Savitribai Phule Pune University

(Formerly University of Pune)

Three Year B.Sc. Degree Program in Computer Science

(Faculty of Science & Technology)

F.Y.B.Sc. (Computer Science)

Choice Based Credit System Syllabus

To be implemented from Academic Year 2019-2020

Title of the Course: B. Sc. (Computer Science)

Preamble:

The B. Sc. (Computer Science) course is systematically designed three year degree program under the faculty of Science and Technology. The objective of the course is to prepare students to undertake careers involving problem solving using computer science and technologies, or to pursue advanced studies and research in computer science. The syllabus which comprises of Computer Science subject along with that of the three allied subjects (Mathematics, Electronics and Statistics) covers the foundational aspects of computing sciences and also develops the requisite professional skills and problem solving abilities using computing sciences.

Introduction:
At the first year of under-graduation, the basic foundations of two important skills required for software development are laid. A course in problem solving and programming along with a course in database fundamentals forms the preliminary skill set for solving computational problems. The practical courses are designed to supplement the theoretical training in the year. Along with Computer Science, the two theoretical and one practical course each in Statistics, Mathematics and Electronics help in building a strong foundation. Career Advancement courses are introduced in both semesters to cover additional areas of Computer Science.

At the second year of under-graduation, computational problem solving skills are further strengthened by a course in Data structures. Software engineering concepts that are required for project design are also introduced. Essential concepts of computer networking are also introduced in this year. The practical course included in both semesters complements the theory courses.

At the third year of under-graduation, all the subjects are designed to fulfill core Computer Science requirements as well as meet the needs of the software industry. Theory courses are adequately supplemented by hands-on practical courses. Skill Enhancement courses enable the students to acquire additional value-added skills.

Objectives:

- To develop problem solving abilities using a computer.
- To build the necessary skill set and analytical abilities for developing computer based solutions for real life problems.
- To train students in professional skills related to Software Industry.
- To prepare necessary knowledge base for research and development in Computer Science.
- To help students build-up a successful career in Computer Science and to produce entrepreneurs who can innovate and develop software products.

Titles of Papers, Credit Allocation and Scheme of Evaluation

Semester I (Total credits=22)

Course type	Paper Code	Paper title	Credits		Evaluation		
			T	P	CA	UA	TOTAL
CC-I	CS-111	Problem Solving using Computer and 'C' Programming	2		15	35	50
	CS-112	Database Management Systems	2		15	35	50
	CS-113	Practical course based on CS101 and CS102		1.5	15	35	50
CC-II*		Mathematics – I, II and III					
CC-III*		Electronics – I,II and III					
CC-IV*		Statistics – I, II and III					

Semester II (Total credits=22)

Course type	Paper Code	Paper title	Credits		Evaluation		
			T	P	CA	UA	TOTAL
CC-V	CS-121	Advanced 'C' Programming	2		15	35	50
	CS-122	Relational Database Management Systems	2		15	35	50
	CS-123	Practical course based on CS201 and CS202		1.5	15	35	50
CC-VI*		Mathematics – I,II and III					
CC-VII*		Electronics – I, II and III					
CC-VIII*		Statistics – I,II and III					

S. Y. B. Sc.(Computer Science)

Semester III (Total credits=22)

Course type	Paper Code	Paper title	Credits		Evaluation		
			T	P	CA	UA	TOTAL
CC-IX	CS-231	Data Structures and Algorithms – I	2		15	35	50
	CS-232	Software Engineering	2		15	35	50
	CS-233	Practical course based on CS301		2	15	35	50
CC-X*		Mathematics – I, II and III					
CC-XI*		Electronics – I,II and III					
AECC-I*		Environment Science – I	2				
AECC-II*		Language Communication – I	2				

Semester IV (Total credits=22)

Course type	Paper Code	Paper title	Credits		Evaluation		
			T	P	CA	UA	TOTAL
CC-XII	CS-241	Data Structures and Algorithms – II	2		15	35	50
	CS-242	Computer Networks - I	2		15	35	50
	CS-243	Practical course based on CS401		2	15	35	50
CC-XIII*		Mathematics – I,II and III					
CC-XIV*		Electronics – I, II and III					
AECC-III*		Environment Science – I	2				
AECC-IV*		Language Communication – I	2				

T. Y. B. Sc.(Computer Science)

Semester V (Total credits=22)

Course type	Paper Code	Paper title	Credits		Evaluation		
			T	P	CA	UA	TOTAL
DSEC - I	CS-351	Operating Systems - I	2		15	35	50
	CS-352	Computer Networks - II	2		15	35	50
	CS-357	Practical course based on CS501		2	15	35	50
DSEC - II	CS-353	Web Technologies - I	2				
	CS-354	Foundations of Data Science	2				
	CS-358	Practical course based on CS503		2			
DSEC - III	CS-355	Object Oriented Programming - I (Core Java)	2				
	CS-356	Theoretical Computer Science and Compiler Construction - I	2				
	CS-359	Practical Course based on CS505		2			
SECC - I	CS-3510	Python Programming / R Programming	1	1	15	35	50
SECC - II	CS-3511	Open Elective	1	1	15	35	50

Semester VI (Total credits=22)

Course type	Paper Code	Paper title	Credits		Evaluation		
			T	P	CA	UA	TOTAL
DSEC - IV	CS-361	Operating Systems - II	2		15	35	50
	CS-362	Software Testing	2		15	35	50
	CS-367	Practical course based on CS601		2	15	35	50
DSEC - V	CS-363	Web Technologies - II	2				
	CS-364	Data Analytics	2				
	CS-368	Practical course based on CS603 and CS604		2			
DSEC - VI	CS-365	Object Oriented Programming - II (Advanced Java)	2				
	CS-366	Theoretical Computer Science and Compiler Construction - II	2				
	CS-369	Practical Course based on CS605		2			
SECC- III	CS-3610	Mobile Application Development OR Software Testing Tools	1	1	15	35	50
SECC - IV	CS-3611	Project OR Open Elective	1	1	15	35	50

Detailed Syllabus:

Semester- I
Paper - I

Course Type: Core Credit **Course Code: CS101**

Course Title : Problem Solving Using Computer and 'C' Programming - I

Teaching Scheme	No. of Credits	Examination Scheme
2 Hours / Week	2	IE : 15 Marks UE: 35 Marks

Course Objectives

1. To introduce the foundations of computing, programming and problem- solving using computers.
2. To develop the ability to analyze a problem and devise an algorithm to solve it.
3. To formulate algorithms, pseudocodes and flowcharts for arithmetic and logical problems
4. To understand structured programming approach.
5. To develop the basic concepts and terminology of programming in general.
6. To implement algorithms in the 'C' language.
7. To test, debug and execute programs.

Course Outcomes:- On completion of this course, students will be able to :

1. Explore algorithmic approaches to problem solving.
2. Develop modular programs using control structures and arrays in 'C'.

Course Contents

Chapter 1	**Problem Solving Aspects**	**5 Hours**

1.1. Introduction to problem solving using computers.
1.2. Problem solving steps.
1.3 Algorithms-definition, characteristics , examples ,advantages and limitations.
1.4 Flowcharts - definition, notations , examples , advantages and limitations, Comparison with algorithms.
1.5 Pseudo codes - notations, examples, advantages and limitations.
1.6 Programming Languages as tools, programming paradigms, types of languages
1.7 Converting pseudo-code to programs.
1.8 Compilation process (compilers , interpreters), linking and loading, syntax and semantic errors, testing a program
1.9 Good Programming Practices (naming conventions , documentation, indentation).

Chapter 2	**'C' Fundamentals**	**7 Hours**

2.1 History of 'C' language.
2.2 Application areas.
2.2 Structure of a 'C' program.
2.3 'C' Program development life cycle.

2.4 Function as building blocks.
2.5 'C' tokens
2.6 Character set, Keywords , Identifiers
2.7 Variables, Constants (character, integer, float, string, escape sequences, enumeration constant).
2.8 Data Types (Built-in and user defined data types).
2.9 Operators, Expressions, types of operators, Operator precedence and Order of evaluation.
2.10 Character input and output.
2.11 String input and output.
2.12 Formatted input and output.

Chapter 3	**Control Structures**	**6 Hours**

3.1 Decision making structures:- if ,if-else, switch and conditional operator.
3.2 Loop control structures:- while ,do while, for.
3.3 Use of break and continue.
3.4 Nested structures.
3.5 Unconditional branching (goto statement).

Chapter 4	**Functions**	**6 Hours**

4.1 Concept of function, Advantages of Modular design.
4.2 Standard library functions.
4.3 User defined functions:- declaration , definition, function call, parameter passing (by value), return statement.
4.4 Recursive functions.
4.5 Scope of variables and Storage classes.

Chapter 5	**Arrays**	**6 Hours**

5.1 Concept of array.
5.2 Types of Arrays – One , Two and Multidimensional array.
5.3 Array Operations - declaration, initialization, accessing array elements.
5.4 Memory representation of two-dimensional array (row major and column major)
5.5 Passing arrays to function.
5.6 Array applications - Finding maximum and minimum, Counting occurrences, Linear search, Sorting an array (Simple exchange sort, bubble sort), Merging two sorted arrays, Matrix operations (trace of matrix, addition, transpose, multiplication, symmetric, upper/ lower triangular matrix)

Reference Books:

1. How to Solve it by Computer, R.G. Dromey, Pearson Education.
2. Problem Solving and Programming Concept, Maureen Sprankle,7th Edition, Pearson Publication.

3. C: the Complete Reference, Schildt Herbert, 4th edition, McGraw Hill
4. A Structured Programming Approach Using C, Behrouz A. Forouzan, Richard F. Gilberg, Cengage Learning India
5. The 'C' programming language, Brian Kernighan, Dennis Ritchie, PHI
6. Programming in C ,A Practical Approach, Ajay Mittal , Pearson
7. Programming with C, B. Gottfried, 3rd edition, Schaum's outline Series, Tata McGraw Hill.
8. Programming in ANSI C, E. Balagurusamy, 7th Edition, McGraw Hill.

Semester- I
Paper - II

Course Type: Core Credit **Course Code: CS102**

Course Title : Database Management Systems

Teaching Scheme	No. of Credits	Examination Scheme
02 Hours / Week	2	IE : 15 Marks UE: 35 Marks

Prerequisites

- Basic Knowledge of file system, storing data in file system and Operations on sets

Course Objectives

- To understand the fundamental concepts of database.
- To understand user requirements and frame it in data model.
- To understand creations, manipulation and querying of data in databases.

Course Outcomes

On completion of the course, student will be able to–

- Solve real world problems using appropriate set, function, and relational models.
- Design E-R Model for given requirements and convert the same into database tables.
- Use SQL.

Course Contents

Chapter 1	**Introduction to DBMS**	**3 Hours**

1.1. Introduction
1.2. File system Vs DBMS
1.3. Levels of abstraction & data independence
1.4.Structure of DBMS (Roles of DBMS Users)
1.5. Users of DBMS Advantages of DBMS

Chapter 2	**Conceptual Design**	**11 Hours**

2.1. Overview of DB design process
2.2. Introduction to data models (E-R model, Relational model, Network model, Hierarchical model)
2.3. Conceptual design using ER data model (entities, attributes, entity sets, relations, relationship sets)
2.4. Constraints (Key constraints, Integrity constraints, referential integrity, unique constraint, Null/Not Null constraint, Domain, Check constraint, Mapping constraints)
2.5. Extended features – Specialization, Aggregation, Generalization
2.6. Pictorial representation of ER(symbols)
2.7. Structure of Relational Databases (concepts of a table)
2.8. DBMS Versus RDBMS
2.9. Case Studies on ER model

Chapter 3	**SQL**	**9 Hours**
3.1. Introduction to query languages 3.2. Basic structure 3.3. DDL Commands 3.4. DML Commands 3.5. Forms of a basic SQL query (Expression and strings in SQL) 3.6. Set operations 3.7. Aggregate Operators and functions 3.8. Date and String functions 3.9. Null values 3.10. Nested Subqueries 3.11 SQL mechanisms for joining relations (inner joins, outer joins and their types) 3.12 Views 3.13. Examples on SQL (case studies)		
Chapter 4	**Relational Database Design**	**7 Hours**
3.1. Introduction to Relational-Database Design (undesirable properties of a RDB design) 3.2. Functional Dependency(Basic concepts, F+, Closure of an Attribute set, Armstrong's axioms) 3.3. Concept of Decomposition 3.4. Desirable Properties of Decomposition (Lossless join, Lossy join, Dependency Preservation) 3.5. Concept of normalization, Normal Forms (1NF,2NF and 3NF), Examples 3.6 Keys Concept with Examples : Candidate Keys and Super Keys, Algorithm to find the super keys / primary key for a relation		
Reference Books:		
1. Database System Concepts, Henry F. Korth, Abraham Silberschatz, S.Sudarshan,ISBN:9780071289597,Tata McGraw-Hill Education 2. Database Management Systems ,RaghuRamakrishnan,ISBN:9780071254342,Mcgraw-hill higher Education 3. Database Management Systems, Raghu Ramakrishnan and Johannes Gehrke,McGraw-Hill Science/Engineering/Math; 3 edition, ISBN: 9780072465631 4. Database Systems, Shamkant B. Navathe, RamezElmasri,ISBN:9780132144988,PEARSON HIGHER EDUCATION 5. Beginning Databases with PostgreSQL: From Novice to Professional, Richard Stones, Neil Matthew, ISBN:9781590594780, Apress 6. PostgreSQL, Korry Douglas, ISBN:9780672327568, Sams 7. Practical PostgreSQL (B/CD),JohnWorsley, Joshua Drake,ISBN:9788173663925Shroff/O'reilly 8. Practical Postgresql , By Joshua D. Drake, John C Worsley **(**O'Reillypublications) 9**.** "An introduction to Database systems", Bipin C Desai, Galgotia Publications		

Semester- I
Paper - III

Course Type: Core Credit **Course Code:CS103**

Title : Practical course on Problem Solving using Computer and 'C' programming and Database Management Systems

Teaching Scheme	No. of Credits	Examination Scheme
3 Hrs / week	1.5	IE : 15 Marks UE: 35 Marks

Course Objectives

- To understand the program development life cycle.
- Solve simple computational problems using modular design and basic features of the 'C' language.
- Understand basic database management operations.
- Design E-R Model for given requirements and convert the same into database tables.

Course Outcomes:-

On completion of this course, students will be able to :

- Devise pseudocodes and flowchart for computational problems.
- Write, debug and execute simple programs in 'C'.
- Create database tables in postgreSQL.
- Write and execute simple, nested queries.

Guidelines :

Lab Book: The lab book is to be used as a hands-on resource, reference and record of assignment submission and completion by the student. The lab book contains the set of assignments which the student must complete as a part of this course.

Submission:

Problem Solving Assignments:

The problem solving assignments are to be submitted by the student in the form of a journal containing individual assignment sheets. Each assignment includes the Assignment Title, Problem statement, Date of submission, Assessment date, Assessment grade and instructors sign.

Programming Assignments:

Programs should be done individually by the student in the respective login. The codes should be uploaded on either the local server, Moodle, Github or any open source LMS. Print-outs of the programs and output may be taken but not mandatory for assessment.

DBMS Assignments:

For each problem/case study, the student must design the database model in the form of an E-R

diagram. Table design should be based on the same and must include proper constraints and integrity checks. The students have to create, populate the tables and then perform the activities specified in each of the assignments. A pool of databases will get created as student progresses through the assignments and these databases can be repeatedly used in subsequent assignments. A separate softcopy of the queries must be maintained for each assignment.

Assessment:

Continuous assessment of laboratory work is to be done based on overall performance and lab assignments performance of student. Each lab assignment assessment will be assigned grade/marks based on parameters with appropriate weightage. Suggested parameters for overall assessment as well as each lab assignment assessment include- timely completion, performance, innovation, efficient codes and good programming practices.

Operating Environment:

For 'C' Programming :
Operating system: Linux
Editor: Any linux based editor like vi, gedit etc.
Compiler : cc or gcc

For DBMS:
Operating System: Linux Operating system
DBMS: PostgreSQL
Language: SQL

Suggested List of Assignments:

A) Problem Solving and C programming:

Assignment 1.
Problem Solving using Pseudo code and Flowchart, Simple programs, Understanding errors and error handling.

Assignment 2.
Decision Making Control Structures.

Assignment 3.
Loop Control Structures

Assignment 4.
Functions (User Defined functions, Library functions and Recursion).

Assignment 5.
Arrays (1-D and 2-D).

B) Database Management Systems

Assignment 1.

To create simple tables with only the primary key constraint (as a table level constraint & as a field level constraint) (include all data types)

Assignment 2.

To create more than one table, with referential integrity constraint, PK constraint.

Assignment 3.

To create one or more tables with following constraints, in addition to the first two constraints (PK & FK)

a. Check constraint
b. Unique constraint
c. Not null constraint

Assignment 4.

To drop a table, alter schema of a table, insert / update / delete records using tables created in previous Assignments. (use simple forms of insert / update / delete statements)

Assignment 5.

To query the tables using simple form of select statement Select <field-list> from table [where <condition> order by <field list>] Select <field-list, aggregate functions > from table [where <condition> group by <> having <> order by <>]

Assignment 6.

To query table, using set operations (union, intersect)

Assignment 7.

To query tables using nested queries (use of 'Except', exists, not exists, all clauses

Assignment 8.

To create views.

Books: Laboratory handbook prepared by the University.

Semester- II
Paper - I

Course Type: Core Credit **Course Code: CS201**

Course Title : Advanced 'C' Programming

Teaching Scheme	No. of Credits	Examination Scheme
2 Hours / Week	2	IE : 15 Marks UE: 35 Marks

Prerequisites

- Problem Solving tools like algorithms, flowcharts and pseudocodes.
- Basic knowledge of 'C' language.

Course Objectives :-

- To study advanced concepts of programming using the 'C' language.
- To understand code organization with complex data types and structures.
- To work with files.

Course Outcomes:- Student will be able to :-

- Develop modular programs using control structures, pointers, arrays, strings and structures
- Design and develop solutions to real world problems using C.

Course Contents

Chapter 1	**Pointers**	**8 Hours**

1.1. Introduction to Pointers.
1.2. Declaration, definition, initialization, dereferencing.
1.3. Pointer arithmetic.
1.4. Relationship between Arrays & Pointers- Pointer to array, Array of pointers.
1.5. Multiple indirection (pointer to pointer).
1.6. Functions and pointers- Passing pointer to function, Returning pointer from function, Function pointer.
1.7. Dynamic memory management- Allocation(malloc(),calloc()), Resizing(realloc()), Releasing(free()).,
1.8. Memory leak, dangling pointers.
1.9. Types of pointers.

Chapter 2	**Strings**	**6 Hours**

2.1 String Literals, string variables, declaration, definition, initialization.
2.2 Syntax and use of predefined string functions
2.3 Array of strings.
2.4. Strings and Pointers
2.5. Command line arguments.

Chapter 3	Structures And Unions.	8 Hours

3.1. Concept of structure, definition and initialization, use of typedef.
3.2. Accessing structure members.
3.3. Nested Structures
3.4. Arrays of Structures
3.5. Structures and functions- Passing each member of structure as a separate argument, Passing structure by value / address.
3.6. Pointers and structures.
3.7. Concept of Union, declaration, definition, accessing union members.
3.8. Difference between structures and union.

Chapter 4	File Handling	6 Hours

4.1. Introduction to streams.
4.2. Types of files.
4.3. Operations on text files.
4.4. Standard library input/output functions.
4.5. Random access to files.

Chapter 5	Preprocessor	2 Hours

6.1. Role of Preprocessor
6.2. Format of preprocessor directive
6.3. File inclusion directives (#include)
6.4. Macro substitution directive, argumented and nested macro
6.5. Macros versus functions

Reference Books:

1. C: the Complete Reference, Schildt Herbert, 4th edition, McGraw Hill
2. A Structured Programming Approach Using C, Behrouz A. Forouzan, Richard F. Gilberg, Cengage Learning India
3. The 'C' programming language, Brian Kernighan, Dennis Ritchie, PHI
4. Programming in C ,A Practical Approach, Ajay Mittal , Pearson
5. Programming with C, B. Gottfried, 3rd edition, Schaum's outline Series, Tata McGraw Hill.
6. Programming in ANSI C, E. Balagurusamy, 7th Edition, McGraw Hill.

Semester- II
Paper - II

Course Type: Core Credit **Course Code: CS202**

Course Title : Relational Database Management Systems

Teaching Scheme	No. of Credits	Examination Scheme
2 Hours / Week	2	IE : 15 Marks UE: 35 Marks

Prerequisites

- Basic Knowledge of DBMS
- Knowledge of SQL Queries
- Basics of relational design
- Basics of ER model

Course Objectives

- To teach fundamental concepts of RDBMS (PL/PgSQL)
- To teach database management operations
- Be familiar with the basic issues of transaction processing and concurrency control
- To teach data security and its importance

Course Outcomes

On completion of the course, student will be able to–

- Design E-R Model for given requirements and convert the same into database tables.
- Use database techniques such as SQL & PL/SQL.
- Explain transaction Management in relational database System.
- Use advanced database Programming concepts

Course Contents

Chapter 1	**Relational Database Design Using PLSQL**	**8 Hours**

1.1 Introduction to PLSQL
1.2 PL/PgSqL: Datatypes, Language structure
1.3 Controlling the program flow, conditional statements, loops
1.4 Stored Procedures
1.5 Stored Functions
1.6 Handling Errors and Exceptions
1.7 Cursors
1.8 Triggers

Chapter 2	Transaction Concepts and concurrency control	10 hours

2.1 Describe a transaction, properties of transaction, state of the transaction.
2.2 Executing transactions concurrently associated problem in concurrent execution.
2.3 Schedules, types of schedules, concept of Serializability, Precedence graph for Serializability.
2.4 Ensuring Serializability by locks, different lock modes, 2PL and its variations.
2.5 Basic timestamp method for concurrency, Thomas Write Rule.
2.6 Locks with multiple granularity, dynamic database concurrency (Phantom Problem).
2.7 Timestamps versus locking.
2.8 Deadlock and deadlock handling - Deadlock Avoidance(wait-die, wound-wait), Deadlock Detection and Recovery (Wait for graph).

Chapter 3	Database Integrity and Security Concepts	6 Hours

3.1 Domain constraints
3.2 Referential Integrity
3.3 Introduction to database security concepts
3.4 Methods for database security
  3.4.1Discretionary access control method
  3.4.2Mandatory access control
  3.4.3. Role base access control for multilevel security.
3.5 Use of views in security enforcement.
3.6 Overview of encryption technique for security.
3.7 Statistical database security.

Chapter 4	Crash Recovery	4 Hours

4.1 Failure classification
4.2 Recovery concepts
4.3 Log base recovery techniques (Deferred and Immediate update)
4.4 Checkpoints, Relationship between database manager and buffer cache. Aries recovery algorithm.
4.5 Recovery with concurrent transactions (Rollback, checkpoints, commit)
4.6 Database backup and recovery from catastrophic failure

Chapter 5	Other Databases	2 Hours

5.1 Introduction to Parallel and distributed Databases
5.2 Introduction to Object Based Databases
5.3 XML Databases
5.4 NoSQL Database
5.5 Multimedia Databases
5.6 Big Data Databases

Reference Books:

1. Database System Concepts, By Silberschatz A., Korth H., Sudarshan S., 6th Edition, McGraw Hill Education
2. Database Management Systems, Raghu Ramakrishnan, Mcgraw-Hill Education
3. Database Systems, Shamkant B. Navathe, Ramez Elmasri, PEARSON HIGHER EDUCATION
4. Fundamentals of Database Systems, By: Elmasri and Navathe, 4th Edition Practical PostgreSQL O'REILLY
5. Database Management Systems,RaghuRamakrishnan and JohannesGehrke,McGraw-Hill Science/Engineering/Math; 3 edition, ISBN: 9780072465631
6. NoSQL Distilled, Pramod J. Sadalage and Martin Fowler, Addison Wesley
7. An Introduction to Database Systems", C J Date, Addison-Wesley
8. Database Systems : Concepts, Design and Application", S.K.Singh, Pearson, Education
9. NoSQL Distilled A Brief Guide to the Emerging World of Polyglot Persistence : by Pramod J. Sadalage, Martin Fowler, Addison-Wesley, Pearson Education, Inc.
10. MongoDB: The Definitive Guide , Kristina Chodorow, Michael Dirolf, O'Reilly Publications

Semester- II
Paper - III

Course Type: Core Credit **Course Code:CS203**

Title : Practical Course on Advanced 'C' Programming and Relational Dstabase Management Systems

Teaching Scheme	No. of Credits	Examination Scheme
3 Hours / week	1.5	IE : 15 Marks UE: 35 Marks

Course Objectives

- To solve real world computational problems.
- To perform operations on relational database management systems.

Course Outcomes:-

On completion of this course, students will be able to :

- Write, debug and execute programs using advanced features in 'C'.
- To use SQL & PL/SQL.
- To perform advanced database operations.

Guidelines :

Lab Book: The lab book is to be used as a hands-on resource, reference and record of assignment submission and completion by the student. The lab book contains the set of assignments which the student must complete as a part of this course.

Submission:

Programming Assignments:

Programs should be done individually by the student in respective login. The codes should be uploaded on either the local server, Moodle, Github or any open source LMS. Print-outs of the programs and output may be taken but not mandatory for assessment.

RDBMS Assignments:

For each problem/case study, the student must design the database model in the form of an E-R diagram. Table design should be based on the same and must include proper constraints and integrity checks. The students have to create, populate the tables and then perform the activities specified in each of the assignments. A separate softcopy of the table creation statements and queries must be maintained for each assignment.

Assessment

Continuous assessment of laboratory work is to be done based on overall performance and lab assignments performance of student. Each lab assignment assessment will be assigned grade/marks based on parameters with appropriate weightage. Suggested parameters for overall

assessment as well as each lab assignment assessment include- timely completion, performance, innovation, efficient codes and good programming practices.

Operating Environment:

For 'C' Programming :
Operating system: Linux
Editor: Any linux based editor like vi, gedit etc.
Compiler : cc or gcc

For DBMS:
Operating System: Linux Operating system
DBMS: PostgreSQL 11 and higher
Language: PL/SQL

Suggested List of Assignments:

A) Advanced C Programming:

Assignment 1.

Simple Pointers.

a) Pointer initialization and use of pointers.
b) Pointer Arithmetic.

Assignment 2.

Dynamic Memory Allocation.

Assignment 3.

String handling using standard library functions.

Assignment 4.

Structure and Unions.

Assignment 5.

File Handling.

Assignment 6.

C Preprocessors.

B) Relational Database Management Systems:

Assignment 1: Stored Procedure

1) A Simple Stored Procedure
2) A Stored Procedure with IN, OUT and IN/OUT parameter

Assignment 2: Stored Function

1) A Simple Stored Function
2) A Stored Function that returns
3) A Stored Function recursive

Assignment 3 : Cursors

1) A Simple Cursor
2) A Parameterize Cursor

Assignment 4 : Exception Handling

1) Simple Exception- Raise Debug Level Messages
2) Simple Exception- Raise Notice Level Messages
3) Simple Exception- Raise Exception Level Messages

Assignment 5 : Triggers

1) Before Triggers (insert, update, delete)
2) After Triggers (insert, update, delete)

Books: Laboratory handbook prepared by the University.

Savitribai Phule Pune University

(Formerly University of Pune)

Faculty of Science & Technology

F.Y.B.Sc. (Computer Science) Electronic Science

Choice Based Credit System Syllabus

To be implemented from Academic Year 2019-2020

Title of the Course: F.Y. B. Sc. Electronics of B. Sc.(Computer Science)

Preamble of the Syllabus:

The systematic and planned curricula for first year and second year Electronics shall motivate and encourage the students for pursuing higher studies in Electronics and Computer and for becoming an entrepreneur.

Introduction:

At **first year of under-graduation:** The basic topics related to the fundamentals of electronics are covered. Since electronics is an inherent part of technological advancements, the practical course is intended to achieve the basic skills required for computer science students.

At **second year under-graduation**: The level of the theory and practical courses shall be one step ahead of the first year B.Sc. Courses based on content of first year shall be introduced. Concepts of Communication, embedded system, Internet of things will be introduced at this stage.

Objectives:

- To provide knowledge of technological and practical aspects of electronics.
- To familiarize with current and recent technological developments.
- To enrich knowledge through activities such as industrial visits, seminars, projects etc.
- To train students in skills related to computer industry and market.
- To create foundation for research and development in Electronics/ Computer.
- To develop analytical abilities towards real world problems
- To help students to build-up a progressive and successful career.

Titles of Papers and Scheme of Study

F. Y. B. Sc. Electronic Science of B. Sc.(Computer Science)

SEM	Paper / subject code	Paper	Paper Title	Credits	Lectures/ practical per week	Evaluation		
						C.A.	U.E.	Total
I	ELC-111	I	Semiconductor Devices and Basic Electronic Systems	2	2	15	35*	50
	ELC-112	II	Principles of Digital Electronics	2	2	15	35*	50
	ELC-113	III	Practical	1.5	3	15	35**	50
II	ELC-121	I	Instrumentation System	2	2	15	35*	50
	ELC-122	II	Basics of Computer Organisation	2	2	15	35*	50
	ELC-123	III	Practical	1.5	3	15	35**	50

Detail Syllabus:

SEMESTER I

Paper I

ELC-111: Semiconductor Devices and Basic Electronic Systems

Objective :

1. To study various types of semiconductor devices
2. To study elementary electronic circuits and systems

Term I

Unit 1. Semiconductor Diodes (5)

Semiconductor, P and N type semiconductors, Formation of PN junction diode, it's working, Forward and Reverse bias characteristics, Zener diode: working principle, breakdown mechanism and characteristics, Working principle of Light emitting diode, photo diode, optocoupler, Solar cell working principle and characteristics

Unit 2. Bipolar Junction Transistor (BJT) (6)

Bipolar Junction Transistor (BJT) symbol, types, construction, working principle, Transistor amplifier configurations - CB, CC (only concept), CE configuration: input and output characteristics, Concept of Biasing, Potential Divider bias, Transistor as amplifier (Concept of Gain and Bandwidth expected), Transistor as a switch.

Unit 3. MOSFET (4)

MOSFET types, Working principle, Characteristics, Application of MOSFET as a Switch.

Unit 4. POWER SUPPLY (6)

Block Diagram of Regulated Power Supply, Rectifiers (half wave, full wave, Bridge), rectifier with capacitor-filter, Use of Zener Diode as a Voltage Regulator, IC 78XX and 79XX as regulator, Block Diagram and explanation of SMPS, Block diagram and explanation of UPS

Unit 5. OSCILLATORS (4)

Barkhauson Criteria, Low frequency Wein-bridge oscillator, High frequency crystal oscillator, IC 555 as astable multivibrator used as square wave generator / clock

Unit 6. DATA CONVERTERS (5)

Need of Digital to Analog converters, parameters, weighted resistive network, R-2R ladder network, need of Analog to Digital converters, parameters, Flash ADC, successive approximation ADC.

Text/reference books :

1. Electronic Devices and Circuits I – T. L. Floyd- PHI Fifth Edition
2. Principles of Analog Electronics by A.P.Malvino
3. Sedha R.S., A Text Book Of Applied Electronics, S.Chand& CompanyLtd

SEMESTER I

PAPER II

ELC 112: Principles of Digital Electronics

Objectives:

1. To get familiar with concepts of digital electronics
2. To learn number systems and their representation
3. To understand basic logic gates, Boolean algebra and K-maps
4. To study arithmetic circuits, combinational circuits and sequential circuits

Unit 1: Number Systems and Digital codes (8)

Introduction to Decimal, Binary and Hexadecimal Number Systems And their inter-conversions, Binary addition and binary subtraction using 2's complement, Binary Coded Decimal Number, Gray Codes, Gray to Binary and Binary to Gray conversion, Alphanumeric representation in ASCII codes.

Unit 2: Logic gates and Boolean Algebra (12)

Logic gates (NOT, AND,OR,NAND,NOR,XOR gate) With their symbol, Boolean Equation and truth table, Universal gates,
Introduction of CMOS and TTL logic families, Parameters like power supply, propagation delay, noise margin, fan in, fan out, Power Dissipation (TTL NAND, inverter, CMOS gates etc not expected)
Boolean algebra rules and Boolean Laws, De Morgan's theorem, Simplifications of Logic equations using Boolean algebra rules, Min terms, Max terms, Boolean expression in SOP and POS form, conversion of SOP/POS expression to its standard SOP/POS form Introduction to Karnaugh Map, problems based on the same (Upto 4 variables), Digital Designing using K Map for: Gray to Binary and Binary to Gray conversion,

Unit 3: Combinational Circuits (10)

Half adder and full adder, 4-Bit Universal adder/ Subtractor, Applications of Ex-OR gates as parity checker and generator, Study of Multiplexer (4:1) and Demultiplexer (1:4), Encoders - Decimal/ BCD to binary, 3X4 matrix keyboard encoder, priority encoder, Decoder- BCD to seven segment decoder, IC 74138 and IC 7447, Digital comparator,

Reference Books:

1. Digital Fundamentals: Floyd T.M., Jain R.P., Pearson Education
2. Digital Electronics: Jain R.P., Tata McGraw Hill
3. Digital Principles and Applications: Malvino Leach, Tata McGraw-Hill
4. M.Morris Mano, " Digital Design " 3rdEdition, PHI, NewDelhi.
5. Ronald J. Tocci. "Digital Systems-Principles and Applications" 6/e. PHI. New Delhi. 1999.(UNITS I to IV)
6. G.K.Kharate-Digital electronics-oxford university press
7. S.Salivahana & S.Arivazhagan-Digital circuits and design
8. 5. Fundamentals of Digital Circuits by AnandKumar

SEMESTER I

Paper III

ELC-113: Practical Course

The practical course consists of 10 experiments out of which two will be preparatory experiments. These will be evaluated in an oral examination for 15% marks at internal and external semester examination.

Preparatory Experiments (Minimum 2/3)

1.Identification of Components (Passive and Active) /Tools

- Minimum 10 different types of components must be given
- Identification based on visual inspection / data sheets be carried out

2.Use of Digital Multimeters

- Measurement of AC/DC voltage and Current – on different ranges
- Measurement of R &C
- Testing of Diodes &Transistors
- Measurement of β.
- Use of Multimeter in measurement of Variation of Resistance of LDR.
- Thermister

3.Study of Signal Generator & CRO

- Understand how to use Signal Generator, CRO
- Study of front panel controls of both
- Measurement of amplitude and frequency of Sine/Square waveform
- Measurement of Phase with the help of RC circuit
- Demonstration of Lissajous figures
- Demonstrate the use of Component testing facility

Semester I List of Practicals (Minimum 08, 4 from each group)
Group A

1. Study of breakdown characteristics and voltage regulation action of Zener diode, Use of 3 Pin Regulator IC 78XX & 79XX as a regulator.
2. Study of half wave, full wave and bridge rectifier circuit with and without capacitor filters.
3. Study of Opto-coupler using LED and Photodiode (Package may be used here), it's application as burglar alarm.
4. Study of Bipolar Junction Transistor as a Switch.
5. Study of Single stage RC coupled CE transistor Amplifier (Gain/ Bandwidth).
6. Study of output and transfer characteristics of MOSFET.
7. Study of SMPS.
8. Study of IC 555 as an Astable Multivibrator.
9. Study of 4-Bit R-2R Ladder Network type of DAC.
10. Study of 3-bit Flash ADC.

Group B

11. Study of Logic Gates (Verification of Truth tables)
12. Study of Binary to Gray & Gray to Binary Converter (K- Map based design).
13. Study of Half Adder and Full Adder using Logic Gates.
14. Use of Ex-OR as a 4-bit Parity Checker and Generator.
15. Study of Decimal to BCD (Binary) Converter.
16. Study of Multiplexer and Demultiplexer (4:1 & 1:4).
17. Study of 3X4 matrix Keyboard Encoder / Priority Encoder.
18. Study of BCD to Seven Segment Display using IC 74138 and IC 7447.

SEMESTER II

PAPER I

ELC 121: Instrumentation System

Unit 1: Introduction to Instrumentation System (4)

Block diagram of Instrumentation system, Definition of sensor, transducer and Actuators, Classification of sensors: Active and passive sensors. Specifications of sensors: Accuracy, range, linearity, sensitivity, resolution, reproducibility.

Unit 2: Sensors and Actuators (10)

Temperature sensor (Thermistor, LM-35), optical sensor (LDR), Passive Infrared sensor (PIR), Tilt Sensor, ultrasonic sensor, Motion sensor, Image Sensor, Actuators : DC Motor, stepper motor

Unit 3: Smart Instrumentation System and Smart Sensors (5)

Block diagram of Smart Instrumentation system, Concept of smart sensor, Film sensors, nanosensor

Unit 4: OPAMP as signal Conditioner (11)

Concept, block diagram of Op amp, basic parameters (ideal and practical): input and output impedance, bandwidth, differential and common mode gain, CMRR, slew rate, IC741/ LM324, Concept of virtual ground, Op amp as inverting and non inverting amplifier, Unity gain follower, Opamp as adder, substractor, Op amp as current to voltage and voltage to current convertor, Voltage to frequency converter, Op amp as comparator, Problems based on above Op Amp applications.

Reference Books:

1. Sensors and Transducers, by: D. Patranabis, pHI publication, 2nd Edition
2. Sensors and Transducers, by : Prof A.D.Shaligram
3. Op Amp and Linear Integrated Circuits By Ramakant Gaykwad

SEMESTER II

PAPER II

ELC 122 : Basics of Computer Organisation

Unit 1: Flip-flops (4)

RS Flip Flop using NAND gate, clocked RS Flip Flop, D Latch, J K Flip Flop

Unit 2: Shift registers and Counters (8)

Shift registers - SISO, SIPO, PISO, PIPO shift registers, Ring Counter using D Flip flop.

Counters -Synchronous and Asynchronous type, 3-bit Up, Down and Up-Down counter, Concept of modulus Counters

(Timing Diagram of all above are expected)

Unit 3: Basics of Computer System (10)

Basic Computer Organization, Concept of Address Bus, Data Bus, Control Bus. CPU Block Diagram and Explanation of each block, Register based CPU organization, Concept of Stack & its organization, I/O organization: need of interface, block diagram of general I/O interface

Unit 4: Memory Organization (08)

Memory Architecture, Memory hierarchy, Types of Memories, Data Read/ Write process, Vertical and Horizontal Memory Expansion, Role of Cache memory, Virtual Memory.

Reference Books:

1. Digital Fundamentals: Floyd T.M., Jain R.P., Pearson Education
2. Digital Electronics: Jain R.P., Tata McGraw Hill
3. Digital Logic and Computer Design : M. Morris Mano, Pearson Education
4. Computer Organization and Architecture, William Stallings, Pearson, 10th Edi.

SEMESTER II

Paper III

ELC-123: Practical Course

The practical course consists of 10 experiments out of which one will be activity equivalent to 2 practical. Activity will carry 15% marks at internal and external semester examination. Activity can be any one of the following :

1. Hobby projects
2. Industrial visit / live work experience
3. PCB Making
4. Market Survey of Electronic Systems
5. Circuit Simulations and CAD tools

GROUP A (Minimum 4/8)

1. To study temperature sensor LM 35
2. Use of LDR to control light intensity
3. Study of PIR and tilt sensor.
4. Study of stepper motor.
5. Use of OPAMP as comparator and its use in DC motor driving.
6. Build and test Inverting and non inverting amplifier using OPAMP.
7. Build and test adder and subtractor circuits using OPAMP.
8. Build and test voltage to frequency converter

GROUP B (Minimum 4/8)

1. Study of RS, JK and D flip flops using NAND gates
2. Study of Four bit ALU
3. Study of asynchronous Up/Down Counter
4. Study of decade counter IC circuit configurations
5. Study of 4-bit SISO Shift register and it's use as Ring Counter
6. Study of read and write action of RAM (using IC 2112/4 or equivalent).
7. Study of Diode Matrix ROM
8. Study of Computer hardware system

Savitribai Phule Pune University

(Formerly University of Pune)

Three Year B.Sc. Degree Program in Mathematics

(Faculty of Science & Technology)

F.Y.B.Sc. Mathematics (Computer Science)

Choice Based Credit System Syllabus

To be implemented from Academic Year 2019-2020

Title of the Course : B.Sc. Mathematics (Computer Science)

Preamble:

Savitribai Phule Pune University has decided to change the syllabi of various faculties from June,2019. Taking into consideration the rapid changes in science and technology and new approaches in different areas of mathematics and related subjects board of studies in mathematics with concern of teachers of mathematics from different colleges affiliated to Savitribai Phule Pune University has prepared the syllabus of F. Y. B.Sc. (Computer Science) Mathematics. To develop the syllabus the U.G.C. Model curriculum is followed.

Aims:

(i) Give the students a sufficient knowledge of fundamental principles, methods and a clear perception of innumerous power of mathematical ideas and tools and know how to use them by modeling ,solving and interpreting.
(ii) Reflecting the broad nature of the subject and developing mathematical tools for continuing further study in various fields of science and technology.
(iii) Enhancing students' overall development and to equip them with mathematical modeling abilities, problem solving skills , creative talent and power of communication necessary for various kinds of employment .
(iv) Enabling students to develop a positive attitude towards mathematics as an interesting and valuable subject of study.

Objectives:

(i) A student should be able to recall basic facts about mathematics and should be able to display knowledge of conventions such as notations, terminology and recognize basic geometrical figures and graphical displays , state important facts resulting from their studies.
(ii) A student should get a relational understanding of mathematical concepts and concerned structures, and should be able to follow the patterns involved, mathematical reasoning.
(iii) A student should get adequate exposure to global and local concerns that explore them many aspects of Mathematical Sciences.
(iv) A student be able to apply their skills and knowledge ,that is, translate information presented verbally into mathematical form, select and use appropriate mathematical formulae or techniques in order to process the information and draw the relevant conclusion.
(v) A student should be made aware of history of mathematics and hence of its past, present and future role as part of our culture.

Course Outcome:

Upon successful completion of this course, the student will be able to:

i) A students should be able to work with graphs and identify certain parameters and properties of the given graphs.
ii) A students should be able to perform certain algorithms, justify why these algorithms work, and give some estimates of the running times of these algorithms.
iii) A students should be able to solve basic exercises of the type: given a graph with properties *X*, prove that the graph also has property *Y*.
iv) A students should develop an appreciation for the literature on the subject and be able to read and present results from the literature.
v)A students should be able to write cohesive and comprehensive solutions to exercises and be able to defend their arguments.

Structure of the course:-

	Semester - I		Semester -II	
Paper I	**MTC-111**	**Matrix Algebra**	**MTC-121**	**Linear Algebra**
Paper II	**MTC-112**	**Discrete Mathematics**	**MTC-122**	**Graph Theory**
Paper III	**MTC-113**	**Mathematics Practical**	**MTC-123**	**Mathematics Practical**

Proposed Structure of S. Y. B. Sc. Mathematics (Computer Science) Courses:

	Semester - III		Semester -IV	
Paper I	**MT-231**	**Group Theory**	**MT-241**	**Calculus**
Paper II	**MT-232**	**Numerical Analysis**	**MT-242**	**Operations Research**
Paper III	**MT-233**	**Mathematics Practical**	**MT-243**	**Mathematics Practical**

All three above courses are compulsory.

Equivalence of Previous syllabus along with new syllabus:

	Old course	New Course
Paper I	**MTC-101 : Discrete Mathematics**	**MTC-111: Matrix Algebra and MTC-121 : Linear Algebra**

Paper II	**MTC-102 : Algebra and Calculus**	**MTC-112 : Discrete Mathematics and MTC-122 : Graph Theory**
Paper III	**MTC-103 : Mathematics Practical**	**MTC – 113 : Mathematics Practical and MTC – 113 : Mathematics Practical**

Detailed Syllabus:

Semester - I

MTC-111: Matrix Algebra

Unit 1 : Introduction (4 lectures)

1.1 Matrix Operations
1.2 The Inverse of a Matrix
1.3 Characterization of invertible matrices

Unit 2 : Linear Equations in Linear Algebra-I (12 lectures)

2.1 System of Linear equations
2.2 Row reduction and echelon forms
2.3 Vector equations
2.4 The matrix equation Ax=b
2.5 Solution sets of linear systems

Unit 3 : Linear Equations in Linear Algebra -II (12 lectures)

3.1 Partitioned Matrices
3.2 Matrix factorization [Lu decomposition]
3.3 Linear Independence
3.4 Introduction to linear transformation
3.5 The matrix of linear transformation
3.6 Subspaces of R^n
3.7 Dimension and Rank

Unit 4 : Determinants (8 lectures)

4.1 Introduction to determinants
4.2 Properties of determinants

4.3 Cramer's rule, Volume and linear transformations

Text Book : Linear Algebra and its Applications, David C Lay, Steven R. Lay, Judi J. MacDonald Pearson Publication,2016, Fifth Edition.

Unit 1: Chapter 2: Sec. 2.1, 2.2, 2.3
Unit 2: Chapter 1: Sec. 1.1, 1.2, 1.3, 1.4, 1.5
Unit 3: Chapter 2: Sec. 2.4, 2.5,2.8, 2.9, Chapter 1: 1.7, 1.8, 1.9
Unit 4: Chapter 3: Sec. 3.1, 3.2, 3.3

Reference Books :

1. Elementary Linear Algebra with supplemental Applications,Howard Anton and others ,Wiley Student Edition.
2. Matrix and Linear Algebra (aided with MATLAB),KantiBhushanDatta, Eastern Economic Edition.

MTC 112: Discrete Mathematics

UNIT 1 : LOGIC (7 Lectures)

1.1 Revision : Propositional Logic, Propositional Equivalences.
1.2 Rules of Inference : Argument in propositional Logic, Validity Argument(Direct and Indirect methods) Rules of Inference for Propositional Logic, Building Arguments.
1.3 Predicates and Quantifiers : Predicate, n-Place Predicate or ,n-ary Predicate, Quantification and Quantifiers, Universal Quantifier, Existential Quantifier, Quantifiers with restricted domains, Logical Equivalences involving Quantifiers.

Unit 2 : Lattices and Boolean Algebra (13 Lectures)

2.1 Relations, types of relations, equivalence relations, Partial ordering relations
2.2 Digraphs of relations, matrix representation and composition of relations.
2.3 Transitive closure and Warshall's Algorithm
2.3 Poset, Hasse diagram.
2.4 Lattices, Complemented lattice, Bounded lattice and Distributive lattice.
2.5 Boolean Functions : Introduction, Boolean variable, Boolean Function of degree n, Boolean identities, Definition of Boolean Algebra.
2.6 Representation of Boolean Functions : Minterm, Maxterm Disjunctive normal form, Conjunctive normal Form.

Unit 3 : Counting Principles (7 Lectures)

3.1 Cardinality of Set : Cardinality of a finite set.
3.2 Basics of Counting : The Product Rule, The Sum Rule, The Inclusion- Exclusion Principle.
3.3 The Pigeonhole Principle: Statement, the Generalized Pigeonhole Principle, Its Applications.

3.4 Generalized Permutations and Combinations : Permutation and
3.5 Combination with Repetitions, Permutations with Indistinguishable Objects

Unit 4: Recurrence Relations (9 Lectures)

4.1 Recurrence Relations: Introduction, Formation.
4.2 Linear Recurrence Relations with constant coefficients.
4.3 Homogeneous Solutions.
4.4 Particular Solutions.
4.5 Total Solutions.

TextBooks:
1. Discrete Mathematics and its applications, by Kenneth Rosen, Tata McGraw Hill, Seventh Edition.
2. Discrete Mathematical Structures, by Kolman, Busby, Ross, Rehman, Prentice Hall,
3. Elements of Discrete Mathematics, by C. L. Liu, Tata McGraw Hill,

Unit 1: Text Book 1: Chapter 1: Sec. 1.1, 1.2, 1.3, 1.4, 1.5
Unit 2: Text Book 2: Chapter 6: Sec. 6.1, 6.2, 6.3, 6.4, 6.5
Unit 3: Text Book 1: Chapter 2: Sec. 2.1, Chapter 5: Sec.5.1, 5.2, 5.3
Unit 4: Text Book 3: Chapter 10: Sec. 10.1, 10.2, 10.3, 10.4, 10.5, 10.6

MTC 113: Mathematics Practical

(Practical based on the applications of articles in MTC-111 and MTC - 112)

In Semester-I, we should conduct 3 written practical and 3 practical on maxima software for each paper MTC -111 and MTC -112.

List of Practical

Practical 1 : Problems on Unit 1 and 2 (Written) from MTC-111.
Practical 2 : Problems on Unit 3 (Written) from MTC-111.
Practical 3 : Problems on Unit 4 (Written) from MTC-111.
Practical 4 :Introduction to maxima software for MTC-111.
Practical 5 : Problems on unit 1 and unit 2 from MTC-111using maxima software.
Practical 6 : Problems on Unit 3 and Unit 4 from MTC-111using maxima software.
Practical 7: Problems on Unit 1 and Unit 2(Written) from MTC-112.
Practical 8 : Problems on Unit 3 (Written) from MTC-112.
Practical 9 : Problems on Unit 4(Written) from MTC-112.
Practical 10 :Introduction to maxima software for MTC-112.
Practical 11 : Problems on unit 1 and unit 2 from MTC-112 using maxima software.
Practical 12 : Problems on Unit 3 and Unit 4 from MTC-112 using maxima software.

Note:

1. The soft copy of practical on maxima software will be prepared and provided by the Board of Studies in mathematics.
2. Practical on maxima software can be performed on computer and android mobiles.
3. Android mobiles are allowed for practical examination on maxima software.
4.Practical examination of 25 marks on written problems, 10 marks for problems on maxima software (5 marks for writing syntax and 5 marks to perform the same on android mobile or computer).

Semester -II

MTC-121: Linear Algebra

Unit 1: Vector Spaces **(10 lectures)**

1.1 Vector spaces and subspaces
1.2 Null spaces, column spaces and linear tranformations.
1.3 Linearly independent sets : Bases
1.4 Coordinate systems
1.5 The dimension of a vector space
1.6 Rank

Unit 2: Eigen values and Eigen vectors **(10 lectures)**

2.1 Eigen values and Eigen vectors
2.2 The characteristic equation
2.3 Diagonalization
2.4 Eigen vectors and Linear transformations

Unit 3:Orthogonality and Symmetric Matrices **(10 lectures)**

3.1 Inner product, length and orthogonality
3.2 Orthogonal sets
3.3 Orthogonal Projections
3.4 Diagonalization of Symmetric Matrices
3.5 Quadratic forms

Unit 4: The Geometry of vector spaces **(6lectures)**

4.1 Affine combinations
4.2 Affine independence
4.3 Convex combinations

Text Book :

Linear Algebra and its Applications (5th Edition) David C Lay, Steven R. Lay, Judi J. MacDonaldPearson Publication, Fifth Edition, 2016.

Unit 1:Chapter 4: Sec.4.1, 4.2, 4.3,4.4, 4.5, 4.6
Unit 2: Chapter 5: Sec. 5.1, 5.2, 5.3, 5.4
Unit 3: Chapter 6: Sec. 6.1, 6.2, 6.3, Chapter 7: 7.1,7.2
Unit 4: Chapter 8:Sec. 8.1, 8.2*,8.3
*From section 8.2 omit Barycentric coordinates.

Reference Books:

1. Elementary Linear Algebra with supplemental Applications, by Howard Anton and others,Wiley Student Edition, Fourth edition.
2. Matrix and Linear Algebra (aided with MATLAB), byKantiBhushanDatta, Eastern Economic Edition, Fourth edition.

MTC-122: Graph Theory

Unit 1: An Introduction to graph (10 lectures)

1.1. Definitions, Basic terminologies and properties of graph, Graph models.
1.2. Special types of graphs, basic terminologies, properties and examples of directed graphs .Types of diagraphs.
1.3. Some applications of special types of graph.
1.4. Matrix representation and elementary results, Isomorphism of graphs.

Unit 2: Connected graph (8 lectures)

2.1. Walk, trail, path, cycle, elementary properties of connectedness. Counting paths between vertices (by Warshall's algorithm).
2.2. Cut edge (Bridge), Cut vertex, cut set, vertex connectivity, edge connectivity, and Properties.
2.3. Shortest path problem, Dijkstra's algorithm.

Unit 3. Euler and Hamilton path. (8 lectures)

3.1. The Konigsberg bridge problem, Euler trail, path, circuit and tour, elementary properties and Fleury's algorithm.
3.2. Hamilton path, circuit, elementary properties and examples.
3.3. Introduction of Travelling salesman problem, Chinese postman problem.

Unit 4. Trees (10 lectures)

4.1. Definitions, basic terminologies, properties and applications of trees.
4.2. Weighted graph, definition and properties of spanning tree, shortest spanning tree, Kruskal's algorithm, Prim's algorithm.

4.3. M-ary tree, binary tree, definitions and properties, tree traversal: preorder, inorder, postorder, infix, prefix, postfix notations and examples.

Text Book:

Kenneth Rosen, Discrete Mathematics and its applications, Tata McGraw Hill, Seventh Edition.

Unit 1: Chapter 8: Sec. 8.1, 8.2, 8.3
Unit 2: Chapter 8: Sec. 8.4
Unit 3: Chapter 8: Sec. 8.5, 8.6
Unit 4: Chapter 9: Sec. 9.1,9.2,9.3,9.4,9.5.

Reference Books:

1. John Clark and Derek Holton, A first look at Graph theory, Allied Publishers.
2. NarsinghDeo, Graph Theory with applications to computer science and engineering, Prentice Hall.
3. C.L.Liu, Elements of Discrete Mathematics, Tata McGraw Hill, Fourth edition
4. Douglas B. West, Introduction to Graph Theory, Pearson Education, second edition.

MTC 123: Mathematics Practical

(Practical based on the applications of articles in MTC- 121 and MTC- 122)

In Semester- II, we should conduct 4 written practical and 2 practical on maxima software for each paper MTC-121 and MTC-122.

List of Practical

Practical 1 : Problems on Unit 1 (Written) from MTC-121.
Practical 2 : Problems on Unit 2 (Written) from MTC-121.
Practical 3 : Problems on Unit 3(Written) from MTC-121.
Practical 4 :Problems on Unit 4(Written) from MTC-121.
Practical 5 : Problems on unit 1 and unit 2 from MTC-121using maxima software.
Practical 6 : Problems on Unit 3 and Unit 4 from MTC-121using maxima software.
Practical 7: Problems on Unit 1 (Written) from MTC-122.
Practical 8 : Problems on Unit 2 (Written) from MTC-122.
Practical 9 : Problems on Unit 3 (Written) from MTC-122.
Practical 10 :Problems on Unit 4 (Written) from MTC-122.
Practical 11 : Problems on unit 1 and Unit 2 from MTC-122 using maxima software.
Practical 12: Problems on Unit 3 and Unit 4 from MTC-122 using maxima software.

Note:

1 The soft copy of practical on maxima software will be prepared and provided by the Board of Studies in mathematics.
2. Practical on maxima software can be performed on computer and android mobiles.
3. Android mobiles are allowed for practical examination on maxima software.
4.Practical examination 25 marks on written problems, 10 marks for problems on maxima software (5 marks for writing syntax and 5 marks to perform the same on android mobile or computer).

Modalities For Conducting The Practical and The Practical Examination:

1) There will be one 3 hour practical session for each batch of 15 students per week.

2) The College will conduct the Practical Examination at least 15 days before the commencement of the Main Theory Examination. The practical examination will consist of written examination of 20 marks, 10 marks on maxima software and oral examination of 05 marks.
3) There will be no external examiner, the practical exam will be of the duration of 3 hours.
4) The subject teacher will set a question paper based on pattern as follows:

Q1. Any 2 out of 4 each question of 5 marks on paper - I.
Q2.Any 2 out of 4 each question of 5 marks on paper - II.
Q3. (a) Any 1 out of 2 each question of 5 marks on maxima software from paper – I.
(b) Any 1 out of 2 each question of 5 marks on maxima software from paper – II.

5) Each student will maintain a journal to be provided by the college.
7) The internal 15 marks will be given on the basis of journal prepared by student and the cumulative performance of student at practical.

8) It is recommended that concept may be illustrated using computer software maxima andgraphing calculators wherever possible.
9) Study tours may be arranged at places having important mathematical institutes or historical places.

10) **Special Instruction:**

a) There should be well equipped mathematics practical laboratory of size 20 X 20 sq. fts containing at least 10 computers.
b) Examiners should set separate question papers, solutions and scheme of marking for each batch and claim the remuneration as per rule.
c) Before starting each practical necessary introduction, basic definitions, intuitive inspiring ideas and prerequisites must be discussed**.**

Savitribai Phule Pune University

(Formerly University of Pune)

Faculty of Science & Technology

F.Y.B.Sc. (Computer Science) Statistics

Choice Based Credit System Syllabus

To be implemented from Academic Year 2019-2020

Title of the Course: B. Sc. (Computer Science) STATISTICS

Preamble of the Syllabus:

Statistics is a branch of science that can be applied practically in every walk of life. Statistics deals with any decision making activity in which there is certain degree of uncertainty and Statistics helps in taking decisions in an objective and rational way. The student of Statistics can study it purely theoretically which is usually done in research activity or it can be studied as asystematic collection of tools and techniques to be applied in solving a problem inreal life.

In last 15 to 20 years, computers are playing very crucial role in the society. Theuse of computers has horizontally spread and also penetrated vertically in thesociety. It has become a part and parcel of common man. Thus there is a hugedemand for computer education.
The University of Pune had done a pioneering work in this area and Three year degree course B. Sc. (Computer Science) of University of Pune is very popular among the student community and I. T. Industry. This course covers various subjects which are required directly or indirectly forbecoming computer professional. Statistics is one such important subject which is required and is extensively used in a vast spectrum of computer based applications. Data Mining and Warehousing, Big Data Analytics, Theoretical Computer Science, Reliability of a computer Program or Software, Machine Learning, Artificial Intelligence, Pattern Recognition, Digital Image Processing, Embedded Systemsare just few applications to name where Statistics can be extensively used.

Introduction: The syllabus of Statistics for First Year of this course covers basic concepts and terminology in Statistics and covers basic tools and methodsrequired for data analysis. The teachers teaching this syllabus and students should give emphasis on understanding the concepts and ability to apply statistical tools and techniques and not on the theoretical discussion. It isexpected that at the end of the course, a student should be well equipped tolearn and apply acquired techniques in computer based applications.

Structure of the Subject

Structure of the subject and the pattern of examination and question papers are as specified below.

Structure of F. Y. B. Sc. (Computer Science)Statistics

Semester	Paper code	Paper	Paper title	credits	Marks		
					CIA	ESE	Total
1	**CSST 111**	**I**	Descriptive Statistics I	**2**	**15**	**35**	**50**
	CSST 112	**II**	Mathematical Statistics	**2**	**15**	**35**	**50**
	CSST113	**III**	Statistics Practical Paper I	**1.5**	**15**	**35**	**50**
2	**CSST121**	I	Methods of Applied Statistics	**2**	**15**	**35**	**50**
	CSST122	**II**	Continuous Probability Distributions and Testing of Hypothesis	**2**	**15**	**35**	**50**
	CSST123	**III**	Statistics Practical Paper II	**1.5**	**15**	**35**	**50**

Semester I

Paper-I

CSST 111 :Descriptive Statistics

No. of Credits :2No. of lectures: 40

TOPICS/CONTENTS:

UNIT1: Data Condensation and Presentation of Data (9L)

1.1 Definition, importance, scope and limitations of statistics.

1.2 Data Condensation: Types of data (Primary and secondary), Attributes and variables, discrete and Continuous variables.

1.3 Graphical Representation: Histogram,Ogive Curves, Steam and leaf chart. [Note: Theory paper will contain only procedures. Problems to be included in practical]

1.4 Numerical problems related to real life situations.

UNIT2: Descriptive Statistics(14L)

2.1 Measures of central tendency:Concept of central tendency, requisites of good measures of central tendency.

2.2 Arithmetic mean: Definition, computation for ungrouped and grouped data, properties of arithmetic mean (without proof) combined mean, weighted mean, merits and demerits.

2.3 Median and Mode: Definition, formula for computation for ungrouped and grouped data, graphical method, merits and demerits. Empirical relation between mean, median and mode (without proof)

2.4 Partition Values: Quartiles, Box Plot.

2.5 Concept of dispersion, requisites of good measures of dispersion, absolute and relative measures of dispersion.

2.6 Measures of dispersion : Range and Quartile Deviation definition for ungrouped and grouped data and their coefficients, merits and demerits,

Variance and Standard deviation: definition for ungrouped and grouped data, coefficient of variation, combined variance & standard deviation, merits and demerits.

2.7 Numerical problems related to real life situations.

UNIT3: Moments, Skewness and Kurtosis (10L)

3.1 Concept of Raw and central moments: Formulae for ungrouped and grouped data (only first four moments), relation between central and raw moments upto fourth order. (without proof)

3.2 Measures of Skewness: Types of skewness, Pearson's and Bowley's coefficient of skewness, Measure of skewness based on moments.

3.3 Measure of Kurtosis: Types of kurtosis, Measure of kurtosis based on moments.

3.4 Numerical problems related to real life situations

UNIT4:Theory of Attributes (7L)

4.1 Attributes: Concept of a Likert scale, classification, notion of manifold classification, dichotomy, class- frequency, order of a class, positive classfrequency, negative class frequency, ultimate class frequency, relationship among different class frequencies (up to two attributes), 4.2 Consistency of data upto 2 attributes.

4.3 Concepts of independence and association of two attributes.

4.4 Yule's coefficient of association (Q), $-1 \leq Q \leq 1$, interpretation.

References:

1. Statistical Methods, George W. Snedecor, William G, Cochran, John Wiley &sons
2. Programmed Statistics, B.L. Agarwal, New Age International Publishers.
3. Modern Elementary Statistics,Freund J.E. 2005, PearsonPublication
4. Fundamentals of Applied Statistics(3rd Edition), Gupta and Kapoor, S.Chand and Sons, New Delhi, 1987.
5. An Introductory Statistics ,Kennedy and Gentle
6. Fundamentals of Statistics, Vol. 1,Sixth Revised Edition,Goon, A. M., Gupta, M. K. and Dasgupta, B. (1983). The World Press Pvt. Ltd., Calcutta

Semester I

Paper-II

CSST 112 :Mathematical Statistics

No. of Credits : 2 No. of lectures: 40

TOPICS/CONTENTS:

UNIT 1:Theory of Probability (10L)

1.1 Counting Principles, Permutation, and Combination.

1.2 Deterministic and non-determination models.

1.3 Random Experiment, Sample Spaces (Discrete and continuous)

1.4 Events: Types of events, Operations on events.

1.5 Probability - classical definition, probability models, axioms of probability, probability of an event.

1.6 Theorems of probability (without proof)

i) $0 \leq P(A) \leq 1$ ii) $P(A) + P(A') = 1$ iii) $P(\Phi) = 0$ iv)$P(A) \leq P(B)$ when $A \subset B$

iv) $P(A \cup B) = P(A) + P(B) - P(A \cap B)$

1.7 Numerical problems related to real life situations.

UNIT 2: Conditional Probability and Independence (8L)

2.1Concepts and definitions of conditional probability, multiplication theorem $P(A \cap B)=P(A).P(B|A)$

2.2 Bayes' theorem (without proof). True positive , false positive and sensitivity of test as application of Bayes' theorem.

2.3 Concept of Posterior probability, problems on posterior probability.

2.4 Concept and definition of independence of two events.

2.5 Numerical problems related to real life situations.

UNIT 3: Random Variable (10L)

3.1 Definition of random variable (r.v.) , discrete and continuous random variable.

3.2 Definition of probability mass function (p.m.f.) of discrete r.v. and Probability density function of continuous r.v..

3.3 Cumulative distribution function (c.d.f.) of discrete and continuous r.v. and their properties. (Characteristic properties only)

3.4 Definition of expectation and variance of discrete and continuous r.v., theorem on expectation and variance (statement only).

3.4 Determination of median and mode using p.m.f. only.

3.5 Numerical problems related to real life situations.

UNIT 4 : Standard Discrete Distributions (12L)

4.1Discrete Uniform Distribution: definition, mean, variance.

4.2 Binomial Distribution: definition, mean, variance, additive property, Bernoulli distribution as a particular case with n = 1.

4.3 Geometric Distribution (p.m.f $p(x) = pq^x$, x = 0,1,2.....): definition,mean, variance.

4.4 Poisson Distribution: definition, mean, variance, mode, additive property, limiting case of B(n, p)

4.5 Illustration of real life situations.

4.6 Numerical problems related to real life situations.

* Only statement of mean and variance, derivation is not expected.

References:

1. A First course in Probability, Sheldon Ross.Pearson Education Inkc.
2. Statistical Methods (An IntroductoryText), Medhi J. 1992 , New Age International.
3. Modern Elementary Statistics ,Freund J.E. 2005, Pearson Publication.
4. Probability, Statistics, Design of Experiments and Queuing Theory with Applications of Computer Science Trivedi K.S. 2001, Prentice Hall of India, New Delhi.
5. Fundamentals of Mathematical Statistics(3rd Edition), Gupta S. C. and Kapoor V. K.1987 S. Chand and Sons, New Delhi.
6. Mathematical Statistics (3rd Edition), Mukhopadhyay P. 2015, Books And Allied (P), Ltd.
7. Introduction to Discrete Probability and Probability Distributions, Kulkarni M.B., Ghatpande S.B. 2007 , SIPF Academy
8. Programmed Statistics, B.L. Agarwal, New Age International Publishers.

Semester I

Paper-III

CSST113: Statistics Practical

No. of Credits : 1.5

TOPICS/CONTENTS

Pre-requisites: Knowledge of the topics in theory papers I and II

Objectives: At the end of the course students are expected to be able

i) To tabulate and make frequency distribution of the given data.
ii) To use various graphical and diagrammatic techniques and interpret.
iii) To compute various measures of central tendency, dispersion, Skewness and kurtosis.
iv) To fit the Binomial and Poisson distributions.
v) To compute the measures of attributes.
vi) The process of collection of data, its condensation and representation for real life data.
vii) To study free statistical softwares and use them for data analysis in project.

Sr. No.	Title of the practical
1	Tabulation and construction of frequency distribution. (Use of at least two data sets more than 50 observations- each for constructing frequency distribution)
2	Diagrammatic and graphical representation using EXCEL and data interpretation. (problems on the basis of SET and NET examination in Paper I to be taken)
3	Summary statistics for ungrouped data and comparison for consistency using EXCEL.
4	Summary statistics for grouped frequency distribution. (Problems based on central tendency, dispersion, measures of skewness: Karl Pearson's and Quartile measure to be covered)
5	Measure of Skewness and kurtosis based on moments.
6	Fitting of Binomial distribution and computation of expected frequencies. (Use the observed and expected frequencies for the next semester χ^2 test)
7	Fitting of Poisson distribution and computation of expected frequencies. (Use the observed and expected frequencies for the next semester χ^2 for test.) (Give one data set for fitting both Poisson and Binomial distributions.)
8	Measure of attributes. (Two attributes only)
9	Study of free statistical softwares and writing a report on it. (individual activity)
10	Project(Part-I) -Data collection, its condensation and representation.

Notes:

1) For project, a group of maximum 8 students be made.
2) All the students in a group are given equal marks for project.
3) Different data sets from primary or secondary sources may be collected.

Semester II

Paper-I

CSST 121 :Methods of Applied Statistics

No. of Credits: 2 No. of lectures: 40

TOPICS/CONTENTS:

UNIT 1:Correlation (For ungrouped data) (10L)

1.1Concept of bivariate data, scatter diagram, its interpretation, concept of correlation, Positivecorrelation, negative correlation, zero correlation.

1.2 Karl Pearson's coefficient of correlation, properties of correlation coefficient, Interpretation of correlation coefficient, coefficient of determination with interpretation.

1.3 Spearman's rank correlation coefficient (formula with and without ties).

1.4Numerical problems

UNIT 2: Regression (for ungrouped data) (12L)

2.1Concept of linear and nonlinear regression.

2.2 Illustrations, appropriate situations for regression and correlation

2.3 Linear regression :Fitting of both lines of regression using least square method.

2.4 Concept of regression coefficients.

2.5 Properties of regression coefficients : $b_{xy} \cdot b_{yx} = r^2$, $b_{xy} * b_{yx} \leq 1$, $b_{xy} = r\,(\sigma_x / \sigma_y)$ and$b_{yx} = r\,(\sigma_y / \sigma_x)$.

2.6 Nonlinear regression models: Second degree curve, exponential curves of the type $Y=ab^x$ and $Y=ax^b$.

2.7 Numerical problems related to real life situations

UNIT3: Multiple Regression and Multiple, partial Correlation (For Trivariate Data)(10L)

3.1 Concept of multiple regressions, Yule's Notations.

3.2 Fitting of multiple regression planes.[Derivation of equation to the plane of regression of X_1on X_2 and X_3 is expected. Remaining two equations to be written analogously.]

3.3 Concept of partial regression coefficients, interpretations.

3.4 Concept of multiple correlation: Definition of multiple correlation coefficientand its formula..

3.5 Concept of partial correlation. Definition of partial correlation coefficient and its formula.

UNIT4: Time series (8L)

4.1 Meaning and utility

4.2 Components of time series

4.3 Additive and multiplicative models

4.4 Methods of estimating trend : moving average method, least squares method and exponential smoothing method(with graph and interpretation).

4.5 Numerical problems related to real life situations

References:

1 Introduction to Linear Regression Analysis,Douglas C. Montgomery, Elizabeth A. Peck, G. Geoffrey Vining, Wiley

2 Time Series Methods, Brockwell and Davis, Springer, 2006.

3 Time Series Analysis,4th Edition, Box and Jenkin, Wiley, 2008.

4 Fundamentals of Applied Statistics(3rd Edition), Gupta and Kapoor, S. Chand and Sons, New Delhi, 1987.

5 Fundamentals of Statistics, Vol. 1, Sixth Revised Edition, Goon, A. M., Gupta, M. K. and Dasgupta, B. (1983). The World Press Pvt. Ltd., Calcutta

Semester II

Paper-II

CSST122: Continuous Probability Distributions and Testing of Hypotheses

No. of Credits : 2 No. of lectures: 40

TOPICS/CONTENTS:

UNIT 1:Standard Continuous Probability Distributions (10L)

1.1 Uniform Distribution: statement of p.d.f., mean, variance, nature ofprobability curve. Theorem (without proof): The distribution function of any continuous r.v. if it is invertible follows U(0, 1) distribution

1.2 Exponential Distribution: statement of p.d.f. of the form,$f(x) = (1/\theta)\, e(-x/\theta)$, mean, variance, nature of probability curve, lack ofmemory property.(with proof)

1.3 Paratodistribution :Form of pdf $f(x):\alpha/ x^{(\alpha+1)}$; $x \geq 1$, $\alpha > 0$. Mean, variance, symmetry, applications

1.3 Normal Distribution: statement of p.d.f., identification of parameters,nature of probability density curve, standard normal distribution,symmetry, distribution of aX+b, aX+bY+c where X and Y areindependent normal variables, computations ofprobabilities usingnormal probability table, normal approximation to binomial and Poissondistribution, central limit theorem (statement only), normal probabilityplot. Box Muller transformation

1.4 Numerical problems related to real life situations.

UNIT 2:Concepts and definitions related to testing of hypothesis (4L)

2.1 Concepts of population and sample.

2.2 Definitions: random samplefrom a probability distribution, parameter, statistic, standard error ofestimator.

2.3 Concept of null hypothesis and alternative hypothesis (Research hypothesis), critical region,level of significance, type I and type II error, one sided and two sided tests, Test of hypothesis,p-value.

UNIT 3:Parametric Tests (20L)

1.1 Large Sample Tests

3.1.1Ho: $\mu = \mu_o$Vs H1: $\mu \neq \mu_o$, $\mu < \mu_o$, $\mu > \mu_o$ (One sided and two sided tests)
3.1.2 Ho: $\mu_1 = \mu_2$ Vs H1: $\mu_1 \neq \mu_2$, $\mu_1 < \mu_2$, $\mu_1 > \mu_2$ (One sided and two sidedtests)
3.1.3 Ho: P = Po Vs H1: P ≠Po, P < Po, P > Po (One sided and two sided tests)
3.1.4 Ho: P1 = P2 Vs H1: P1≠P2, P1 < P2, P1 > P2 (One sided and two sidedtests)
3.1.5 Numerical problems related to real life situations.

3.2 Test based on F- distribution

3.2.1 F-test for testing significance of equality of two population variances.

3.3 Tests based on t – distribution

3.3.1 Ho: $\mu_1 = \mu_2$ Vs H1: $\mu_1 \neq \mu_2$, $\mu_1 < \mu_2$, $\mu_1 > \mu_2$ (One sided and two sided tests)
3.3.2 Paired t-test.

3.4 Tests based on Chi square distribution

3.4.1 Chi-square test for goodness of fit

3.4.2 Test for independence of attributes (mxn and 2x2)

3.5 Numerical problems related to real life situations.

UNIT 4 :Simulation (6L)

4.1 Introduction, concept of simulation , random numbers, pseudo random numbers , Advantages , Disadvantages of Simulation. Applications

4.2 Methods of simulation, Linear congruential generator and simulation from Uniform, Exponential and Normal Distribution.

References

1. A First course in Probability, Sheldon Ross.Pearson Education Inc.
2. Statistical Methods (An IntroductoryText),Medhi J. 1992 , New AgeInternational.
3. Modern Elementary Statistics ,Freund J.E. 2005, PearsonPublication.
4. Probability, Statistics, Design of Experiments and Queuing Theory with Applications of Computer Science,Trivedi K.S. 2001,Prentice Hallof India, NewDelhi.
5.Gupta S. C.andKapoor V. K.1987 Fundamentals of Mathematical Statistics(3rd Edition)S. Chandand Sons,New Delhi.
6. Mukhopadhyay P. 2015, Mathematical Statistics (3rd Edition), Books And Allied (P), Ltd.
7. Simulation Modelling and Analysis Law A. M. and Kelton W.D. 2007,Tata McGraw Hill.
8. Programmed Statistics, B.L. Agarwal, New Age International Publishers.
9. Common Statistical Tests Kulkarni M.B.,Ghatpande, S.B.,Gore S.D.1999 Satyajeet Prakashan,

Semester II

Paper-III

CSST 123: Statistics Practical

No. of Credits : 1.5

Pre-requisites: Knowledge of the topics in theory papers I and II

Objectives: At the end of the course students are expected to be able

i) To understand the relationship between two variables using scatter plot.
ii) To compute coefficient of correlation, coefficient of regression.
iii) To fit various regression models and to find best fit.
iv) To fit the Normal distribution.
v) To understand the trend in time series and how to remove it.
vi) To apply inferential methods for real data sets.
vii) To generate model sample from given distributions.
viii) To understandthe importance and functions of different statistical organizations in the development of nation.

Sr. No.	Title of the Practical
1	Linear correlation and regression (use of scatter plot for explaining the linear relationship between two variables)
2	Fitting of non-linear regression. (use of scatter plot for explaining the non-linear relationship between two variables)
3	Fitting of normal distribution and computation of expected frequencies.
4	Fitting of linear regression model (Simple and Multiple) and non-linear regression models and finding the best fit byusing EXCEL.
5	Modelsampling from continuous uniform, exponential and normal distributions using Excel.
6	Large sample tests.
7	F test, t test, χ^2 test using EXCEL (one problem each with equal and unequal variance)(χ^2 test – for goodness of fit-use fitted problems of Binomial, Poisson and Normal distribution in previous practical problems)
8	Time Series- Estimation of trend by using the method of moving averages
9	Write a report on application of some statistical technique in the field of computers.(individual activity)
10	Project (Part-II) - Analysis of data collected in semester-I

Notes:

i) For project, a group of maximum 8 students be made.
ii) All the students in a group are given equal marks for project.
iii) Students will be asked to use Statistical methods which they have learnt and use of free statistical software for data analysis.

Savitribai Phule Pune University

(Formerly University of Pune)

Three Year B.Sc. Degree Program in Computer Science

(Faculty of Science & Technology)

S.Y.B.Sc. (Computer Science)

Choice Based Credit System Syllabus
To be implemented from Academic Year
2020-2021

S. Y. B. Sc.(Computer Science)

Semester III

(Total credits=22)

Course type	Paper Code	Paper title	Credits	Evaluation		
				CA	UE	TOTAL
CC-VIII	CS 231	Data Structures and Algorithms – I	2	15	35	50
	CS 232	Software Engineering	2	15	35	50
	CS 233	Practical course on CS 231 and CS 232	2	15	35	50
CC-IX		Mathematics - I	2	15	35	50
		Mathematics - II	2	15	35	50
		Practical course in Mathematics	2	15	35	50
CC-X		Electronics - I	2	15	35	50
		Electronics - II	2	15	35	50
		Practical course in Electronics	2	15	35	50
AECC-I		Environment Science – I	2			
AECC-II		Language Communication – I	2			

Semester IV

(Total credits=22)

Course type	Paper Code	Paper title	Credits	Evaluation		
				CA	UE	TOTAL
CC-XI	CS 241	Data Structures and Algorithms – II	2	15	35	50
	CS 242	Computer Networks - I	2	15	35	50
	CS 243	Practical course on CS 241 and CS 242	2	15	35	50
CC-XII		Mathematics - I	2	15	35	50
		Mathematics - II	2	15	35	50
		Practical course in Mathematics	2	15	35	50
CC-XIII		Electronics - I	2	15	35	50
		Electronics - II	2	15	35	50
		Practical course in Electronics	2	15	35	50
AECC-I		Environment Science – II	2			
AECC-II		Language Communication –II	2			

- Each theory Lecture time for S.Y. B.Sc Computer Science is of 50 min (3 lectures/ week for 2 credit course)
- Each practical session time for S.Y. B.Sc Computer Science is of 4 hrs 20 minutes (260 min)
- Practical batch size =12

Savitribai Phule Pune University
S.Y.B.Sc. (Computer Science)
Computer Science Paper - I
Course Code: CS 231
Title : Data Structures and Algorithms – I

Teaching Scheme	No. of Credits	Examination Scheme
3 Lectures / week (50 mins duration)	2	IE : 15 marks UE: 35 marks

Prerequisites:
Basic knowledge of algorithms and problem solving
Knowledge of C Programming Language

Course Objectives
1. To learn the systematic way of solving problem
2. To understand the different methods of organizing large amount of data
3. To efficiently implement the different data structures
4. To efficiently implement solutions for specific problems
5. To apply linear data structures.

Course Outcomes: On completion of the course, student will be able to
1. To use well-organized data structures in solving various problems.
2. To differentiate the usage of various structures in problem solution.
3. Implementing algorithms to solve problems using appropriate data structures.

Course Contents

Chapter 1	**Introduction to Data Structures and Algorithm Analysis**	**4 lectures**

1.1 Introduction
- 1.1.1 Need of Data Structure
- 1.1.2 Definitions - Data and information, Data type, Data object, ADT, Data Structure
- 1.1.3 Types of Data Structures

1.2 Algorithm analysis
1.2.1 Space and time complexity, Graphical understanding of the relation between different functions of n, examples of linear loop, logarithmic,quadratic loop etc.
1.2.2 Best, Worst, Average case analysis, Asymptotic notations (Big O, Omega Ω, Theta θ), Problems on time complexity calculation.

Chapter 2	**Array as a Data Structure**	**10 lectures**

2.1 ADT of array, Operations
2.2Array applications - Searching
2.2.1 Sequential search, variations - Sentinel search, Probability search, ordered list search
- 2.2.2 Binary Search
- 2.2.3 Comparison of searching methods

2.3 Sorting Terminology- Internal, External, Stable, In-place Sorting
- 2.3.1 Comparison Based Sorting - Lower bound on comparison based sorting, Methods- Bubble Sort, Insertion Sort, Selection Sort, Algorithm design strategies - Divide and Conquer strategy, Merge Sort, Quick Sort, complexity analysis of sorting methods.

2.3.2 Non Comparison Based Sorting: Counting Sort, Radix Sort, complexity analysis.
2.3.3 Comparison of sorting methods

Chapter 3	**Linked List**	**10 lectures**

3.1 List as a Data Structure, differences with array.
3.2 Dynamic implementation of Linked List, internal and external pointers
3.3 Types of Linked List – Singly, Doubly, Circular
3.4 Operations on Linked List - create, traverse, insert, delete, search, sort, reverse, concatenate, merge, time complexity of operations.
3.5 Applications of Linked List – polynomial representation, Addition of two polynomials
3.6 Generalized linked list – concept, representation, multiple-variable polynomial representation using generalized list.

Chapter 4	**Stack**	**6 lectures**

4.1 Introduction
4.2 Operations – init(), push(), pop(), isEmpty(), isFull(), peek(), time complexity of operations.
4.3 Implementation- Static and Dynamic with comparison
4.4 Applications of stack
4.4.1 Function call and recursion, String reversal, palindrome checking
4.4.2 Expression types - infix, prefix and postfix, expression conversion and evaluation (implementation of infix to postfix, evaluation of postfix)
4.4.3Backtracking strategy - 4 queens problem (implementation using stack)

Chapter 5	**Queue**	**6 lectures**

5.1 Introduction
5.2 Operations - init(), enqueue(), dequeue(), isEmpty(), isFull(), peek(),time complexity of operations, differences with stack.
5.3 Implementation - Static and Dynamic with comparison
5.4 Types of Queue - Linear Queue, Circular Queue, Priority Queue, Double Ended Queue (with implementation)
5.5 Applications – CPU Scheduling in multiprogramming environment, Round robin algorithm

Reference Books:

1. Classic Data Structures-D. Samanta, Prentice Hall India Pvt. Ltd.
2. Fundamentals of Data Structures in C- Ellis Horowitz, SartajSahni,Susan Anderson-Freed, 2nd Edition, Universities Press.
3. Data Structures using C and C++-YedidyahLangsam, Moshe J. Augenstein, Aaron M. Tenenbaum, Pearson Education
4. Data Structures: A Pseudo code approach with C, Richard Gilberg ,Behrouz A. Forouzan, Cengage Learning.
5. Introduction to Data Structures in C-Ashok Kamthane, Pearson Education
6. Algorithms and Data Structures, Niklaus Wirth, Pearson Education

Savitribai Phule Pune University
S.Y.B.Sc. (Computer Science)
Computer Science Paper -II
Course Code: CS 232
Title : Software Engineering

Teaching Scheme	No. of Credits	Examination Scheme
3 lectures / week (50 mins duration)	**2**	IE : 15 marks UE: 35 marks

Prerequisites
ER Modeling

Course Objectives

1. To get knowledge and understanding of software engineering discipline.
2. To learn analysis and design principles for software project development.

Course Outcomes
On completion of the course, student will be able to-

1. Compare and chose a process model for a software project development.
2. Identify requirements analyze and prepare models.
3. Prepare the SRS, Design document, Project plan of a given software system.

Course Contents

Chapter 1	**Title : Introduction To Software Engineering and Process Models**	**8 lectures**

1.1 Definition of Software
1.2 Nature of Software Engineering
1.3 Changing nature of software
1.4 Software Process
- 1.4.1 The Process Framework
- 1.4.2 Umbrella Activities
- 1.4.3 Process Adaptation

1.5 Generic Process Model
1.6 Prescriptive Process Models
- 1.6.1 The Waterfall Model
- 1.6.2 Incremental Process Models
- 1.6.3 Evolutionary Process Models
- 1.6.4 Concurrent Models
- 1.6.5 The Unified Process

Chapter 2	**Title : Agile Development**	**5lectures**

2.1 What is Agility?
2.2 Agile Process
- 2.2.1 Agility Principles
- 2.2.2 The Politics Of Agile Development
- 2.2.3 Human Factors

2.3 Extreme Programming(XP)
- 2.3.1XP Values
- 2.3.2XP Process
- 2.3.3 Industrial XP

2.4 Adaptive Software Development(ASD)
2.5 Scrum
2.6 Dynamic System Development Model (DSDM)
2.7 Agile Unified Process (AUP)

Chapter 3	**Title : Requirements Analysis**	**7 lectures**

3.1 Requirement Elicitation,
3.2 Software requirement specification (SRS)
3.2.1 Developing Use Cases (UML)
3.3 Building the Analysis Model
3.3.1 Elements of the Analysis Model
3.3.2 Analysis Patterns
3.3.3 Agile Requirements Engineering
3.4 Negotiating Requirements
3.5 Validating Requirements

Chapter 4	**Title : Requirements Modeling**	**10 lectures**

4.1 Introduction to UML
4.2Structural Modeling
4.2.1 Use case model
4.2.2Class model
4.3Behavioral Modeling
4.3.1 Sequence model
4.3.2 Activity model
4.3.3 Communication or Collaboration model
4.4 Architectural Modeling
4.4.1 Component model
4.4.2 Artifact model
4.4.3 Deployment model

Chapter 5	**Title :Design Concepts**	**6lectures**

5.1 Design Process
5.1.1 Software Quality Guidelines and Attributes
5.1.2 Evolution of Software Design
5.2 Design Concepts
5.2.1 Abstraction
5.2.2 Architecture
5.2.3 Patterns
5.2.4 Separation of Concerns
5.2.5 Modularity
5.2.6 Information Hiding
5.2.7 Functional Independence
5.2.8 Refinement
5.2.9 Aspects
5.2.10 Refactoring
5.2.11 Object Oriented Design Concepts
5.2.12 Design Classes
5.2.13 Dependency Inversion
5.2.14 Design for Test
5.3 The Design Model
5.3.1 Data Design Elements
5.3.2 Architectural Design Elements

5.3.3 Interface Design Elements
5.3.4 Component-Level Diagram
5.4.5 Deployment-Level Diagram

Reference Books:

1. Software Engineering : A Practitioner's Approach - Roger S. Pressman, McGraw hill(Eighth Edition) ISBN-13: 978-0-07-802212-8, ISBN-10: 0-07-802212-6
2. A Concise Introduction to Software Engineering - Pankaj Jalote, Springer ISBN: 978-1-84800-301-9
3. The Unified Modeling Language Reference Manual - James Rambaugh, Ivar Jacobson, Grady Booch ISBN 0-201-30998-X

Savitribai Phule Pune University
S.Y.B.Sc. (Computer Science)
Computer Science Paper - III
Course Code: CS 233
Title : Practical course on CS 231 (Data Structures and Algorithms I) and CS 232 (Software Engineering)

Teaching Scheme	No. of Credits	Examination Scheme
4 hrs 20 mins / week Batch Size : 12	2	IE : 15 marks UE: 35 marks

Operating Environment:
For Data Structures:

- **Operating system:** Linux
- **Editor:** Any linux based editor like vi, gedit etc.
- **Compiler** : cc or gcc

Lab Book:
The lab book is to be used as a hands-on resource, reference and record of assignment submission and completion by the student. The lab book contains the set of assignments which the student must complete as a part of this course.

Programming Assignments:
Programs should be done individually by the student intheir respective login. The codes should be uploaded on either the local server, Moodle, Github or any open source LMS. Print-outs of the programs and output may be taken but not mandatory for assessment.

Assessment:
Continuous assessment of laboratory work is to be done based on overall performance and lab assignments performance of student. Each lab assignment assessment will be assigned grade/marks based on parameters with appropriate weightage. Suggested parameters for overall assessment as well as each lab assignment assessment include-timely completion, performance, innovation, efficient codes and good programming practices.

- **Internal Evaluation :**
  - 10 marks will be given based on a mini project of Software Engineering.
  - 5 marks will be allocated for Assignment completion and practical attendance.
- **University Evaluation :**
  - The Practical slip will be of 35 Marks which will be based on Data structures.

Course Contents:

Suggested Assignments for Data Structures – I

Assignment1: Searching Algorithms
Implementation of searching algorithms to search an element using: Linear Search, Sentinel Search, Binary Search (with time complexity)

Assignment 2: Sorting Algorithms - I
Implementation of sorting algorithms: Bubble Sort, Insertion Sort, Selection Sort

Assignment 3: Sorting Algorithms - II
Implementation of sorting algorithms: Quick Sort, Merge Sort , Counting Sort

Assignment 4: Singly Linked List

1. Dynamic implementation of Singly Linked List to perform following operations: Create, Insert, Delete, Display, Search, Reverse
2. Create a list in the sorted order.

Assignment 5: Doubly Linked List

1. Dynamic implementation of Doubly circular Linked List to perform following operations: Create, Insert, Delete, Display, Search

Assignment 6: Linked List Applications

1. Merge two sorted lists.

Addition of two polynomials in a single variable.

Assignment 7: Stack

1. Static and Dynamic implementation of Stack to perform following operations: Init, Push, Pop, Peek, Isempty, Isfull

Assignment 8: Applications of Stack

1. Implementation of an algorithm that reverses string of characters using stack and checks whether a string is a palindrome.
2. Infix to Postfix conversion.
3. Evaluation of postfix expression.

Assignment 9: Linear Queue

1. Static and Dynamic implementation of linear Queue to perform following operations: Init, enqueue, dequeue Peek, IsEmpty, IsFull.

Assignment 10: Circular and Priority Queue

1. Implementation of circular queue
2. Implementation of priority queue

Suggested Assignments for Software Engineering mini Project	**3**

1. Prepare detailed statement of problem for the selected mini project
2. Identify suitable process model for the same.
3. Develop Software Requirement Specification for the project.
4. Identify scenarios and develop UML Use case
5. Other artifacts: Class Diagram, activity diagram, sequence diagram, component diagram and any other diagrams as applicable to the project.

Sample project titles: (These are just samples, students are suggested to take up different case studies)

1. Online mobile recharge system
2. Credit calculation system
3. Image sharing and editing system
4. Internal examination system
5. e-learning management system

Savitribai Phule Pune University
S.Y.B.Sc. (Computer Science)
Computer Science Paper - I
Course Code: CS 241
Title : DATA STRUCTURES AND ALGORITHMS-II

Teaching Scheme	No. of Credits	Examination Scheme
3 Lectures / week (50 mins. duration)	02	IE : 15 marks UE: 35 marks

Prerequisites :

- Knowledge of C Programming Language
- Basic knowledge of algorithms
- Basic knowledge of linear data structures

Course Objectives

- To learn the systematic way of solving problems
- To design algorithms
- To understand the different methods of organizing large amount of data
- To efficiently implement the non-linear data structures

Course Outcomes: On completion of this course students will be able to

- Implementation of different data structures efficiently
- Usage of well-organized data structures to handle large amount of data
- Usage of appropriate data structures for problem solving

Course Contents

Chapter 1	**Tree**	**10 lectures**

1.1 Concept and Terminologies
1.2 Types of Binary trees - Binary tree, skewed tree, strictly binary tree, full binary tree, complete binary tree, expression tree, binary search tree, Heap
1.3 Representation – Static and Dynamic
1.4 Implementation and Operations on Binary Search Tree - Create, Insert, Delete, Search, Tree traversals– preorder, inorder, postorder (recursive implementation), Level-order traversal using queue, Counting leaf, non-leaf and total nodes, Copy, Mirror.
1.5 Applications of trees
1.5.1 Heap sort, implementation
1.5.2 Introduction to Greedy strategy, Huffman encoding (implementation using priority queue)

Chapter 2	**Efficient Search Trees**	**8 lectures**

2.1 Terminology: Balanced trees - AVL Trees, Red Black tree, splay tree, Lexical search tree -Trie
2.2 AVL Tree- concept and rotations
2.3 Red Black trees - concept, insertion and deletion.
2.4 Multi-way search tree - B and B+ tree - Insertion, Deletion

Chapter 3	**Graph**	**12 lectures**

3.1 Concept and terminologies
3.2 Graph Representation –Adjacency matrix, Adjacency list, Inverse Adjacency list, Adjacency multilist
3.3 Graph Traversals – Breadth First Search and Depth First Search (with implementation)
3.4 Applications of graph

3.4.1 Topological sorting
3.4.2 Use of Greedy Strategy in Minimal Spanning Trees (Prims and Kruskals algorithm)
3.4.3 Single source shortest path - Dijkstra's algorithm
3.4.4 Dynamic programming strategy, All pairs shortest path - Floyd Warshall algorithm
3.4.5 Use of graphs in social networks

Chapter 4	**Hash Table**	**6 lectures**

4.1 Concept of hashing
4.2 Terminologies – Hash table,Hash function, Bucket, Hash address, collision, synonym, overflow etc.
4.3 Properties of good hash function
4.4 Hash functions : division function, MID square , folding methods
4.5 Collision resolution techniques
4.5.1 Open Addressing - Linear probing, quadratic probing, rehashing
4.5.2 Chaining - Coalesced , separate chaining

Reference Books:

1. Fundamentals of Data Structures in C- Ellis Horowitz, SartajSahni,Susan Anderson-Freed, 2nd Edition, Universities Press.
2. Data Structures using C and C++-YedidyahLangsam, Moshe J. Augenstein, Aaron M. Tenenbaum, Pearson Education
3. Data Structures: A Pseudo code approach with C, Richard Gilberg ,Behrouz A. Forouzan, Cengage Learning.
4. Introduction to Data Structures in C-Ashok Kamthane, Pearson Education
5. Algorithms and Data Structures, Niklaus Wirth, Pearson Education
6. Introduction to Algorithms—Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest, Clifford Stein--MIT Press
7. Fundamentals of Computer Algorithms-- Ellis Horowitz, SartajSahni, SanguthevarRajasekaran, Universities Press
8. The Algorithm Design Manual - Steven S Skiena, Springer

Savitribai Phule Pune University
S.Y.B.Sc. (Computer Science)
Computer Science Paper - I Semester II
Course Code: CS 242 Title : Computer Networks-I

Teaching Scheme	No. of Credits	Examination Scheme
3 lectures / week (50 mins. duration)	**02**	IE : 15 marks UE: 35 marks

Prerequisites
Principles of Digital Electronics
Communication Principles

Course Objectives
To prepare students with basic networking concepts: data communication, protocolsand standards, various topologies and applications of network.

Course Outcomes

1. Have a good understanding of the OSI and TCP/IP Reference Models and in particular have a good knowledge of Layers.
2. Understand the working of various protocols.
3. Analyze the requirements for a given organizational structure and select the most appropriate networking architecture and technologies

Course Contents

Chapter 1	**Introduction to Networks and Network Models**	**4 lectures**

1.1 Data communication, components, data representation
1.2 Networks, network criteria, network types - LAN, WAN, Switching, The Internet, Accessing the Internet
1.3 Network Software- Protocol hierarchies, Design Issues of the layer, Connection Oriented and Connectionless Services,
1.4 Reference models - OSI Reference Models, TCP/IP Reference model, Connection devices in different layers, Comparison of OSI and TCP/IP Reference Models.

Chapter 2	**Lower Layers**	**10 lectures**

2.1 Communication at the physical layer, data rate limits - Noiseless channel (Nyquist bit rate), noisy channel (Shannon capacity), Performance - bandwidth, throughput, latency, bandwidth-delay product, jitter
2.2 Design issues of Data Link Layer, Services - Framing, flow control, error control, congestion control, Link layer addressing
2.3 Framing Methods - Character Count, Flag bytes with Byte Stuffing, Flags bits with Bit Stuffing, Physical Layer Coding Violations
2.4 The Channel allocation problem, Static and dynamic allocation, Media Access Methods - Taxonomy of multiple-access protocols
2.5 Switching and TCP/IP layers, Types - circuit switching, packet switching and message switching
2.6 Wired LANs - Standard Ethernet characteristics, Addressing, Access method, implementation, Fast and Gigabit Ethernet
2.7 Wireless LANs - Architectural comparison, Characteristics, Access control, IEEE 802.11

architecture, Physical layer, MAC sublayer, Bluetooth architecture, Layers

Chapter 3	**Network Layer**	**12 lectures**

3.1 Network layer services - Packetizing, Routing and forwarding, other services
3.2 Open and closed loop congestion control
3.3 IPv4 addressing- Address space, classful addressing, Subnetting, Supernetting, classless addressing, Network address resolution (NAT)
3.4 Forwarding of IP packets- based on destination address, based on label
3.5 Network Layer Protocols- Internet Protocol (IP), IPv4 datagram format, Fragmentation, options
3.6 Mobile IP-addressing, agents, Three phases
3.7 Next Generation IP- IPv6 address representation, address space, address types, IPv6 protocol, packet format, extension header, Difference between IPv4 and IPv6
3.8 Routing - General idea, Algorithms - Distance vector routing, link state routing, path-vector routing

Chapter 4	**Transport Layer**	**10 Lectures**

4.1 Transport layer Services- Process-to-process communication, Addressing, Encapsulation and decapsulation, Multiplexing and demultiplexing, Flow control, Pushing or pulling, Flow control, Buffers, Sequence numbers, Acknowledgements, sliding window, congestion control
4.2 Connectionless and Connection-oriented service, Port numbers
4.3 Transport layer protocols- User datagram protocol, user datagram, UDP services
4.4 Transmission Control Protocol - TCP Services, TCP Features, TCP Segment format, three-way handshake for connection establishment and termination, State transition diagram, windows in TCP.

Reference Books:

1. Computer Networks-Andrew S. Tanenbaum, 5th Edition, Pearson Education
2. Data Communication and Networking- BehrouzFourouzan, 5th Edition, McGraw Hill Pvt. Ltd.

Savitribai Phule Pune University
S.Y.B.Sc. (Computer Science)
Computer Science Paper - III
Course Code: CS 243
Title : Practical course on CS 241(Data Structures and Algorithms II) and CS 242 (Computer Networks I)

Teaching Scheme	No. of Credits	Examination Scheme
4 hrs 20 mins / week Batch size : 12	2	IE : 15 marks UE: 35 marks

Lab Book:

The lab book is to be used as a hands-on resource, reference and record of assignment submission and completion by the student. The lab book contains the set of assignments which the student must complete as a part of this course.

Programming Assignments:

Programs should be done individually by the student in the respective login. The codes should be uploaded on either the local server, Moodle, Github or any open source LMS. Print-outs of the programs and output may be taken but not mandatory for assessment.

Assessment:

Continuous assessment of laboratory work is to be done based on overall performance and lab assignments performance of student. Each lab assignment assessment will be assigned grade/marks based on parameters with appropriate weightage. Suggested parameters for overall assessment as well as each lab assignment assessment include-timely completion, performance, innovation, efficient codes and good programming practices.

- **Internal Evaluation :**
  - 10 marks will be given based on Networking assignments.
  - 5 marks will be allocated for Assignment completion and practical attendance
- **University Evaluation :**
  - The Practical slip will be of 35 Marks which will be based on Advanced Data structures.

Operating Environment:

For Data Structures:

- **Operating system:** Linux
- **Editor:** Any linux based editor like vi, gedit etc.
- **Compiler** : cc or gcc

Course Contents :-

Assignment 1 Binary Search Tree and Traversals

1. Implement Binary Search Tree (BST) to perform following operations on BST– Create, Recursive Traversals - Inorder, Preorder, Postorder
2. Perform following operations: insert, delete

Assignment 2 Binary Search Tree Operations

1. Implement Binary Search Tree (BST) to perform following operations on BST–copy and mirror image of BST, counting leaf, non-leaf and total nodes.
2. Level-order traversal of binary search tree using queue.

Assignment 3 Applications of Binary Tree

1. Sort set of elements using Heap sort
2. Encode a set of characters using Huffman encoding

Assignment 4 Graph implementation

1. Implement Graph as adjacency matrix and adjacency list
2. Calculate indegree and outdegree of vertices
3. Graph traversals: BFS and DFS.

Assignment 5 Graph Applications - I

1. Implementation of Topological sorting
2. Implementation of Prims/Kruskals Minimum spanning tree algorithm

Assignment 6 Graph Applications - II

1. Implementation of Dijkstra's shortest path algorithm for finding Shortest Path from a given source vertex using adjacency cost matrix.
2. Implementation of Floyd Warshall algorithm for all pairs shortest path.

Assignment 7 Hash Table

1. Implementation of static hash table with Linear Probing.
2. Implementation of static hash table with chaining.

Assignment 8 Hash Table-2

1. Implementation of linked hash table with chaining.

Assignment 9 Networking Assignment

Assignment 10 Networking Assignment

SAVITRIBAI PHULE PUNE UNIVERSITY

(Formerly University of Pune)

S.Y. B. Sc. (Computer Science), Electronics

Choice Based Credit System Syllabus

To be implemented from

Academic Year 2020–2021

(Under the faculty of Science and Technology)

Savitribai Phule Pune University

(Formerly University of Pune)

SYLLABUS OF

S. Y. B. Sc. (Computer Science), Electronics

Choice Based Credit System

To be implemented from A.Y. 2020-21

Structure of S. Y. B. Sc.(Computer Science) Electronics

Semester	Paper Code	Paper	Paper title	No. of Credit	Lectures/Week	Evaluation		
						CA	UE	Total
III	ELC-231	I	Microcontroller Architecture & Programming	2	3 (each lecture of 50 minutes)	15	35	50
	ELC-232	II	Digital Communication and Networking	2	3 (each lecture of 50 minutes)	15	35	50
	ELC-233	III	Practical Course I	2	1 pract / week (each practical of 04 hours & 20 minutes)	15	35	50
IV	ELC-241	I	Embedded System Design	2	3 (each lecture of 50 minutes)	15	35	50
	ELC-242	II	Wireless Communication and Internet of Things	2	3 (each lecture of 50 minutes)	15	35	50
	ELC-243	III	Practical Course II	2	1 pract / week (each practical of 04 hours & 20 minutes)	15	35	50

S.Y.B.Sc.(Computer Science), Electronics- Semester III

Paper-I: Microcontroller Architecture & Programming (ELC 231)

Objectives:

1. To study the basics of 8051microcontroller
2. To study the Programming of8051microcontroller
3. To study the interfacing techniques of 8051microcontroller
4. To design different application circuits using 8051microcontroller

Course Outcomes : On completion of the course, student will be able

1. To write programs for 8051 microcontroller
2. To interface I/O peripherals to 8051 microcontroller
3. To design small microcontroller based projects

COURSE CONTENTS

UNIT- 1: Basics of Microcontroller & Intel 8051 architecture [08]

Introduction to microcontrollers, difference in controller and processor.
Architecture of 8051, Internal block diagram, Internal RAM organization, SFRS, pin functions of 8051, I/O port structure & Operation, External Memory Interface.

UNIT-2: Programming model of 8051 [10]

Instruction classification, Instruction set, Addressing Modes: Immediate, register, direct, indirect and relative, assembler directives (ORG, END), features with examples, I/O Bit & Byte programming using assembly language for LED and seven segment display (SSD) interfacing.
Introduction to 8051 programming in C.

UNIT- 3: Timer /Counter, Interrupts [10]

Timer / counter: TMOD, TCON, SCON, SBUF, PCON Registers, Timer modes, programming for time delay using mode 1 and mode 2.
Interrupts: Introduction to interrupt, Interrupt types and their vector addresses, Interrupt enable register and interrupt priority register (IE, IP)

UNIT- 4: Interfacing, Serial Communication [08]

Programming of serial port without interrupt, Serial Communication: Synchronous and asynchronous serial communication, Use of timer to select baud rate for serial communication. Interfacing : ADC, DAC, LCD, stepper motor.

Recommended books:

1. 8051 microcontroller and Embedded system using assembly and C : Mazidi and McKinley, Pearson publications
2. The 8051 microcontroller – Architecture, programming and applications: K.Uma Rao and Andhe Pallavi, Pearson publications.

S.Y.B.Sc. Computer Science), Electronics, Semester III

Paper-II, Digital Communication and Networking, ELC- 232

Objectives:

1. To introduce to all aspects of data communication system
2. To introduce various digital modulation schemes
3. To identify the need of data coding and error detection/correction mechanism.
4. To study bandwidth utilization techniques : multiplexing and Spectrum spreading
5. To know data link layer protocol: Media Access Control
6. To study OSI and TCP/IP models of Networking.

Course Outcomes : On completion of the course, student will be able

1. Define and explain terminologies of data communication
2. Understand the impact and limitations of various digital modulation techniques
3. To acknowledge the need of spread spectrum schemes.
4. Identify functions of data link layer and network layer while accessing communication link
5. To choose appropriate and advanced techniques to build the computer network

.

COURSE CONTENTS

UNIT 1: Introduction to Electronic Communication (9)

Introduction to Communication: Elements of Communication system, types of noise sources, Electromagnetic spectrum, signal and channel bandwidth,

Types of communication: simplex, half duplex, full duplex, baseband and broadband,

Serial communication: asynchronous and synchronous,

Information Theory: Information entropy, rate of information (data rate, baud rate), channel capacity, Nyquist theorem, Signal to noise ratio, Noise Figure, Shannon theorem,

Error handling codes: Necessity, Hamming code, CRC

UNIT 2: Modulation and Demodulation (5)

Introduction to modulation and demodulation: Concept and need of modulation and demodulation,

Digital Modulation techniques: Pulse Code Modulation (PCM), FSK, QPSK, QAM.

UNIT 3: Multiplexing, Spectrum Spreading and Media Access Control (12)

Multiplexing techniques: Frequency division multiplexing, wavelength division multiplexing, Time division multiplexing

Spread Spectrum techniques: Frequency hopping Spread Spectrum, Direct Sequence Spread Spectrum

Media Access Control (MAC):

Random Access Protocol: ALOHA, CSMA, CSMA/CD, CSMA/CA,
Controlled Access Protocols: Reservation, Polling, Token passing,
Channelization Protocols: FDMA, TDMA, CDMA.

UNIT 4: Computer Networking (10)

Introduction to computer networks

Types of networks : LAN, MAN, WAN, Wireless networks, Switching, Internet,

Network topology : point to point, Star, Ring, Bus, Mesh, Tree, Daisy Chain, Hybrid

Network devices : Repeater, Switch, Networking cables, Router, Bridge, Hub, Brouter, Gateway.

Wired LANs:-

Ethernet: Ethernet protocol, standard Ethernet, 100 MBPS Ethernet, Gigabit Ethernet, 10 Gigabit Ethernet,

Computer network model: OSI and TCP/IP.

Recommended books:

1.Communication Electronics: Principles and Applications, Frenzel, Tata Mc Graw Hill publication, 5th edition.

2. Data Communication and Networking, Forouzan, Mc Graw Hill publication, 5th edition

3. Computer Networks, Tanenbaum, pHI publication, 5th edition

S.Y.B.Sc.(Computer Science), Electronics, Semester III
Paper III, Practical Course (ELC-233)

Objectives:

1. To get hands on training of Embedded C
2. To study experimentally interfacing of microcontroller
3. To design, build and test modulator and demodulators of digital communication
4. To build and test experimentally various techniques of wired communication
5. To develop practical skills of network setup

Course Outcomes : On completion of the course, student will be able

1. To design and build his/her own microcontroller based projects.
2. To acquire skills of Embedded C programming
3. To know multiplexing and modulation techniques useful in developing wireless application
4. Do build and test own network and do settings.

Guidelines for Practical:

- Practical batch size : 12
- Minimum no of Practical to be performed : 10
- At least five practical from each Group
- Electronics lab should have set up for embedded programming (Computers and microcontroller target and interfacing boards)

COURSE CONTENTS

Group A: (Any 5)

1. Arithmetic, logical & code conversion problems using assembly/C programming
2. Interfacing of thumbwheel & seven segment display to 8051 microcontroller
3. Traffic light controller using 8051 microcontroller
4. Interfacing LCD to 8051Microcontroller
5. Waveform generation using DAC Interface to 8051Microcontroller

6. Event counter using opto-coupler, seven segment LED/LCD display interface to 8051Microcontroller
7. Speed Control of stepper motor using 8051 microcontroller

Group B: (Any 5)

1. Study of 3 or 4 Bit Pulse Code Modulation technique
2. Study of Frequency Shift Keying
3. Study of Time Division Multiplexing
4. Study of Frequency Division Multiplexing
5. Study of Code Division Multiple Access System
6. Study of Error detection and correction by using Hamming Code technique
7. Study of Computer network components : Cables, Connectors, Routers, Switches, Ethernet and related interfacing cards
8. To study Configuration of IP and MAC address and to study Local Area Network setup

S.Y.B. Sc. (Computer Science), Electronics, Semester IV

Paper I : Embedded System Design (ELC-241)

Objectives:

1. To understand the concept of Embedded systems.
2. To study the design flow and available tools for an Embedded system.
3. To understand the implementation of embedded system using firmware and hardware components.
4. To acquire programming skills for the development of Embedded system design.
5. To develop practical skills for designing embedded system Applications.

Course Outcomes : On completion of the course, student will be able

1. To understand the difference between general computing and the Embedded systems.
2. To know the fundamentals of embedded systems.
3. Understand the use of Single board Computer (Such as Raspberry Pi) for an embedded system application.
4. Familiar with the programming environment to develop embedded systems and their interfaces with peripheral devices.
5. To develop familiarity with tools used to develop in an embedded environment.

COURSE CONTENTS

Unit 1:Introduction to Embedded systems using single board computers (SBC) (08)

Single boards computer block diagram, types, Comparison of SBC models, Specifications, I/O devices (Storage, display, keyboard and mouse), Network access devices

Unit 2: Architecture of System on Chip (SOC) (08)

Architecture of SoC, Basic version Broad Coprocessor, Pin Description of Raspberry Pi, Architectural features: CPU Overview, CPU Pipeline stages, CPU Cache Organization, Branch Prediction & Folding (Concept), GPU Overview

Unit 3:Programming using Python (10)

Overview of Rasberian OS (Operating System), Installation, different types of Operating Systems

Basic Python Programming (Script programming):Variable & data types, Flow Control structures, Conditional statements (If…Then…else),
Functions: I/O function (GPIO, Digital),Time functions, Library functions
Basic Arithmetic Programs: Addition, Subtraction, Multiplication, Division

Unit 4 : Interfacing of devices using Python Programming (10)

Basic interfacing: LED, Switch, LCD
Internal Advanced: Bluetooth, Wifi, Ethernet,
External advanced: Camera, Serial Communication GSM, Ultrasonic Sensor, PIR, Finger Print reader.

Recommended Books:

1. Rasberry Pi CookBook: Software & Hardware problems and Solutions By Simon Monk(O'Reilly Media Inc.)
2. Raspberry Pi Hardware Reference by Warren Gay (Apress)
3. Rasberry Pi User Guide By Eben Upton, Greath Halfacree (John Wiley & Sons, Inc.)
4. Learning Python with Rasberry Pi, by Alex Bradbury, Ben Everard, John Wiley & Sons, Inc
5. Learn Raspberry Pi programming with Python By Wolfram Donat (Apress)

S.Y.B.Sc.(Computer Science), Electronics, Semester IV
Paper II: Wireless Communication and Internet of Things (ELC242)

Objectives:

1. To learn and understand applications of wireless communication system
2. To learn and understand cellular system
3. To learn and understand architecture of short range Wireless Technologies
4. To learn and understand basics of Internet of Things
5. To study applications of IoT

Course Outcomes: Students will be able to

1. Know working of wireless technologies such as Mobile communication, GSM, GPRS
2. Become familiar with 3G and 4G Cellular Network Technologies for Data Connections.
3. Understand working principles of short range communication application
4. Get introduce to upcoming technology of Internet of Things
5. Explore themselves and develop new IoT based applications

COURSE CONTENTS

Unit1: Wireless Communication: Cellular Telephony (12)

Overview of wireless communication,

Introduction of cellular telephony system: Frequency reuse, handoff strategies, Co-channel and adjacent channel interference, block diagram of mobile handset

Overview of Cellular Telephony generations: 1G to 5G,3G (W-CDMA, UMTS), 4G(LTE)

GSM: architecture, frame structure, mobility management,

GPRS : architecture, application

Unit 2 : Short Range Wireless Technologies and Location Tracking (12)

Short range Technologies :

Bluetooth: Bluetooth architecture, Bluetooth protocol stack, Bluetooth frame structure
Zigbee: Architecture, topologies, applications, Z wave: Protocol architecture, applications
RFID: working of RFID system, types of RFID tags, RFID frequencies, applications

Location Tracking: GPS system**:** components of GPS system (space segment, control segment, user segment), GPS receiver, Applications

Unit 3: IoT Architecture (08)

Introduction to IOT : Evolution of IOT, M2M and/or IOT, Seven layer architecture of IoT, Role of cloud in IoT, cloud topologies, Cloud access, Protocols in IoT, Cross connectivity across IoT system components:

- Device to Gateway-short range Wireless: cellphone as gateway, dedicated wireless Access points
- Gateway to cloud: Long range connectivity, (wired, cellular, Satellite, WAN)
- Direct Device to Cloud connectivity ,

Networking technologies: Low power local area networking (LPLAN), Low power wide area networking (LPWAN) technologies, comparison of LoRa, sigfox NB-IoT, Cat –M.

Unit 4: IoT Applications (04)

Application domains,

Challenges in IoT : Power consumption, Physical security, durability, Secure Connectivity, Secure Data Storage, Data volume, Scalability

Case studies:

Case Study 1: Smart Irrigation system for Agricultural field
Case Study 2:Home Automation
Case Study 3: Smart Cities

Recommended books:

1. Wireless Communications Principles and Practice, Rappaport, Pearson publication
2. Mobile Communications, Jochen Schiller, Pearson publication
3. Internet of Things : Principles and Paradigms, Rajkumar Buyya and Dastjerdi, MK publishers
4. Internet of Things, Mayur Ramgir, Pearson publication

S.Y.B.Sc.(Computer Science), Electronics, Semester IV
Paper III, Practical Course (ELC-243)

Objectives:

1. To use basic concepts for building various applications of embedded electronics.
2. To build experimental setup and test the circuits.
3. To develop skills of analyzing test results of given experiments.
4. Developing Trained Personals for educating and training for upcoming graduates in wireless communication.
5. Implement basic IoT applications on embedded platform

Course Outcomes : On completion of the course, students will be able

1. To design and develop own smart applications using Rasberry-Pi
2. To write Python program for simple applications
3. To build own IoT based system

Guidelines :

- Practical batch size : 12
- Minimum no of Practical to be performed : 10
- Eight compulsory experiments: At least four practical from each Group
- One activity equivalent to 2 experiments by the student.
  a. Continuation of F. Y. activity.
  b. Electronics project Based on the Theory Courses learnt
  c. Documentation type experiments
  d. Presentation/Seminar on Electronics /advanced topic/research topics.

Prerequisite: Rasberry Pi boards, Arduino / LoRa boards

COURSE CONTENTS

Group A (any 4)

1. Programming of Raspberry Pi to control LEDs attached to the GPIO pins
2. Programming of Raspberry Pi to get feedback from a switch connected to the GPIO pins

3. Programming of Raspberry Pi to detect temperature using temperature sensor

4. Programming of Raspberry Pi to detect light intensity using photocell sensor
5. Programming of Raspberry Pi for Motion detection
6. Programming of Raspberry Pi for image detection

Group B (any 4)

1. Study of GSM system (Message transmission & Reception).
2. To study working of SIM card in GSM handset
3. Study of GPRS system
4. Study of Zig-bee for one application
5. Study of RFID system
6. Introduction to Python programming.
7. To study Arduino based LED switching using mobile
8. Temperature and humidity sensing using Arduino
9. LoRa Interfacing.

University of Pune

Board of Studies in Mathematics

S. Y. B. Sc. (Computer Science)

Syllabus of Mathematics

Introduction:

Savitribai Phule Pune University, Pune has decided to change the syllabi of various faculties from June, 2020. Taking into consideration the rapid changes in science and technology and new approaches in different areas of mathematics and related subjects Board of studies in Mathematics with concern of teachers of Mathematics from different colleges affiliated to Savitribai Phule Pune University, Pune has prepared the syllabus of S.Y.B.Sc. Computer Science Mathematics. To develop the syllabus the U.G.C. Model curriculum is followed.

Aims:

i) Give the students a sufficient knowledge of fundamental principles ,methods and a clear perception of innumerous power of mathematical ideas and tools and know how to use them by modeling ,solving and interpreting.

ii) Reflecting the broad nature of the subject and developing mathematical tools for continuing further study in various fields of science.

iii) Enhancing students overall development and to equip them with mathematical modeling abilities, problem solving skills , creative talent and power of communication necessary for various kinds of employment .

iv) Enabling students to develop a positive attitude towards mathematics as an interesting and valuable subject of study.

Objectives:

(i) A student should be able to recall basic facts about mathematics and should be able to display knowledge of conventions such as notations, terminology and recognize basic geometrical figures and graphical displays, state important facts resulting from their studies.

(ii) A student should get a relational understanding of mathematical concepts and concerned structures, and should be able to follow the patterns involved, mathematical reasoning.

(iii) A student should get adequate exposure to global and local concerns that explore them many aspects of Mathematical Sciences.

(iv) A student be able to apply their skills and knowledge, that is, translate information presented verbally into mathematical form, select and use appropriate mathematical formulae or techniques in order to process the information and draw the relevant conclusion.

(v) A student should be made aware of history of mathematics and hence of its past, present and future role as part of our culture.

*** Medium of Instruction: English**

*** Eligibility:** F.Y.B.Sc. Computer Science, as per University rules.

Structure of the course:

Semester - I			**Semester -II**	
Paper I	**MTC-231**	**Groups and Coding Theory**	**MTC-241**	**Computational Geometry**
Paper II	**MTC-232**	**Numerical Techniques**	**MTC-242**	**Operations Research**
Paper III	**MTC-233**	**Mathematics Practical: Python Programming Language-I**	**MTC-243**	**Mathematics Practical: Python Programming Language-II**

* **All three above courses are compulsory.**

*** External Students: Not allowed.**

*** Variation / Revaluation: Allowed for Paper- I and Paper-II.**

*** Qualifications for Teacher: M.Sc. Mathematics (with NET /SET as per existing rules)**

Equivalence of Previous syllabus along with new syllabus:

	Semester-III		**Semester-IV**	
	New Course	**Old Course**	**New Course**	**Old Course**
Paper I	**MTC-231: Groups and Coding Theory**	**MTC-211 : Applied Algebra**	**MTC-241: Computational Geometry**	**MTC-221: Computational Geometry**
Paper II	**MTC-232: Numerical Techniques**	**MTC-212: Numerical Analysis**	**MTC-242: Operations Research**	**MTC-222: Operations Research**

Paper III	**MTC-233: Mathematics Practical: Python Programming Language-I**	**MTC-213 : Mathematics Practical**	**MTC-243: Mathematics Practical: Python Programming Language-II**	**MTC–223: Mathematics Practical**

Semester III

MTC-231 : Groups and Coding Theory

Unit 1. Integers **[05 Lectures]**

1.1 Division Algorithm (without Proof)

1.2 G.C.D. using division algorithm and expressing it as linear combination

1.3 Euclid's lemma

1.4 Equivalence relation (revision), Congruence relation on set of integers, Equivalence class partition

Unit 2. Groups **[03 Lectures]**

2.1 Binary Operation

2.2 Group: Definition and Examples

2.3 Elementary Properties of Groups

Unit 3. Finite Groups and Subgroups **[10 Lectures]**

3.1 Order of a group, order of an element

3.2 Examples (Zn, +) and (U(n), *)

3.3 Subgroup definition, Finite subgroup test, subgroups of Zn

3.4 Generator, cyclic group, finding generators of Zn(Corollary 3,4 without proof)

3.5 Permutation group, definition, composition of two permutations, representation as product of disjoint cycles, inverse and order of a permutation, even/ odd permutation

3.6 Cosets: Definition, Examples and Properties, Lagrange Theorem(without Proof)

Unit 4. Groups and Coding Theory **[18 Lectures]**

4.1 Coding of Binary Information and Error detection

4.2 Decoding and Error Correction

4.3 Public Key Cryptography

Text Books:-

1. **Contemporary Abstract Algebra By J. A, Gallian (Seventh Edition)**
   Unit 1:Chapter 0, Unit 2: Chapter 2, Unit 3: Chapter 3 ,4, 5 and 7
2. **Discrete Mathematical Stuctures By Bernard Kolman, Robert C. Busby and Sharon Ross (6th Edition) Pearson Education Publication**
   Unit 4: Chapter 11

MTC-232 : Numerical Techniques

Unit 1: Algebraic and Transcendental Equation [04 Lectures]

1.1 Introduction to Errors

1.2 False Position Method

1.3 Newton-Raphson Method

Unit 2: Calculus of Finite Differences and Interpolation [16 Lectures]

2.1 Differences

2.2. Forward Differences

2.3 Backward Differences

2.4 Central Differences

2.5 Other Differences (δ, μ operators)

2.6 Properties of Operators

2.7 Relation between Operators

2.8 Newton's Gregory Formula for Forward Interpolation

2.9 Newton's Gregory Formula for Backward Interpolation

2.10 Lagrange's Interpolation Formula

2.11 Divided Difference

2.12 Newton's Divided Difference Formula

Unit 3: Numerical Integration [08 Lectures]

3.1 General Quadrature Formula

3.2 Trapezoidal Rule

3.3 Simpson's one-Third Rule

3.4 Simpson's Three-Eight Rule

Unit 4: Numerical Solution of Ordinary Differential Equation [08 Lectures]

4.1 Euler's Method

4.2 Euler's Modified Method

4.3 Runge-Kutta Methods

Text Book:-

1. A textbook of Computer Based Numerical and Statistical Techniques, by A. K. Jaiswal and Anju Khandelwal. New Age International Publishers.

Unit 1: Chapter 2: Sec. 2.1, 2.5, 2.7
Unit 2: Chapter 3: Sec. 3.1, 3.2, 3.4, 3.5, Chapter 4: Sec. 4.1, 4.2, 4.3, Chapter 5: Sec. 5.1, 5.2, 5.4, 5.5
Unit 3: Chapter 6: Sec. 6.1, 6.3, 6.4, 6.5, 6.6, 6.7
Unit 4: Chapter 7: Sec. 7.1, 7.4, 7.5, 7.6

Reference Books:-

1. S.S. Sastry; Introductory Methods of Numerical Analysis, 3rd edition, Prentice Hall of India, 1999.
2. H.C. Saxena; Finite differences and Numerical Analysis, S. Chand and Company.
3. K.E. Atkinson; An Introduction to Numerical Analysis, Wiley Publications.
4. Balguruswamy; Numerical Analysis.

MTC-233: Mathematics Practical: Python Programming Language-I

Unit 1: Introduction to Python

1.1 Installation of Python
1.2 Values and types: int, float and str,
1.3 Variables: assignment statements, printing variable values, types of variables.
1.4 Operators, operands and precedence:+, -, /, *, **, % PEMDAS(Rules of precedence)
1.5 String operations: + : Concatenation, * : Repetition
1.6 Boolean operator:
    1.6.1 Comparison operators: ==, !=, >, =, <=
    1.6.2 Logical operators: and, or, not
1.7 Mathematical functions from math, cmath modules.
1.8 Keyboard input: input() statement

Unit 2: String, list, tuple

2.1 Strings:
    2.1.1 Length (Len function)
    2.1.2 String traversal: Using while statement, Using for statement
    2.1.3 String slice
    2.1.4 Comparison operators (>, <, ==)
2.2 Lists:
    2.2.1 List operations
    2.2.2 Use of range function
    2.2.3 Accessing list elements
    2.2.4 List membership and for loop
    2.2.5 List operations
    2.2.6 Updating list: addition, removal or updating of elements of a list

2.3 Tuples:
- 2.3.1 Defining a tuple,
- 2.3.2 Index operator,
- 2.3.3 Slice operator,
- 2.3.4 Tuple assignment,
- 2.3.5 Tuple as a return value

Unit 3: Iterations and Conditional statements

3.1 Conditional and alternative statements, Chained and Nested Conditionals: if, if-else, if-elif-else, nested if, nested if-else

3.2 Looping statements such as while, for etc, Tables using while.

3.3 Functions:
- 3.3.1 Calling functions: type, id
- 3.3.2 Type conversion: int, float, str
- 3.3.3 Composition of functions
- 3.3.4 User defined functions, Parameters and arguments

Unit 4: Linear Algebra

4.1 Matrix construct, eye(n), zeros(n,m) matrices

4.2 Addition, Subtraction, Multiplication of matrices, powers and invers of a matrix.

4.3 Accessing Rows and Columns, Deleting and Inserting Rows and Columns

4.4 Determinant, reduced row echelon form, nullspace, columnspace, Rank

4.5 Solving systems of linear equations (Gauss Elimination Method, Gauss Jordan Method, LU- decomposition Method)

4.6 Eigenvalues, Eigenvectors, and Diagonalization

Unit 5: Numerical methods in Python

5.1 Roots of Equations

5.2 Newton-Raphson Method

5.3 False Position (Regula Falsi) Mehtod

5.4 Numerical Integration:
- 5.1.1 Trapezoidal Rule,
- 5.1.2 Simpson's 1/3rd Rule,
- 5.1.3 Simpson's 3/8th Rule

Text Books:-

1. **Downey, A. et al., How to think like a Computer Scientist: Learning with Python, John Wiley, 2015.**
   Sections: 1, 2, 3
2. **Robert Johansson, Introduction to Scientific Computing in Python**
   Section: 4

Reference Books:-

1. **Lambert K. A., Fundamentals of Python - First Programs, Cengage Learning India, 2015.**
2. **Guzdial, M. J., Introduction to Computing and Programming in Python, Pearson**

India.
3. **Perkovic, L., Introduction to Computing Using Python, 2/e, John Wiley, 2015.**
4. **Zelle, J., Python Programming: An Introduction to Computer Science, Franklin, Beedle & Associates Inc.**
5. **Sandro Tosi, Matplotlib for Python Developers, Packt Publishing Ltd.(2009)**

Practicals:
Practical 1: Introduction to Python, Python Data Types-I (Unit 1)
Practical 2: Python Data Types- II (Unit 2)
Practical 3: Control statements in Python-I (Unit 3- 3.1, 3.2)
Practical 4: Control statements in Python-II (Unit 3- 3.3)
Practical 5: Application : Matrices (Unit 4 – 4.1-4.3)
Practical 6: Application : Determinants, system of Linear Equations (Unit 4- 4.4, 4.5)
Practical 7: Application : System of equations (Unit 4- 4.5)
Practical 8: Application : Eigenvalues, Eigenvectors (Unit 4 – 4.6)
Practical 9: Application : Eigenvalues, Eigenvectors (Unit 4 – 4.6)
Practical 10: Application : Roots of equations (Unit 5 – 5.1)
Practical 11: Application : Numerical integration (Unit 5 – 5.2, 5.3)
Practical 12: Application : Numerical integration (Unit 5 – 5.4)

Semester - IV

MTC-241: Computational Geometry

Unit 1. Two dimensional transformations: [12 Lectures]

1.1 Introduction.
1.2 Representation of points.
1.3 Transformations and matrices.
1.4 Transformation of points.
1.5 Transformation of straight lines
1.6 Midpoint Transformation
1.7 Transformation of parallel lines
1.8 Transformation of intersecting lines
1.5 Transformation: rotations, reflections, scaling, shearing.
1.6 Combined transformations.
1.7 Transformation of a unit square.
1.8 Solid body transformations.
1.9 Translations and homogeneous coordinates.
1.10 Rotation about an arbitrary point.
1.11 Reflection through an arbitrary line.

Unit 2. Three dimensional transformations: [08 Lectures]

2.1 Introduction.
2.2 Three dimensional – Scaling, shearing, rotation, reflection, translation.
2.3 Multiple transformations.
2.4 Rotation about – an axis parallel to coordinate axes, an arbitrary line
2.5 Reflection through – coordinate planes, planes parallel to coordinate planes , an arbitrary plane

Unit 3. Projection **[08 Lectures]**

3.1 Orthographic projections.
3.2 Axonometric projections.
3.3 Oblique projections
3.4 Single point perspective projection

Unit 4. Plane and space Curves: **[08 Lectures]**

4.1 Introduction.
4.2 Curve representation.
4.3 Parametric curves.
4.4 Parametric representation of a circle and generation of circle.
4.5 Bezier Curves – Introduction, definition, properties (without proof), Curve fitting (up to n = 3), equation of the curve in matrix form (upto n = 3)

Textbook:

1. D. F. Rogers, J. A. Adams, Mathematical elements for Computer graphics, Mc Graw Hill Intnl Edition.

Unit 1: Chapter 2: Sec. 2-1 to 2.17
Unit 2: Chapter 3: Sec. 3.1 to 3.10,
Unit 3: Chapter 3: Sec. 3.12 to 3.14
Unit 4: Chapter 4: Sec. 4.1, 4.2, 4.5, Chapter 5: Sec. 5.1, 5.8

Reference books:

1. Computer Graphics with OpenGL, Donald Hearn, M. Pauline Baker, Warren Carithers, Pearson (4^{th} Edition)
2. Schaum Series, Computer Graphics.

MTC-242: Operations Research

Unit 1: Linear Programming Problem I **[12 Lectures]**

1.1 Introduction Definition and Examples
1.2 Problem solving using Graphical method
1.3 Theory of Linear Programming, Slack and surplus variables, Standard form of LPP, Some important definitions, Assumptions in LPP, Limitations of Linear programming, Applications of Linear programming, Advantages of Linear programming Techniques
1.4 Simplex method, Big- M-method

Unit 2: Linear Programming Problem II **[08 Lectures]**

2.1 Special cases of LPP : Alternative solution, Unbounded solution, Infeasible solution
2.2 Duality in Linear Programming, Primal to dual conversion, Examples

Unit 3: Assignment Models **[06 Lectures]**

3.1 Assignmment Model -Introduction
3.2 Hungerian method for Assignment problem

Unit 4: Transportation Models **[10 Lectures]**

4.1 Introduction, Tabular representation

4.2 Methods of IBFS (North-West rule, Matrix-minima, Vogel's Approximation), Algorithms

4.3 The Optimality Test of Transportation Model (MODI method only)

Text Book:-

Operation Research (12 th Edition), by S.D.Sharma.

Unit 1: Chapter 1: Sec. 1.1, 1.3-1, 1.3-2, 1.5, 1.6, 1.8, 1.9, 1.10, 1.11, 1.12,
Chapter 3: Sec. 3.1, 3.2, 3.3, 3. 4, 3.5-4,

Unit 2: Chapter 3: Sec. 3.8-1,3.8-2, Chapter 5: Sec. 5.1-1, 5.2-1,5.3,5.7-1, 5.7-2

Unit 3: Chapter 9: Sec. 9.1, 9.2, 9.4-1, 9.4-2, 9.5, 9.6, 9.7-1, 9.7-2

Unit 4: Chapter 10: 10.1, 10.2, 10.5, 10.8-1,10.9, 10.10

Reference Books:-

1. Operations Research by H. A. Taha
2. Operations Research by R. Panneerselvam, Prentice Hall of India.
3. Principles of Operations Research by H. M. Wagner, Prentice Hall of India.
4. Operations Research by Gupta and Hira.
5. Operation Research by J.K. Sharma

MTC-243: Mathematics Practical: Python Programming Language-II

Unit 1: 2D, 3D Graphs

1.1 Installation of numpy, matplotlib packages

1.2 Graphs plotting of functions such as ... etc.

1.3 Different formats of graphs.

1.3 Three-dimensional Points and Lines

1.4 Three-dimensional Contour Plots

1.5 Wireframes and Surface Plots

1.6 Graphs plotting of functions such as... etc.

Unit 2: Computational Geometry

1.1 Points: The distance between two points, Lists of Points - the PointList class, Integer point lists, Ordered Point sets, Extreme Points of a PointList, Random sets of Points not in general position

2.2 Points: Displaying Points and other geometrical objects, Lines, rays, and line segments, The geometry of line segments, Displaying lines, rays and line segments

2.3 Polygon : Representing polygons in Python, Triangles, Signed area of a triangle, Triangles and the relationships of points to lines, is Collinear, is Left, is Left On, is Right, is Right On, Between

2.4 Two dimensional rotation and reflection

2.5 Three dimensional rotation and reflection

2.6 Generation of Bezier curve with given control points

Unit 3: Study of Operational Research in Python

3.1 Linear Programming in Python
3.2 Introduction to Simplex Method in Python

Practicals:

Practical 1: Graph Plotting (Unit 1 – 1.1 – 1.3)
Practical 2: Graph Plotting (Unit 1 – 1.4 – 1.7)
Practical 3: Application to Computational Geometry (Unit 2 – 2.1)
Practical 4: Application to Computational Geometry (Unit 2 – 2.2)
Practical 5: Application to Computational Geometry (Unit 2 – 2.3)
Practical 6: Study of Graphical aspects of Two dimensional transformation matrix using matplotlib
Practical 7: Study of Graphical aspects of Three dimensional transformation matrix using matplotlib
Practical 8: Study of Graphical aspects of Three dimensional transformation matrix using matplotlib
Practical 9: Study of effect of concatenation of Two dimensional and Three dimensional transformations
Practical 10: Generation of Bezier curve using given control points
Practical 11: Study of Operational Research in Python (Unit 3.1)
Practical 12: Study of Operational Research in Python (Unit 3.2)

Text Books:-

1. **Jaan Kiusalaas, Numerical Methods in Engineering with Python, Cambridge University Press, (2005)**
   Sections: 3
2. **Robert Johansson, Introduction to Scientific Computing in Python**
   Section: 1
3. **Jason Brownlee, Basics of Linear Algebra for Machine Learning, Discover the Mathematical Language of Data in Python**
   Sections: 2

Reference Books:-

1. Lambert K. A., Fundamentals of Python - First Programs, Cengage Learning India, 2015.
2. Guzdial, M. J., Introduction to Computing and Programming in Python, Pearson India.
3. Perkovic, L., Introduction to Computing Using Python, 2/e, John Wiley, 2015.
4. Zelle, J., Python Programming: An Introduction to Computer Science, Franklin, Beedle and Associates Inc.
5. Jim Arlow, Interactive Computational Geometry in Python

Note:

(i) In paper -I , paper-II and paper-III, each course is of 50 marks (35 marks theory and 15 marks internal examination).

(ii) Paper III: Mathematics Practical - MTC-233 and MTC-243 is practical course and

is of 50 marks. Practicals shall be perforemed on computer.

Examination:

A) Pattern of examination: Paper- I, Paper-II and paper-III: Semesterwise

B) Pattern of question papers: For Paper -I and Paper-II

Q 1. Attempt any 05 out of 07 questions each of 01 marks. [05 Marks]
Q 2. Attempt any 02 out of 04 questions each of 05 marks. [10 Marks]
Q 3. Attempt any 02 out of 04 questions each of 05 marks. [10 Marks]
Q 4. Attempt any 02 out of 04 questions each of 10 marks. [10 Marks]

C) Instructions Regarding Practical:

Paper-III:Mathematics Practical:

(i) Mathematics Practical, external examiner shall be appointed by Savitribai Phule Pune University, Pune.
(ii) The minimum duration of parctical examination is 3 hours.
(iii) The semester examination is of 35 marks 15 marks are from internal evaluation (Journal, attendence and viva-voce or internal test etc.)
(iv) The slips for the questions on programming and problem solving using python shall be prepared and provided and these can be used at least for 3 years.

D) Standard of passing:

For Paper- I, Paper-II and Papaer -III: 14 Marks out of 35 and 06 marks out of 15 marks and total should be 20 marks for each course.

SYBSC & SYBSC (Computer Science)

ENGLISH

(Ability Enhancement Course-AEC)

(Choice Based Credit System-35:15-Pattern)
(w. e. f- 2020- 2021)

(03 Credit Course-2+1)

Text: ***Horizons: English in Multivalent Contexts (***Board of Editors- Orient BlackSwan)

Preamble:

This is an ABILITY ENHANCEMENT COURSE. Considering the needs of students and the requirements of professional sectors, the syllabus of this paper is designed to enhance linguistic and professional skills of the students. In the age of technology, it's high time for the students to acquire and exercise the skill and sub-skills of using English in multivalent contexts.

The paper aims at a balanced up-gradation of the students, focussing on their ability enhancement. Hence, to avoid a lopsided professional development, the humane values are also taken care of by accommodating literature section in the syllabus. The other units cater to the needs of enhancing speaking ability, writing ability, the ability to face an interview, the ability of using soft skills effectively while planning one's work and working on the plans. By and large, the present syllabus is an attempt to galvanise the existing competencies of the students and enhancing their abilities for a better performance and better results.

Each semester shall have 2+1=3 credits for teaching (One credit is for practical/discussion purpose). However, each credit is equal to 15 hours, so this course shall have 45 teaching hours. In addition to that there shall be 03 hours allotted to internal evaluation. **(3x15=45+3=48).**

Objectives:

1. To introduce the use of English in multimedia
2. To acquaint the students with the language skills in multivalent contexts
3. To acquaint and enlighten students regarding the speaking skill in various contexts
4. To acquaint and familiarize the students with advanced writing skills in different contexts
5. To acquaint and familiarize the students with soft skills
6. To minimize the gap between the existing communicative skills of the students and the skills they require at professional level
7. To develop competence among the students to appreciate and analyze short stories and poetry

Semester-III

Text: ***Horizons: English in Multivalent Contexts (***Board of Editors- Orient BlackSwan)

Content-

UNIT-I- LITERATURE **10 Clock Hours**

1. **Short Story:**
   i) 'A Shadow': R. K. Narayan
2. **Poetry:**
   i) La Belle Dame sans Merci: John Keats
   ii) Where the Mind is without Fear: Rabindranath Tagore
3. **Practical/Discussion** **05 Clock Hours**

UNIT-II-CONVERSATIONAL SKILL **10 Clock Hours**

(Sample Dialogues, Useful Expressions and Exercises)

1. Introducing Yourself and Others
2. Asking, Giving and Refusing Permission
3. Describing Daily Routine
4. Complaining and Apologizing
5. **Practical/Discussion** **05 Clock Hours**

UNIT-III-INTERVIEW TECHNIQUES **10 Clock Hours**

1. Job Application Letter
2. Resume Writing
3. GDPI
4. Presentations
5. **Practical/Discussion** **05 Clock Hours**

Semester-IV

Text: ***Horizons: English in Multivalent Context (***Board of Editors- Orient BlackSwan)

UNIT-I-LITERATURE **10 Clock Hours**

1. **Short Story:**
   i) My Lost Dollar: Stephen Leacock
2. **Poetry:**
   i) The Bird Sanctuary: Sarojini Naidu
   ii) Stopping by Woods on a Snowy Evening: Robert Frost
3. **Practical/Discussion:** **05 Clock Hours**

UNIT-II-WRITING SKILLS **10 Clock Hours**

(Sample Passages, Useful Techniques and Exercises)

1. Notices
2. Agenda
3. Minutes
4. Content Writing
5. **Practical/Discussion** **05 Clock Hours**

UNIT-III-SOFT SKILLS AND PERSONALITY DEVELOPMENT **10 Clock Hours**

(Sample Situations, Useful Techniques and Exercises)

1. An Introduction to Soft Skills
2. SWOC Analysis
3. Goal Setting
4. Project Management
5. **Practical/Discussion** **05 Clock Hours**

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BIBLIOGRAPHY:

1. Adair, John. Effective Communication, London: Pan Macmillan Ltd. 2003.

2. Amos, Julie-Ann. Handling Tough Job Interviews. Mumbai: Jaico Publishing, 2004.

3. Baron, N.S., (2008).Always On: Language in an Online and Mobile World. Oxford University Press. Oxford.

4. Borg, James.(2010). Body Language: 7 Easy Lessons to Master the Silent Language. FT Press.

5. Collins, Patrick. Speak with Power and Confidence. New York: Sterling, 2009.

6. Kroehnert, Gary. Basic Presentation Skills. Sidney: McGraw Hill, 2010.

7. Linda B., Iris V. (2001). Intercultural Communication in the Global Workplace. 2nd Edition. Tata McGraw

8. Mitra, B. (2011). Personality Development & Soft Skills.1st edition. Oxfor.

9. Moore, Ninja-Jo, et al. Nonverbal Communication: Studies and Applications. New York: Oxford University Press, 2010.

10. Nelson, Paul E. & Judy C. Pearson, Confidence in Public Speaking.

11. Prasad, H. M. How to Prepare for Group Discussion and Interview. New Delhi: Tata McGraw-Hill Publishing Company Limited, 2001.

12. Pease, Allan. Body Language. Delhi: Sudha Publications, 1998.

13. Raman, Meenakshi & Sangeeta Sharma. Technical Communication: Principles and Practice. Second Edition. New Delhi: Oxford University Press, 2011.

14. Rutherford, Andrea J. Basic Communication Skills for Technology: Second Edition. Delhi: Pearson Education, 2007.

15. Sharma, R. C. & Krishna Mohan. Business Correspondence and Report Writing: Third Edition. New Delhi: Tata McGraw-Hill Publishing company Limited, 2007.

WEB LINKS:

http://networketiquette.net/

https://public.wsu.edu/~brians/errors/

http://users3.ev1.net/~pamthompson/body_language.htm

http://www.albion.com/netiquette/corerules.html

http://www.bbc.co.uk/worldservice/learningenglish/radio/specials/15

35_questionanswer/page15.shtml

http://www.colostate.edu/Depts/Speech/rccs/theory44.html

http://www.dailywritingtips.com/

EVALUATION PATTERN

Considering the choice-based credit system (CBCS) and the semester pattern, both Semesters-III & IV will have a uniform evaluation pattern of **50 marks** each. There will be an '**Internal Examination**' for **15 marks** and **Semester-end Examination** for **35 marks**.

The Internal Examination for **15 marks** will be conducted in two parts.

1) Practical Examination for 05 marks:

(The choices like Group Discussion, Mock Interviews, Seminar, Project Presentation, Role Play, Home Assignment, Library Work, Lecture Notes etc. can be considered.)

2) A Mid-semester Written Test for 10 marks:

The Mid-semester Written Test will be based on the book prescribed for the syllabus. The test aims at assessing students' writing competence in general. Hence, descriptive and essay type questions can be considered while setting the question paper.

Semester-end Examination:

The Semester-end Examination will have a uniform question paper pattern for both semesters. The pattern of the question paper is given below.

SEMESTER-END EXAMINATION

Question Paper Patterns

(Sem-III)

Marks: 35 **Time: 2 Clock Hours**

Instructions:

1. All questions are compulsory.

2. Figures to the right indicate full marks.

Q.1) Long-answer question on Unit-1

(Any 1 out of 2) (15)

Q.2) Short notes on Unit-2

(Any 2 out of 3) (10)

Q.3) Short notes on Unit-3

(Any 2 out of 3) (10)

(Sem-IV)

Marks: 35 **Time: 2 Clock Hours**

Instructions:

1. All questions are compulsory.

2. Figures to the right indicate full marks.

Q.1) Long-answer question on Unit-1

(Any 1 out of 2) (15)

Q.2) Short notes on Unit-2

(Any 2 out of 3) (10)

Q.3) Short notes on Unit-3

(Any 2 out of 3) (10)

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