectives by applying scientific knowledge and skills to real-world issues, collaborating with individuals from diverse backgrounds, including community members, educators and professionals. <br> CO4: Reflect on their experiences, challenges and accomplishments which will contribute to their personal growth, self-awareness and resilience. <br> CO5: Enhance their employability and career readiness by gaining practical experience, networking opportunities and exposure to real-world applications of scientific knowledge. <br> CO6: Cultivate a lifelong commitment to community continuing to apply their scientific expertise and skills to address societal issues and contribute to positive change throughout their lives. |
| |

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|---|
| **Guidelines for Community Engagement and Service (CEP)** |
| This course requires learners to participate in field based learning /projects generally under the supervision of faculty. It will involve activities that expose learners to the socio-economic issues in the society. <br> **Learner has to work 90 hours in a semester for a Community Engagement and Service Project.** <br><br> **30 hours for classroom activities** <br> • Classroom activities include preparation for community engagement and service, independent reading and study, analysis of data and preparation of report etc. <br> **60 hours for Field work** <br> • Field work includes implementation of the planned community engagement activities according to the programme schedule, collection of data |

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| ● Engagement activities may include events, workshops, meetings or door-to-door outreach. | |
| Learners can participate in activities related to National Service Scheme (NCC), National Cadet Corps (NCC), Adult education / Literacy initiatives, Mentoring of school learners / Organization of Open Day/ Celebration of day on various national and international days like National Science Day, International day of women and Girls in Science  etc | |

**Evaluation Pattern**

**Continuous Internal Evaluation: Maximum Marks (20):**

| Method | Marks |
|---|---|
| CEP report | 15 |
| Active Participation | 05 |

**Semester End Examination: Maximum Marks (30):**

| Method | Marks |
|---|---|
| Field work<br>Undertaking and completing community engagement and service | 30 |

- Learners can participate in any one activity from the list given below.
- Learns should engage 90 / 60 Hours of work for CEP / FP respectively.

| Sr. No. | Activities for Field Project and Community Engagement and Service |
|---|---|
| 1 | Host science talks or webinars open to the public on topics of scientific interest |
| 2 | Anti-Drug awareness campaign in an urban/ rural area |
| 3 | Engage community members in citizen science projects |
| 4 | Organize a science fair or exhibition |
| 5 | Aids awareness campaign in an urban/ rural area |
| 6 | Environment awareness campaign |
| 7 | Water Conservation Awareness program in an urban/ rural area |
| 8 | Design and execute a waste management initiative in an urban neighbourhood |
| 9 | Conduct surveys on access to clean water and sanitation facilities in both rural and urban settings |
| 10 | Conduct / participate in workshops or seminars to provide guidance and information about career opportunities in STEM fields |
| 11 | Organize science outreach workshops for local schools or community centres on various science topics |
| 12 | Create educational materials on environmental conservation and distribute them in schools and communities. |
| 13 | Conduct research projects on fruit processing and value added products. |
| 14 | Conduct research projects on fish industry and its impact on communities. |
| 15 | Conduct research projects on fruit industry and its impact on communities. |
| 16 | Organize events for building scientific temper |
| 17 | Implement initiatives to promote sustainable energy practices in rural environment. |
| 18 | Establish community-driven initiatives for disaster preparedness and response. |
| 19 | Organize community clean-up drives in both rural and urban areas. |
| 20 | Collaborate with local businesses to provide vocational training and job opportunities. |
| 21 | Conduct workshops on digital literacy and technology skills for community members. |
| 22 | Establish community-led initiatives for environmental conservation and biodiversity preservation. |
| 23 | Organize campaigns to promote responsible consumption and waste reduction. |
| 24 | Implement initiatives to address food insecurity and malnutrition in both settings. |
| 25 | Establish community-based initiatives for urban agriculture projects. |
| 26 | Organize capacity-building workshops for community-based environmental organizations. |

| 27 | Establish community-led initiatives for waste reduction and recycling. |
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| 28 | Survey on quality and availability of water |
| 29 | Survey on quality of soil and soil fertility |
| 30 | Conduct research on the impact of pollution on marine ecosystem. |
| 31 | Conduct research projects on the environmental issues. |
| 32 | Conduct research on the impact of pollution on biodiversity. |
| 33 | Any other subjects of your choice and get it approved by the field project or CEP guide |

**Date:** 30/04/2024
**Place:** Ratnagiri

Signature

**Chairperson and HoD**