

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



**Bachelor of Science (Information Technology)(B.Sc.IT)
Programme Three Year Integrated Programme-
Six Semesters**

Course Structure

S. Y. B.Sc. (I.T.) Sem- III & IV

Under Choice Based Credit System (CBCS)

To be implemented from Academic Year 2024-25 progressively

Preamble

The Bachelor of Science in Information Technology (BSc IT) program is designed to provide students with a comprehensive understanding of the theory, principles, and practical applications of information technology in contemporary society. Rooted in a commitment to academic excellence, innovation, and professional development, the program aims to prepare students for dynamic careers in the rapidly evolving field of IT.

The main objectives of the programme are:

1. **Technical Proficiency:** Equip students with a strong foundation in core IT concepts, methodologies, and technologies, empowering them to analyze, design, develop, and implement innovative solutions to real-world problems.

2. **Critical Thinking and Problem-Solving:** Foster critical thinking skills essential for analyzing complex IT issues, evaluating alternative solutions, and making informed decisions to address technological challenges effectively.

3. **Communication and Collaboration:** Cultivate effective communication skills, both written and oral, and foster collaborative teamwork abilities, essential for successful interaction within multidisciplinary teams and effective dissemination of information.

4. **Ethical and Social Responsibility:** Instill ethical awareness and social responsibility among students, emphasizing the importance of integrity, respect, and accountability in the ethical use of technology and its impact on individuals, organizations, and society.

5. **Professional Development:** Provide opportunities for students to develop essential professional skills, including project management, leadership, and lifelong learning habits, preparing them for successful careers and continued personal and professional growth in the field of IT.

The syllabus is restructured according to the New Education Policy 2020 and is aimed to achieve the objectives.

The syllabus spanning three years-Six Semesters covers the industry relevant courses. The students will be ready for the jobs available in different fields like:

- Software Development (Programming)
- Website Development
- Mobile app development
- IoT
- Software Testing
- Networking
- Database Administration
- System Administration
- Cyber Law Consultant
- GIS (Geographic Information Systems)
- IT Service Desk
- Security
- And many others

Name of Programme	B.Sc. Information Technology
Level	UG
No of Semesters	06
Year of Implementation	2024-25
Programme Specific Outcomes (PSO)	<ol style="list-style-type: none"> 1. Programming Proficiency: <ol style="list-style-type: none"> a. PSO1: Proficient in Python and Java. b. PSO2: Design real-world applications. c. PSO3: Apply programming libraries for data analysis. 2. Networking, Database, and Data Structures: <ol style="list-style-type: none"> a. PSO4: Understand computer networks and databases. b. PSO5: Configure and troubleshoot networks. c. PSO6: Implement data structures and algorithms. 3. Applied Mathematics and Statistics: <ol style="list-style-type: none"> a. PSO7: Apply math and statistics for problem-solving. 4. Embedded Systems and Real-Time Applications: <ol style="list-style-type: none"> a. PSO8: Develop real-time applications. b. PSO9: Utilize microcontrollers and sensors.
Relevance of PSOs to the local, regional, national, and global developmental needs (200 words)	<p>The PSOs align with India's growing IT industry, Konkan region's local needs, national development, and global technology demands. Proficient programmers support the country's digital transformation, and networking expertise enhances connectivity. Applied math aids local challenges, while embedded systems find applications in healthcare and smart cities. These PSOs contribute to India's IT leadership, regional industries, and global tech market presence, addressing developmental needs at all levels.</p>

**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
S.Y.B.Sc. I.T.**

No. of Courses	Semester III	Credits	No. of Courses	Semester IV	Credits
	Discipline Specific Course (DSC)			Discipline Specific Course (DSC)	
	Major			Major	
24_USIT301	Core Java	2	24_USIT401	Advanced Java	2
24_USIT302	Database Management Systems	2	24_USIT402	Software Engineering	2
24_USIT303	Computer Networks	2	24_USIT403	Data Structures	2
24_USIT304	Programming Practical 3	2	24_USIT404	Programming Practical 4	2
	Minor			Minor	
24_USIT305	Applied Mathematics	2	24_USIT405	Statistical Techniques	2
24_USIT306	M3 Practical	2	24_USIT406	M4 Practical	2
	Skill Enhancement Course (SEC)			Vocational Skill Course (VSC)/Skill Enhancement Course (SEC)	
24_USITS307	Computer skills -3 Practical	2	24_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
			USITC408	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	24_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, and 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.
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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

Nomenclature of the Course	Database Management Systems	
Class	S.Y.B.Sc(IT)	
Semester	III	
Course Code	24_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

Nomenclature of the Course	Computer Networks
Class	S.Y.B.Sc(IT)
Semester	III
Course Code	24_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:

- 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

Nomenclature of the Course	Programming Practical 3	
Class	S.Y.B.Sc(IT)	
Semester	III	
Course Code	24_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		
CO1 : Execute programs using java language.		
CO2 : Performed various String,vector operations.		
CO3 : Design small desktop applications using command line.		
CO4 : Configure and manage network devices.		
CO5 : Implement and analyze network protocols.		
CO6 : Design and simulate network topologies.		
CO7 : Ensure network security and troubleshoot issues.		
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. b. Write a Java program to display the following pattern. ***** **** *** ** * 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. b. Check whether a year is Leap Year or not. c. Write a Java Menu driven program: 1. Print Palindrome Number 2. Print Armstrong Number
3	Methods and Constructors	a. Designed a class SortData that contains the method asec() and desc(). b. Designed a class that demonstrates the use of constructor and destructor. 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. b. Write a java program to implement method overriding.
5	Interface	a. Write a java program to implement the concept of Interface 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. 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. 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. 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	a. Study of Different color codes b. Study of different connecting devices and their

	(Cat5/6/7) cable	differences c. Crimping LAN Cable
2	Configuring LAN setup	a. Planning and Setting IP networks b. Configuring subnet c. Study of basic network command and Network configuration commands. ipconfig, netstat, ARP, ping, trace route etc. d. Basic network troubleshooting. e. Configuration of TCP/IP Protocols in Windows / Linux. 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: <ul style="list-style-type: none"> ● Network address ● Network broadcast address ● Total number of host bits ● Number of hosts b. Given an IP address and network mask, determine other information about the IP address such as: <ul style="list-style-type: none"> ● The subnet address of this subnet ● The broadcast address of this subnet ● The range of host addresses for this subnet ● The maximum number of subnets for this subnet mask ● The number of hosts for each subnet ● The number of subnet bits ● The number of this subnet
4	Designing and configuring a network topology-I	a. Configure IP static routing 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 b. Configure DNS c. Configure Mail
7	Configuring server and client-II	a. Configure Telnet b. Configure FTP 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

Nomenclature of the Course	Applied Mathematics
Class	S.Y.B.Sc(IT)
Semester	III
Course Code	24_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.

CO2: Solve and analyze the differential equations and its applications.

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

Nomenclature of the Course	M3 Practical
Class	S.Y.B.Sc(IT)
Semester	III
Course Code	24_USIT306
No. of Credits	2(4 Hours Per Week)
Nature	Practical
Type	Minor

Course Outcomes:

Learners will be able to:

CO1: Design database schema for a given application and apply normalization.

CO2: Acquire skills in using SQL Commands for data Definition and data manipulation.

CO3: Understand the basics of PL/SQL.

CO4: Use of the control and conditional statement in PL/SQL.

CO5: Apply sequences and cursor in PL/SQL.

CO6: Know the concept of stored procedure and functions

CO7: Create the triggers and packages in PL/SQL.

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	Creating view, Dropping view, Selecting from a view

	following	
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

Nomenclature of the Course	Computer skills -3 Practical
Class	S.Y.B.Sc(IT)
Semester	III
Course Code	24_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 skill set 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. 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. 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. 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. b. Write a function that reverses the user defined value. 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. b. Define a function that computes the length of a given

		list or string.
6	Recursive function	a. Write a function for Palindrome. 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. 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. b. Write a program to multiply all values in the list using list traversal. c. Take a list, say for example this one: a = [1, 1, 2, 3, 5, 8, 13, 21, 34, 55, 89] 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. b. Write a program to print a specified list after removing the 0th, 2nd, 4th and 5th elements. c. Write a program to clone or copy a list. d. Write a program to implement tuple.
10	Dictionaries	a. Write a Python script to sort (ascending and descending) a dictionary by value. b. Write a Python script to concatenate the following dictionaries to create a new one. Sample Dictionary : dic1={1:10, 2:20} dic2={3:30, 4:40} dic3={5:50, 6:60} Expected Result : {1: 10, 2: 20, 3: 30, 4: 40, 5: 50, 6: 60} 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. b. Write a Python program to append text to a file and display the text. 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). i. Write a method called add which returns the sum of the attributes x and y. ii. Write a class method called multiply, which takes a single number parameter a and returns the product of a and MULTIPLIER. 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. 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. 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 Try and add print dir(geometry) to the file and run it. 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. 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 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. 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 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

SEMESTER IV

Nomenclature of the Course	Advanced Java	
Class	S.Y.B.Sc(IT)	
Semester	IV	
Course Code	24_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):		
<ul style="list-style-type: none"> • 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

Nomenclature of the Course	Software Engineering
Class	S.Y.B.Sc(IT)
Semester	IV
Course Code	24_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. <ul style="list-style-type: none"> • Waterfall Model. • Prototyping. • Iterative Development. • Rational Unified Process. • The RAD Model • 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 - Subhajt 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
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Nomenclature of the Course	Data Structures	
Class	S.Y.B.Sc(IT)	
Semester	IV	
Course Code	24_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

Nomenclature of the Course	Programming Practical 4	
Class	S.Y.B.Sc(IT)	
Semester	IV	
Course Code	24_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. 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. 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: a. Flow Layout b. Grid Layout c. Border Layout
5	Events	Write programs to demonstrate the following events: a. ActionEvent b. MouseEvent c. KeyEvent d. FocusEvent
6	Advanced Swing Controls	a. Design Swing application to generate a result marks sheet. 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. 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: a. Write a program to implement the concept of Queue with Insert, Delete, Display and Exit operations. b. Write a program to implement the concept of Circular Queue c. Write a program to implement the concept of Deque.
5	Programs on Sorting	Implement the following sorting techniques: a. Write a program to implement selection sort. b. Write a program to implement insertion sort. c. Write a program to implement merge sort.
6	Programs on Searching Techniques	Implement the following data structure techniques: a. Write a program to search the element using sequential search. b. Write a program to search the element using binary search.
7	Programs on Tree	Implement the following data structure techniques: a. Write a program to create the binary tree and display the elements. b. Write a program for inorder, postorder and preorder traversal of tree.
8	Programs on Advanced Tree Structures	Implement the following data structure techniques: a. Write a program to insert the element into the maximum heap. 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

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 Hypothesis 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

Nomenclature of the Course	M4 Practical
Class	S.Y.B.Sc(IT)
Semester	IV
Course Code	24_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	<ul style="list-style-type: none"> a. Create and save new workbooks b. Close and open workbooks c. Import Data d. Add a worksheet to an existing workbook e. Copy and move a worksheet
2	Format Worksheets and Workbooks	<ul style="list-style-type: none"> a. Rename a worksheet b. Change worksheet order and colour c. Insert and delete columns or rows d. Change workbook themes e. Adjust row height and column width f. Hide or unhide worksheets g. Hide or unhide rows and columns
3	Apply Custom Data Formats and Validation	<ul style="list-style-type: none"> a. Create custom number formats b. Populate cells by using advanced Fill Series options c. Configure data validation
4	Apply Advanced Conditional Formatting	<ul style="list-style-type: none"> a. Create custom conditional formatting rules b. Create conditional formatting rules that use formulas c. Manage conditional formatting rules
5	Data Filtering	<ul style="list-style-type: none"> a. Use AutoFilters b. Apply a custom AutoFilter c. Create advanced filters d. Copy filtered results to a new location

		e. Use database functions
6	Create and Manage Tables	a. Create an Excel table from a cell range b. Convert a table to a cell range c. Add or remove table rows and columns d. Apply styles to tables e. Configure table-style options f. Insert total rows
7	Filter and Sort a Table	a. Filter records b. Sort by multiple columns c. Change sort order d. Remove Duplicate records
8	Summarise Data by using Functions	a. Perform calculations by using the SUM function b. Perform calculations by using MIN and MAX functions c. Perform calculations by using the COUNT function 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 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 b. Format text by using UPPER, LOWER, and PROPER functions c. Format text by using the CONCATENATE function
11	Create and Format Charts	a. Create a new chart b. Add additional data series c. Switch between rows and columns in the source data d. Analyze data e. Resize charts f. Add and modify chart elements g. Apply chart layouts and styles h. Move charts to a chart sheet
12	Look up data by using Functions	a. Look up data by using the VLOOKUP function b. Look up data by using the HLOOKUP function

13	Create and Manage PivotTables	<ul style="list-style-type: none"> a. Create PivotTables b. Modify field selections and options c. Create slicers d. Group PivotTable data e. Add calculated fields f. Format data
14	Create and Manage Pivot Charts	<ul style="list-style-type: none"> a. Create PivotCharts b. Manipulate options in existing PivotCharts c. Apply styles to PivotCharts d. Drill down into PivotChart details
15	Security Features	<ul style="list-style-type: none"> a. Unlocking cells b. Worksheet protection c. Workbook protection 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 Charts, 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

Nomenclature of the Course	Computer Skills - 4 Practical
Class	S.Y.B.Sc(IT)
Semester	IV
Course Code	24_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	Study and implementation of Deployment Diagrams

	Diagrams	
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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

Field Project (FP)

Nomenclature of the Course	Field Project
Class	SYBScIT
Semester	IV
Course Code	24_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	24_USITC408
No. of Credits	02
Nature	Project
Type	Elective Course

Course Outcomes:

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

- 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.
- 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.
- 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.
- CO4: Reflect on their experiences, challenges and accomplishments which will contribute to their personal growth, self-awareness and resilience.
- CO5: Enhance their employability and career readiness by gaining practical experience, networking opportunities and exposure to real-world applications of scientific knowledge.
- 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.

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.

Learner has to work 90 hours in a semester for a Community Engagement and Service Project.

30 hours for classroom activities

- Classroom activities include preparation for community engagement and service, independent reading and study, analysis of data and preparation of report etc.

60 hours for Field work

- Field work includes implementation of the planned community engagement activities according to the program schedule, collection of data
- 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

- Learners can participate in any one activity from the list given below.
- Learners 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.
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

Evaluation Pattern- (Theory courses)

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	Unit Type of Question (Essay / short note / Objective / Diagram, etc.)	Marks
Q.1) A)	Unit 1 Short Note / Diagram	06
Q.1) B)	Unit 1 Short Note / Diagram	04
Q.2) A)	Unit 2 Short Note / Diagram	06
Q.2) B)	Unit 2 Short Note / Diagram	04
Q.3) A)	Unit 3 Short Note / Diagram	06
Q.3) B)	Unit 3 Short Note / Diagram	04

Evaluation Pattern-(Practical courses)

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

Question No	Unit	Marks
1	One Practical Question OR Combination of Practical Questions OR Combination of Practical Question and Theory Question	25
3	Viva	05

Standard of Passing

The learner to pass a course shall have to obtain a minimum of 40% marks in aggregate for each course where the course consists of Internal Assessment & Semester End Examination. The learner shall obtain minimum of 40% marks (i.e. 8 out of 20) in the Internal Assessment and 40% marks in Semester End Examination (i.e. 12 out of 30) separately to pass the course and minimum of Letter Grade "P" in the project component, wherever applicable to pass a particular semester. A learner will be said to have passed the course if the learner passes the Internal Assessment & Semester End Examination together.

Performance Grading:

Letter Grades and Grade Points Semester GPA/ Program CGPA Semester/Program	% of Marks	Alpha-Sign / Letter Grade Result
9.00-10.00	90.0 -100	O (Outstanding)
8.00 ≤ 9.00	80.0 ≤ 90.0	A+ (Excellent)
7.00 ≤ 8.00	70.0 ≤ 80.0	A (Very Good)
6.00 ≤ 7.00	60.0 ≤ 70.0	B+ (Good)
5.50 ≤ 6.00	55.0 ≤ 60.0	B (Above Average)
5.00 ≤ 5.50	50.0 ≤ 55.0	C (Average)
4.00 ≤ 5.00	40.0 ≤ 50.0	P (Pass)
Below 4.00	Below 40	F (Fail)
Ab (Absent)	-	Absent

Date:

Place: Ratnagiri

Chairperson
Board of Studies
Information Technology

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5.00 ≤ 5.50	50.0 ≤ 55.0	C (Average)
4.00 ≤ 5.00	40.0 ≤ 50.0	P (Pass)
Below 4.00	Below 40	F (Fail)
Ab (Absent)	-	Absent

Date:

Place: Ratnagiri

S. Padalkar

Chairperson
Board of Studies
Information Technology