



AC/27.06.2023/RS1

College of Arts,  
Science &  
Commerce (Autonomous)

RISE WITH EDUCATION

NAAC REACCREDITED - 'A' GRADE

**SIES College of Arts, Science and Commerce  
( Autonomous)  
Affiliated to University of Mumbai**

**Syllabus revised in June 2023**

**Program: T.Y. B.Sc.  
Course: APPLIED COMPONENT  
Computer Programming and Applications**

**Choice Based Credit System (CBCS)  
with effect from the academic year 2023-24**

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## **1. Preamble**

This undergraduate course is designed to provide students specializing in mathematics and statistics with a strong foundation in programming using Java, Python, SQL, and PL-SQL. The course aims to equip students with the essential programming skills necessary to effectively analyse and manipulate data, develop algorithms, and implement computational solutions in their field of study. Through a combination of theoretical concepts, hands-on programming exercises, and real-world applications, students will develop a solid understanding of programming principles and gain practical experience in utilising programming languages for mathematical and statistical analysis.

## **2. Learning Objectives:**

- Understand programming fundamentals
- Apply SQL for database management
- Utilise PL-SQL for advanced data processing
- Integrate programming for mathematical and statistical applications
- Develop problem-solving skills
- Collaborate and communicate effectively

### 3. Course structure with credits and Lectures/Week

<b>SEMESTER V</b>				
<b>THEORY</b>				
<b>Course Code</b>	<b>UNIT</b>	<b>TOPICS</b>	<b>Credits</b>	<b>L or P/Week</b>
<b>SIUSCPA51</b>	I	<b>Introduction to Java Programming</b>	2	4L
	II	<b>Inheritance, Exception Handling</b>		
	III	<b>Relational Database Management System</b>		
	IV	<b>Introduction to PL/SQL</b>		
<b>PRACTICALS</b>				
<b>SIUSCPAP5</b>	Practicals based on <b>SIUSCPA51</b>		2	2P (1P=2L) per batch*
<b>*Number of students per batch for the regular practical should not exceed 20.</b>				

<b>SEMESTER VI</b>				
<b>THEORY</b>				
<b>Course Code</b>	<b>UNIT</b>	<b>TOPICS</b>	<b>Credits</b>	<b>L or P /Week</b>
<b>SIUSCPA61</b>	I	<b>Introduction to Python 3x</b>	2	4L
	II	<b>Loops and functions</b>		
	III	<b>NumPy, SymPy, SciPy</b>		
	IV	<b>Pandas and Matplotlib</b>		
<b>PRACTICALS</b>				
<b>SIUSCPAP6</b>	Practicals based on <b>SIUSCPA61</b>		2	2P (1P=2L) per batch
<b>*Number of students per batch for the regular practical should not exceed 20.</b>				

#### 4. Consolidated Syllabus for semesters V & VI with Course Outcomes

##### Semester V

##### Course: Computer Programming and Applications

##### Course Code: SIUSCPA51

##### Course Outcomes:

On successful completion of this course students should be able to:

- Write programs in java with and without instance variables and methods
- Understand the concept of arrays, constructors and Overloading methods
- Understand error handling using exceptions and inheritance by creating suitable classes
- Create database tables with and without constraints
- Update and alter table structures
- Retrieve data from single or multiple tables
- Process data with date, string and aggregate functions
- Write simple PL/SQL block codes with and without loops.

<b>Unit 1</b>	<b>Introduction to Java Programming (15 L)</b>
	<p>A. <b>Object-Oriented approach:</b> Features of object-orientations, Abstraction, Inheritance, Encapsulation and Polymorphism.</p> <p>B. <b>Introduction:</b> History of Java, Java features, Differentiate Java with other conventional languages. Java Virtual Machine.</p> <p>C. <b>Java Basics:</b> Variables and data types, declaring variables, literals: numeric, Boolean, character and string literals, keywords, type conversion and casting. Standard default values. Java Operators, Loops and Controls</p> <p>D. <b>Classes:</b> Defining a class, creating instance and class members: creating object of a class; accessing instance variables of a class; creating method; naming method of a class; accessing method of a class; overloading method; 'this' keyword, constructor and Finalizer: Basic Constructor; parameterized constructor; calling another constructor; finalize () method; overloading constructor.</p> <p>E. <b>Arrays:</b> one and two-dimensional array, declaring array variables, creating array objects, accessing array elements.</p>
<b>Unit II</b>	<b>Inheritance, Exception Handling (15 L)</b>
	<p>A. <b>Access control:</b> public access, friendly access, protected access, private access.</p> <p>B. <b>Inheritance:</b> Various types of inheritance, super and subclasses, keywords-extends'; 'super', overriding method, final and abstract class: final variables and methods; final classes, abstract methods and classes. Concept of interface.</p>

	<p>C. <b>Exception Handling and Packages:</b> Need for Exception Handling, Exception Handling techniques: try and catch; multiple catch statements; finally block; usage of throw and throws. Concept of packages. Inter class method: parseInt().</p>
<b>Unit III</b>	<b>Relational Database Management System (15L)</b>
	<p>A. <b>Introduction to Database Concepts,</b> Database systems vs file systems, view of data, data models, data abstraction, data in-dependence, three level architecture, database design, database languages - data definition language(DDL), data manipulation language(DML).</p> <p>B. <b>E - R Model,</b> Basic concepts, keys, E-R diagram, design of E-R diagram schema (simple example). Relational structure</p> <p>C. <b>Tables (relations),</b> rows (tuples), domains, attributes, candidate keys, primary key, entity integrity constraints, referential integrity constraints, query languages.</p> <p>D. <b>SQL Commands and Functions,</b> Handling data, selecting data using SELECT statement. FROM clause, WHERE clause, HAVING clause, ORDER BY, GROUP BY, DISTINCT and ALL predicates. Adding data with INSERT statement. Changing data with UPDATE statement. Removing data with DELETE statement. Joining Tables, Inner joins, outer joins, cross joins, union. Functions</p> <p>E. <b>Aggregate functions:</b> -- AVG, SUM, MIN, MAX and COUNT. Date functions - ADD_MONTHS (), CURRENT_DATE (), LAST_DAY (),MONTHS_BETWEEN (), NEXT_DAY (). String functions - LOWER (), UPPER (), TRIM (), RTRIM (), INSTR (), PATINDEX (), REPLICATE (), SUBSTR (), REVERSE (), RIGHT (), LEFT (). Numeric functions:-ABS(),EXP(),LOG(),SQRT(),POWER(),ROUND().</p> <p>F. <b>Creating and altering tables:-</b>CREATE statement, ALTER statement, and DROP statement.</p> <p>G. <b>Constraints:-</b> Types of constraints, KEY constraints, CHECK constraints, DEFAULT constraints, disabling constraints. Indexes, Understanding indexes, creating and dropping indexes, maintaining indexes.</p>
<b>Unit IV</b>	<b>Introduction to PL/SQL (15L)</b>
	<p>A. <b>Fundamentals of PL/SQL:</b> Defining variables and constants, PL/SQL expressions and comparisons: Logical Operators, Boolean Expressions, CASE Expressions Handling, Null Values in Comparisons and Conditional Statements.</p> <p>B. <b>PL/SQL Data types:</b> Number Types, Character Types, Boolean Type. Datetime and Interval Types.</p> <p>C. <b>Overview of PL/SQL Control Structures:</b> Conditional Control: IF and CASE Statements, IF-THEN Statement, IF-THEN-ELSE Statement, IF-THEN-ELSIF Statement, CASE Statement.</p> <p>D. <b>Iterative Control:</b> LOOP and EXIT Statements, WHILE-LOOP, FOR-LOOP, Sequential Control: GOTO and NULL Statements.</p>

**Course: CPA Practicals**  
**Course Code: SIUSCPAP5**

No.	Topics for Practical
0	Java programs that illustrate the concept of selection statements, loops, nested loops, breaking out of loop.
1	Java programs that illustrate the concept of arrays (one and two dimensional).
2	Programs to create a Java class (i) with instance variables and methods (ii) with instance variables and without methods (iii) without instance variables and with methods Create an object of this class that will invoke the instance variables and methods accordingly.
3	Programs to illustrate the concept of Java class that includes constructor with and without parameters.
4	Programs to illustrate the concept of Java class that includes overloading methods and inheritance.
5	Creating, altering and updating a single table with/ without constraints and executing queries.
6	Joining tables and processing queries. Queries containing aggregate, string and date functions fired on a single table.
7	Writing PL/SQL Blocks with basic programming constructs
8	Writing PL/SQL blocks with control structures

**References:**

- (a) E. Balagurusamy(2009), *Programming with Java: A Primer 4th Edition* by Tata McGraw Hill.
- (b) Herbert Schildt,(2013)*Java The Complete Reference, 8th Edition*, Tata McGraw Hill
- (c) George Koch and Kevin Loney(2002),*ORACLE —The Complete Reference*ll, Tata McGraw Hill,New Delhi.
- (d) Ivan Bayross, (2012) —*SQL, PL/SQL -The Programming language of Oracle*ll, B.P.B.Publications, 3rd Revised Edition.
- (e) Ramakrishnam, Gehrke, (2003) *Database Management Systems*, McGraw-Hill.

## Semester VI

### Course: Computer Programming and Applications

Course Code: SIUSCPA61

#### Course Outcomes:

On successful completion of this course students should be able to:

- Write python programs using different constructs and data type
- Master the fundamentals of writing Python scripts
- Learn core Python scripting elements such as variables and flow control structures
- Integrate Mathematical and Statistical concepts in python programs

Unit I	<b>PYTHON 3.x (15 L)</b>
	<p>A. <b>Introduction:</b> The Python Programming Language, History, features, Installing Python. Running code in the Interactive Shell, IDLE. Input, Processing and Output, Editing, Saving and Running a Script, Debugging: Syntax Errors, Runtime Errors, Semantic Errors. Experimental Debugging.</p> <p>B. <b>Data types and expressions:</b> Variables and the assignment statement, Program Comments and Docstrings, Data types:- Numeric integers and Floating point numbers, Boolean, string. Mathematical operators +, -, *, **, %, PEMDAS. Arithmetic expressions, Mixed-Mode Arithmetic and type Conversion, type(), input(), print(), program comments.id(), int(), str(), float().</p> <p>C. <b>Strings, Lists, Tuple, Dictionary :</b> Assessing characters, indexing, slicing, replacing. Concatenation (+), Repetition (*). Searching a substring with the 'in' operator, Traversing string using while and for. String methods:- find, join, split, lower, upper, len()</p> <p>D. Math module: sin(), cos(), exp(), sqrt(), constants-pi, e.</p>
Unit II	<b>Loops and functions</b>
	<p>A. <b>Loops and selection statements:-</b> If statements, while construct, for statements, the range function, break, continue, else clause</p> <p>B. <b>Design with Functions:</b> Defining Simple Functions-parameters and arguments, the return statement, tuple as return value. Boolean functions. Defining a main function. Defining and tracing recursive functions</p> <p>C. <b>Exception Handling:</b> Try-except. Calculating the factors of an Integer, Generating Multiplication tables, converting units of measurement, finding the roots of a quadratic equation.</p>
Unit III	<b>NumPy, SymPy, SciPy</b>
	<p>A. <b>Numpy arrays:</b> Creating arrays creating n-dimensional arrays using np.array and array operations (indexing and slicing, transpose, mathematical operations)</p>



	<p><b>B. Algebra and Symbolic Math with SymPy:</b> Symbolic math using the SymPy library. Defining Symbols and Symbolic operations, factoring and expanding expressions, substituting in values, converting strings to mathematical expressions. Solving equations, solving quadratic equations, solving for one variable in terms of others, solving a system of linear equations, plotting using SymPy, Plotting expressions input by the user, plotting multiple functions.</p> <p><b>C. SciPy:</b> constants, optimizers, sparse data, graphs, spatial data, matlab arrays.</p>
Unit IV	<b>Pandas and Matplotlib</b>
	<p><b>A. Pandas dataframes:</b> Creating series and dataframes and Operations on series and dataframes. Reading and writing data: From and to Excel and CSV files, Text data operations: len, upper, lower, slice, replace, contains, Frequency Tables</p> <p><b>B. Plotting:</b> using “matplotlib” (Histograms, Box plots, Scatter plot, Bar plot, Line plot), Descriptive Statistics: mean, median, mode, min, max, quantile, standard deviation, variance, skewness, kurtosis, correlation.</p>

**Coure: CPA Practicals**  
**Course Code: SIUSCPAP5**

No.	Topics for Practical
1	Basic Python programs based on data types and expressions
2	Python programs using strings, lists, tuples, dictionary, math modules
3	Python programs using loops and functions
4	Exception Handling
5	NumPy, SymPy
6	SciPy
7	Pandas
8	Matplotlib

**References:**

- (a) E. Balagurusamy(2017), Introduction to computing and *Problem Solving using Python* by Tata McGraw Hill.
- (b) Herbert Schildt,(2013)*Java The Complete Reference, 8th Edition*, Tata McGraw Hill
- (c) Ivan Bayross,(2006),*Web Enabled Commercial Applications Development Using Java 2*,BPB Publications, Revised Edition
- (d) Kenneth A Lambert chapters 1,2 and 3,4,5 .(2018)*Fundamentals of Python First Programs 2<sup>nd</sup> edition*
- (e) Doing Math with Python by Amit Saha(internet source) chapter 1,4
- (f) **Software:** <http://continuum.io/downloads.Anaconda> **3.x**

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## 5. Scheme of Evaluation

### **Internal Assessment of Theory Course of each semester (Total 40 marks)**

- (a) One Assignment/Project ..... 10 Marks.
- (b) One Class Test: .....20 Marks.
- (c) Active participation in class and attendance . .....10 Marks.

### **Semester End Theory Examination (Total 60 marks)**

**Theory:** At the end of the semester, examinations of two and half hours duration and 60 marks based on the four units shall be held for each theory course.

Pattern of Theory question paper at the end of the semester for each course: There shall be Four compulsory Questions of 15 marks each with an internal option. Question 1 based on Unit I, Question 2 based on Unit II, Question 3 based on Unit III and Question 4 based on Unit IV

### **Semester End Practical Examination (Total 100 marks)**

**Semester V and Semester VI: Total evaluation is as follows:-**

- 1) Semester end Practical exam on computer- 80 marks
- 2) Viva 10 marks
- 3) Certified Journal 10 marks

### **Pattern of Practical Examination:-**

- 1. There shall be four compulsory questions of twenty marks each for the semester end practical examination on computer.
  - 2. The questions to be asked in the practical examination shall be from the list of practical experiments mentioned in the practical topics. A few simple modifications may be expected during the examination.
  - 3. The semester end practical examination on the machine will be of THREE hours.
  - 4. Students should carry a certified journal with a minimum of 06 practicals (mentioned in the practical topics) at the time of examination.
  - 5. **Number of students per batch for the regular practical should not exceed 20. Not more than two students are allowed to do practical experiments on one computer at a time.**
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