# S. P. Mandali's

# Ramnarain Ruia Autonomous College

*(Affiliated to University of Mumbai)*



## Syllabus for

## Program: F.Y.B.Sc.

## Program Code: RUSCS

(As per the guidelines of National Education Policy 2020-
Academic year 2023-24)

(Choice Based Credit System)

# GRADUATE ATTRIBUTE

S. P. Mandali's Ramnarain Ruia Autonomous College has adopted the Outcome Based Education model to make its science graduates globally competent and capable of advancing in their careers. The Bachelors Program in Science also encourages students to reflect on the broader purpose of their education.

| GA | GA Description |
|---|---|
| | **A student completing Bachelor's Degree in Science program will be able to:** |
| **GA 1** | Recall and explain acquired scientific knowledge in a comprehensive manner and apply the skills acquired in their chosen discipline. Interpret scientific ideas and relate its interconnectedness to various fields in science. |
| **GA 2** | Evaluate scientific ideas critically, analyse problems, explore options for practical demonstrations, illustrate work plans and execute them, organise data and draw inferences |
| **GA 3** | Explore and evaluate digital information and use it for knowledge upgradation. Apply relevant information so gathered for analysis and communication using appropriate digital tools |
| **GA 4** | Ask relevant questions, understand scientific relevance, hypothesize a scientific problem, construct and execute a project plan and analyse results. |
| **GA 5** | Take complex challenges; work responsibly and independently, as well as in cohesion with a team for completion of a task. Communicate effectively, convincingly and in an articulate manner. |
| **GA 6** | Apply scientific information with sensitivity to values of different cultural groups. Disseminate scientific knowledge effectively for upliftment of the society |
| **GA 7** | Follow ethical practices at workplace and be unbiased and critical in interpretation of scientific data. Understand the environmental issues and explore sustainable solutions fo |
| **GA 8** | Keep abreast with current scientific developments in the specific discipline and adapt to technological advancements for better application of scientific knowledge as a lifelong learner |

# PROGRAM OUTCOMES

| PO | Description |
|---|---|
| | **A student completing Bachelor's Degree in Science program in the subject of Statistics will be able to:** |
| **PO 1** | Apply knowledge of computational mathematics ,statistics and programming acquired inthe field of Computer Science |
| **PO 2** | Identify , analyze complex problems in the real world and formulate innovative solutions to those problems. |
| **PO 3** | Compare and apply hardware and software technologies for implementing reliable optimized solutions catering to need and available resources. |
| **PO 4** | Apply domain expertise to pursue higher education and Research in computer science discipline. |
| **PO 5** | Apply software development, managerial, Professional and soft skills in industry |
| **PO 6** | Understand the global needs and prepare themselves for the changing needs worldwide adapting an ability to engage in life- long learning.. |
| **PO 7** | Become a responsible ,ethical citizen and explore environmental issues to develop sustainable solutions for it. |
| **PO 8** | Use the techniques, skills and modern computing tools to emerge as a freelancer and entrepreneur in the field. |

## CREDIT STRUCTURE B.Sc.

| Semester | Subject 1 | | | | | | |
|---|---|---|---|---|---|---|---|
| | | | | | | | |

| | DSC | DSE | Subject 2 | GE/ OE course (Across disciplines) | Vocational and Skill Enhancement Course (VSC) & SEC | Ability Enhancement Course/ VEC/IKS | OJT/FP/CEPCC, RP | Total Credits |
|---|---|---|---|---|---|---|---|---|
| 1 | 4 | | 4 | 4 (2*2) | VSC-2 + SEC -2 | AEC- 2 (CSK) + VEC- 2 (Env Sc.) + IKS-2 | | 22 |
| 2 | 4 | | 4 | 4 (2*2) | VSC-2 + SEC-2 | AEC-2 (CSK)+ VEC-2 (Understanding India) | CC-2 | 22 |
| **Total** | **8** | | **8** | **8** | **8** | **10** | **2** | **44** |
| **Exit option: award of UG certificate in Major with 44 credits and an additional 4 credit Core NSQF course/ Internship or Continue with Major and Minor** | | | | | | | |
| 3 | Major 8 | | Minor 4 | 2 | VSC-2 | AEC-2 MIL | FP -2, CC-2 | 22 |
| 4 | Major 8 | | Minor 4 | 2 | SEC-2 | AEC-2 MIL | CEP-2, CC-2 | 22 |
| **Total** | **16** | | **8** | **4** | **4** | **4** | **8** | **44** |
| **Exit option: award of UG Diploma in Major with 88 credits and an additional 4 credit Core NSQF course/ Internship or Continue with Major and Minor** | | | | | | | |
| 5 | DSC 12 | DSE 4 | Minor 2 | | VSC-2 | | CEP/FP-2 | 22 |
| 6 | DSC 12 | DSE 4 | Minor 2 | | | | OJT-4 | 22 |
| **Total** | **24** | **8** | **4** | | **2** | | **6** | **44** |
| **Exit option: award of UG Degree in Major with 132 credits or Continue with Major for Honours/ Research** | | | | | | | |

# PROGRAM OUTLINE

# B.Sc. Computer Science
# Discipline Specific Core Courses

| YEAR | SEM | COURSE CODE | TYPE OF COURSE | COURSE TITLE | CREDITS |
|---|---|---|---|---|---|
| FY B.Sc. | I | RUSCS.O101 | DSC Subject I | Algorithms And Programming With C | 3 |
| | | RUSCSP.O101 | Practical based on DSE Subject I | Practicals of Algorithms And Programming With C | 1 |
| | I | RUSCS.O102 | DSC Subject II | Database Management System | 3 |
| | | RUSCSP.O102 | Practical based on DSE Subject II | Practicals of Database Management System | 1 |
| | | | | | |
| FY B.Sc. | II | RUSCS.E111 | DSC Subject I | Computer Organization and Architecture | 3 |
| | | RUSCSP.E111 | Practical based on DSE Subject I | Practicals of Computer Organization and Architecture | 1 |
| | II | RUSCS.E112 | DSC Subject II | Python Programming | 3 |
| | | RUSCSP.E112 | Practical based on DSE Subject II | Practicals of Python Programming | 1 |

# SEMESTER I

**Course Code: RUSCS.O101**

**Course Title: ALGORITHMS AND PROGRAMMING WITH C**

**Type of Course: Discipline Specific Core Course**

**Academic year 2023-24**

| COURSE OUTCOMES | DESCRIPTION<br>A student completing this course will be able to: |
|---|---|
| CO 1 | Critically think ,Assess and choose best solution for solving problem |
| CO 2 | Design Algorithms and Flowcharts for representing Logic |
| CO 3 | Interpret syntax and semantics of C programming |
| CO 4 | Develop modular Programs and Applications of data structures. |
| CO 5 | Use Pointers, Structures and File processing for various applications. |

## DETAILED SYLLABUS

| RUSCS.O101 | ALGORITHMS AND PROGRAMMING WITH C | Credits 3/ 45 Hours |
|---|---|---|
| Unit I | **Fundamentals of algorithms:** | 15 Hrs |

| | Notion of an algorithm. Pseudo-code conventions like assignment statements and basic control structures.<br>Different approaches in programming: Procedural approach, Object Oriented approach, Event Driven approach.<br>Structure of C: Header and body, Use of comments, Compilation of a program. Interpreters vs. compilers.<br>Data Concepts: Variables, Constants, data types. Declaring variables, Scope of the variables according to block, Hierarchy of data types.<br>**Types of operators:** Arithmetic, Relational, Logical, Compound Assignment, Increment and decrement, Conditional or ternary, Bitwise and Comma operators. Precedence and order of evaluation. Statements and Expressions.<br>**Type conversions:** Automatic and Explicit type conversion.<br>**Iterations:** Control statements for decision making: (i) Branching: if statement, else.. if statement, switch statement. (ii) Looping: while loop, do.While, for loop. (iii) Jump statements: break, continue and goto. | |
|---|---|---|
| **Unit II** | **Arrays:** (One and multidimensional), declaring array variables, initialization of arrays, accessing array elements.<br>**Strings:** Declaring and initializing String variables, Character and string handling functions<br>**Data Input and Output functions:** Formatted I/O: printf(), scanf(). Character I/O format: getch(), getche(), getchar(), getc(), gets(), putchar(), putc(), puts().<br>**Functions:** Function declaration, function definition, Global and local variables, return statement, Calling a function by passing values.<br>**Recursion:** Definition, Recursive functions. Storage Classes:Automatic, External, static, RegisterVarable | 15 Hrs |
| **Unit III** | **Pointer:** Fundamentals, Pointer variables, Referencing and dereferencing, Pointer Arithmetic, Using Pointers with Arrays, Using Pointers with Strings, Array of Pointers, Pointers as function arguments, Functions returning pointers.<br>**Dynamic Memory Allocation:** malloc(), calloc(), realloc(), free() and sizeof operator.<br>**Structure:** Declaration of structure, reading and assignment of structure variables, Array of structures, arrays within structures, structures within structures.<br>**Unions:** Defining and working with unions.<br>**File handling:** Different types of files like text and binary, Different types of functions. | 15 Hrs |

## PRACTICAL

| COURSE CODE: RUSCSP.O101 | |
|---|---|
| **Sr. No.** | **PRACTICAL TITLE** |
| 1 | Programs on Structures and Unions |

| 2 | Develop Algorithms and design flow chart along with c program for the given problem |
|---|---|
| 3 | Program to understand Basic Data types and and I/O |
| 4 | Programs on Operators and Expression |
| 5 | Programs on Control Structures |
| 6 | programs on functions |
| 7 | Programs on Array |
| 8 | Programs on Dynamic Memory Allocation |
| 9 | Programs on Strings |

**Textbooks:**
1. Programming in ANSI C, E Balagurusamy, TMH, 3rd Edition.

**Additional References:**
- Let Us C, Yashavant P. Kanetkar, BPB Publications

## Course Code: RUSCS.O102

## Course Title: DATABASE MANAGEMENT SYSTEM

## Type of Course: Discipline Specific Core Course

## Academic year 2023-24

| COURSE OUTCOME | DESCRIPTION<br>A student completing this course will be able to: |
|---|---|
| CO 1 | Interpret the basic concepts and functions of DBMS and design E-R models |
| CO 2 | Create database with appropriate constraints and query the database |
| CO 3 | Understand the fundamental concepts of transaction processing- concurrency control techniques and recovery procedures |
| CO 4 | To know pl/sql constructs |
| CO 5 | Interpret the basic concepts and functions of DBMS and design E-R models |

## DETAILED SYLLABUS

| RUSCS.O102 | Course/ Unit Title | Credits 3 / 45 Hours |
|---|---|---|
| Unit I | **Introduction:** Overview of Database System, Advantages of DBMS, Levels of abstraction,Data Models ,Database System Architecture ,Relational Algebra | 15 Hrs |

| | | | |
|---|---|---|---|
| | | **Database design :** E-R Diagrams, Enhanced ER Model, ER-to-Relational Mapping, Functional Dependencies ,Non-loss Decomposition , First, Second, Third Normal Forms, Boyce/Codd Normal Form Multivalued Dependencies and Fourth Normal Form , Join Dependencies and Fifth Normal Form,ER to table conversion | |
| **Unit II** | | **Structured query language :**Overview of SQL query language , SQL syntax,,operators,DDL,DML,DCL,Aggregate functions,Integrity constraints

**Joins, Subqueries** – Types of joins, subqueries implementation, Nested subqueries, ANY/ALL clause, Processing on views

**Fundamentals of PL/SQL:** Advantages of PL/SQL, Main Features of PL/SQL, Architecture of PL/SQL, sequence,Exception handling | 15 Hrs |
| **Unit III** | | **Stored Procedures and Functions**: Types and benefits of stored procedures, creating stored procedures, executing stored procedures, altering stored procedures, viewing stored procedures. Creating and Calling function , recursion function

**Triggers and Cursors**: Overview of Triggers, creating triggers, Insert, delete, and update triggers, nested triggers, viewing, deleting, and modifying triggers, and enforcing data integrity through triggers,Overview of Cursor, Types of cursors, Cursor for loops, Cursor variables, parameterized cursors

**Transaction:**Transaction Concepts,ACID Properties,Schedules, Serializability , Concurrency Control ,Need for Concurrency , Locking Protocols , Deadlock | 15 Hrs |

## PRACTICAL

| COURSE CODE: RUSCSP.O102 | |
|---|---|
| **Sr. No.** | **PRACTICAL TITLE** |
| 1 | Database Design using ER modelling |
| 2 | DDL,DML and DCL |
| 3 | Queries based on Functions |
| 4 | Subqueries and Join |
| 5 | Views |
| 6 | PL/SQL Blocks |
| 7 | Procedures and Functions |
| 8 | Triggers |
| 9 | Cursors |

| 10 | Exception handling |
|----|--------------------|

**Textbooks:**

- Ramez Elmasri, Shamkant B. Navathe, "Fundamentals of Database Systems", Sixth Edition, Pearson Education, 2011
- Raghu Ramakrishnan, "Database Management Systems", Fourth Edition, McGraw-Hill College Publications, 2015.

# SEMESTER II

## Course Code: RUSCS.E111

## Course Title: COMPUTER ORGANIZATION & ARCHITECTURE

## Type of Course: Discipline Specific Core Course

## Academic year 2023-24

| COURSE OUTCOME | DESCRIPTION A student completing this course will be able to: |
|---|---|
| **CO 1** | Explains and demonstrates the architecture, structure, working, issues and problems, CPU architecture and its working. |
| **CO 2** | Demonstration to digital circuits. |
| **CO 3** | Illustrate the multicore systems and embedded systems along with its applications. |
| **CO 4** | Understand and explain the underlying principles of computers. |
| **CO 5** | Identify various hardware used in the computer. |
| **CO 6** | Construct how digital circuits are implemented in computers. |
| **CO 7** | Simulates how data is transferred between various peripheral devices in the computer. |

## DETAILED SYLLABUS

| RUSCS.E111 | Computer Organization and Architecture | Credits 3 / 45 Hours |
|---|---|---|
| **Unit I** | **Fundamentals of Digital Logic:** Boolean algebra, Logic Gates, Simplification of Logic Circuits: Algebraic Simplification, Karnaugh Maps. <br> **Number Systems & Codes -** <br> Introduction, Number Systems, Binary Number System, Signed Binary Numbers, Binary Arithmetic, 2's Complement Arithmetic, Octal Number System, Hexadecimal Number System, codes <br> **Combinational Circuits:** Adders, Mux, Demux, Sequential Circuits: FlipFlops (SR, JK & D), Counters: synchronous and asynchronous. <br> **Counter Computer System:** Comparison of Computer Organization & Architecture, Computer Components and Functions, Interconnection Structures. Bus Interconnections, | **15 Hrs** |
| **Unit II** | **Input / Output**: I/O Module, Programmed I/O, Interrupt Driven I/O, Direct Memory Access. <br> **Memory System Organisation:** Classification and design parameters, Memory Hierarchy, Internal Memory: RAM, SRAM and DRAM, Interleaved and Associative Memory. | **15 Hrs** |

| | | |
|---|---|---|
| | **Cache Memory:** Design Principles, Memory mappings, Replacement Algorithms, Cache performance, Cache Coherence. Virtual Memory, **External Memory:** Magnetic Discs, Optical Memory, Flash Memories, RAID Levels Processor Organization: Instruction Formats, Instruction Sets, Addressing Modes, Addressing Modes Examples with Assembly Language [8085/8086 CPU], Processor Organization, Structure and Function. Register | |
| **Unit III** | **RISC and CISC:** Introduction to RISC and CISC Architecture, Instruction Level Parallelism and Superscalar Processors: Design Issues<br>**Control Unit:** Micro-Operations, Functional Requirements, Processor Control, Hardwired Implementation, Micro-programmed Control.<br>**Fundamentals of Advanced Computer Architecture:** Parallel Architecture: Classification of Parallel Systems, Flynn"s Taxonomy, Array Processors, Clusters, and NUMA Computers.<br>**Multiprocessor Systems:** Structure & Interconnection Networks, Multi-Core Computers: Introduction, Organization and Performance. | **15 Hrs** |

## PRACTICAL

| COURSE CODE: RUSCSP.E111 | |
|---|---|
| **Sr. No.** | **PRACTICAL TITLE** |
| 1 | Knowledge of hardware that goes in the making of a computer: Assembling a PC. Installation of OS, setting up of dual boot, installation of hardware and software |
| 2 | Execution of File handling commands in DOS Prompt |
| 3 | Study and verify the truth table of various logic gates (NOT, AND, OR, NAND, NOR, EX-OR, and EX-NOR) |
| 4 | Design and verify a half/full adder & Subtractor |
| 5 | Design ALU using Logisim |
| 6 | Design and verify the operation of flip-flops using logic gates |
| 7 | Verify the operation of a counter |
| 8 | Verify the operation of a 4 bit shift register |
| 9 | Write an assembly language code in GNUsim8085 to find the factorial of a number |
| 10 | Write an assembly language code in GNUsim8085 to implement logical instructions |
| | Practical No. 3 to 8 can be performed using any open source simulator (like Logisim) (Download it from https://sourceforge.net/projects/circuit/)<br><br>Practical No. 9 to 10 can be performed using GNUsim8085 |

**Textbooks:**

1. Computer Organization & Architecture Designing for Performance, William Stallings, PHI, 8th Edition.
2. Computer Organization & Embedded Systems, Carl Hamacher, Zvonko Vranesic, Safwat Zaky, & Naraig Majikian, McGraw Hill, 6th Edition
3. Modern Digital Electronics, R. P. Jain, McGraw Hill, 4th Edition
4. Embedded System, Architecture and programming,Rajkamal,TMH,2008

**Additional References:**

- Patterson and Hennessy, Computer Organization and Design, Morgan Kaufmann, ARM Edition, 2011

- https://www.embeddedrelated.com/showarticle/453.php

- https://www.8051projects.net/wiki/Keil_Embedded_C_Tutorial#Introduction_to_Keil_C

**Course Code: RUSCS.E112**

**Course Title: PYTHON PROGRAMMING**

**Type of Course: Discipline Specific Core Course**

**Academic year 2023-24**

| COURSE OUTCOME | DESCRIPTION<br>A student completing this course will be able to: |
|---|---|
| **CO 1** | Describe core syntax and semantics of python |
| **CO 2** | Understand data storing and processing mechanism on String, List, Dictionary, Tuples |
| **CO 3** | Implement File And exception handling techniques |
| **CO 4** | Design GUI Applications |
| **CO 4** | Apply Object-oriented Programming concepts |

## DETAILED SYLLABUS

| RUSCS.E112 | Python Programming | Credits 3 / 45 Hours |
|---|---|---|
| **Unit I** | **Introduction to Python**: History, Features, Execution of Python Programs, Identifiers and Keywords, Comments, Indentation and Multi-lining, Variables (Local and Global), data types, Types of operators, Expressions,comments, Print and, Input Statements in python.<br>**Conditional and Control Statement:** if and else statement, Nested If statement, Loop Statement: While Loop, do and while loop, for loop statement, Continue, Break and pass Statement, Conditional Statements<br>**Data structures**: Strings, Lists, Tuples, Dictionaries, Sets, Accessing Elements, Properties and methods | **15 Hrs** |
| **Unit II** | **Functions and Modules**: Built-in-functions, library functions, Defining and calling the functions, return statements, Passing the arguments, Lambda Functions, Recursive functions, Use of modules, importing Modules, Modules for data analytics<br>**File and Exception Handling:** Files I/O operations, Read / Write Operations, File Opening Modes, with keywords, moving within a file, Manipulating files and directories, OS and SYS modules. Built-in Exceptions, Handling Exceptions, Exception with Arguments, User-defined Exceptions<br>**Regular expression:** Concept of regular expression, Various types of Regular expression, Usage of search, match and findall | **15 Hrs** |
| **Unit III** | **Fundamental ideas of OOP:** OOP features, Classes and Objects, Public and Private Members, Class Declaration and Object Creation, Class Variables and methods, Accessing Objects, Constructors, Inheritance | **15 Hrs** |

| | Database Connectivity in Python: Installing mysql connector, accessing connector module module, using connect, cursor, execute & close functions, reading single & multiple results of query execution, executing different types of statements, executing transactions<br><br>Graphical User Interface: Introduction to GUI library, Layout management, events and bindings, fonts, colors, hands on widgets like canvas, frame, label, button, checkbutton, entry, listbox, message, radiobutton, text, spinbox | |

## PRACTICAL

| COURSE CODE: RUSCSP.E112 | |
|---|---|
| **Sr. No.** | **PRACTICAL TITLE** |
| 1 | Program based on I/O concepts |
| 2 | Programs based on Control Statement |
| 3 | Programs based on Data Structures |
| 4 | Programs based on Functions and modules |
| 5 | Programs based on File processing |
| 6 | Programs based on Exception handling |
| 7 | Programs based on Regular expression |
| 8 | Programs based on OOPS concepts |
| 9 | Programs based on Database connectivity |
| 10 | Programs based on GUI programming |
| | |

**Textbooks:**
1. Beginning Python: From Novice to Professional, Magnus Lie Hetland, Apress,2nd edition.
2. Practical Programming: An Introduction to Computer Science Using Python, Paul Gries, et alPragmatic Bookshelf, 2nd Edition 2014.
3. John Grayson, "Python and Tkinter Programming", Manning Publications (1 March 1999).

**Additional References:**
- Introduction to Computer Science using Python, Charles Dierbach, Wiley, 2013
- Programming Languages - Principles and Paradigms, Adesh Pandey, Naros
- MySQL for Python: Database Access Made Easy, A. Lukaszewski, Pact Publisher, 2010.

# MODALITY OF ASSESSMENT

## Department Specific Course (3 Credit Theory Course for BSc)

### A) Total Marks
    a. Theory – 75 Marks
    b. Practical – 50 Marks

### B) Theory Internal Assessment (40%) - 30 Marks

| Sr No | Evaluation type | Marks |
|-------|-----------------|-------|
| 1 | Class Test | 20 |
| 2 | Class Test/ Project / Assignment / Presentation | 10 |
| | **TOTAL** | **30** |

### C) Theory External Assessment (Semester End Examination) (60%) - 45 Marks
    1. Duration – The duration for these examinations shall be of **One hour 30 Minutes**.
    2. Theory question paper pattern:

| Question | Options | Marks | Questions Based on |
|----------|---------|-------|--------------------|
| 1 | Three out of four | 15 | Unit I |
| 2 | Three out of four | 15 | Unit II |
| 3 | Three out of four | 15 | Unit III |
| | **TOTAL** | **45** | |

### D) Practical Examination (Semester End): 50 marks
    a. **Practical Internal Assessment (40%) 20 Marks:** Students have to acquire at least 40% marks in each paper individually.
    b. **Practical Sem End Exam (60%) 30 Marks**.

| Particulars | Practical |
|-------------|-----------|
| Internal Assessment | 20 |
| Laboratory work | 30 |
| **Total** | **50** |