Resolution No:AC/II(23-24).2.RUS6

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 2024-25)

(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:**
GA1	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.
GA2	Evaluate scientific ideas critically, analyse problems, explore options for practical demonstrations, illustrate work plans and execute them, organise data and draw inferences
GA3	Explore and evaluate digital information and use it for knowledge upgradation. Apply relevant information so gathered for analysis and communication using appropriate digital tools
GA4	Ask relevant questions, understand scientific relevance, hypothesize a scientific problem, construct and execute a project plan and analyse results.
GA5	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.
GA6	Apply scientific information with sensitivity to values of different cultural groups. Disseminate scientific knowledge effectively for upliftment of the society
GA7	Follow ethical practices at workplace and be unbiased and critical in interpretation of scientific data. Understand the environmental issues and explore sustainable solutions fo
GA8	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 Computer Science 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		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
	DSC	DSE						
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	Advanced Database management System	3
		RUSCSP.E112	Practical based on DSE Subject II	Practicals of Advanced Database management System	1

SEMESTER I

Course Code: RUSCS.O101

Course Title: ALGORITHMS AND PROGRAMMING WITH C

Type of Course: Discipline Specific Core Course

Academic year 2024-25

COURSE OUTCOMES	DESCRIPTION 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:** Notion of an algorithm. Pseudo-code conventions like assignment statements and basic control structures. Different approaches in programming: Procedural approach, Object Oriented approach, Event Driven approach. Structure of C: Header and body, Use of comments, Compilation of a program. Interpreters vs. compilers. Data Concepts: Variables, Constants, data types. Declaring variables, Scope of the variables according to block, Hierarchy of data types. **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. **Type conversions:** Automatic and Explicit type conversion. **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.	15 Hrs

Unit II	**Arrays:** (One and multidimensional), declaring array variables, initialization of arrays, accessing array elements. **Strings:** Declaring and initializing String variables, Character and string handling functions **Data Input and Output functions:** Formatted I/O: printf(), scanf(). Character I/O format: getch(), getche(), getchar(), getc(), gets(), putchar(), putc(), puts(). **Functions:** Function declaration, function definition, Global and local variables, return statement, Calling a function by passing values. **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. **Dynamic Memory Allocation:** malloc(), calloc(), realloc(), free() and sizeof operator. **Structure:** Declaration of structure, reading and assignment of structure variables, Array of structures, arrays within structures, structures within structures. **Unions:** Defining and working with unions. **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 2024-25

COURSE OUTCOME	DESCRIPTION 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	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 **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	15 Hrs
Unit II	**Relational Algebra** - operations (selection, projection, set operations union, intersection, difference, cross product, Joins – conditional, equi join and natural joins, division) **Structured query language :**Overview of SQL query language ,SQLsyntax,,operators,DDL,DML,DCL,Aggregate functions,Integrity constraints **Joins, Subqueries** – Types of joins, subqueries implementation, Nested subqueries, ANY/ALL clause, Processing on views	15 Hrs
Unit III	File Organization and Indexing: Cluster, Primary and secondary indexing, Index data structure: hash and Tree based indexing,	15 Hrs

	Comparison of file organization: cost model, Heap files, sorted files, clustered files. Creating, dropping and maintaining indexes **Transaction and concurrency management:**Transaction basics,ACID Properties,Schedules, Serializability ,Need for Concurrency , Locking Protocols , Deadlock **Crash recovery**:Failure Classification,Recovery and Atomicity,ARIESalgorithm,checkpoints,Log- based Recovery	

CODE: RUSCSP.O102
Practicals of Database Management System

COURSE OUTCOMES

A student completing successfully completing this course will be able to:

CO	Description
CO1	Apply RDBMs concepts
CO2	Use DDL,DML,DQL queries
CO2	Interpret use of joins and subqueries

COURSE CODE: RUSCSP.O102	
Sr. No.	**PRACTICAL TITLE**
1	Database Design using ER modelling
2	Relational algebra
2	Creation of table with Constraints
3	DML and DCL
4	Queries based on Functions
5	Subqueries
6	Views
7	Joins
8	DCL and TCL
9	Indexes

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 2024-25

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. **Number Systems & Codes -** Introduction, Number Systems, Binary Number System, Signed Binary Numbers, Binary Arithmetic, 2's Complement Arithmetic, Octal Number System, Hexadecimal Number System, codes **Combinational Circuits:** Adders, Mux, Demux, Sequential Circuits: FlipFlops (SR, JK & D), Counters: synchronous and asynchronous. **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.	**15 Hrs**

	Memory System Organisation: Classification and design parameters, Memory Hierarchy, Internal Memory: RAM, SRAM and DRAM, Interleaved and Associative Memory. **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 **Control Unit:** Micro-Operations, Functional Requirements, Processor Control, Hardwired Implementation, Micro-programmed Control. **Fundamentals of Advanced Computer Architecture:** Parallel Architecture: Classification of Parallel Systems, Flynn"s Taxonomy, Array Processors, Clusters, and NUMA Computers. **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/)

	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:Advanced DBMS

Type of Course: Discipline Specific Core Course

Academic year 2024-25

COURSE OUTCOME	DESCRIPTION A student completing this course will be able to:
CO 1	Describe core syntax and semantics of PL-SQL
CO 2	Understand Conditional and control statements in PL/SQl
CO 3	Explain Exception handling techniques
CO 4	Interpret need of triggers and cursors

DETAILED SYLLABUS

RUSCS.E112	Advanced DBMS	Credits 3 / 45 Hours
Unit I	**Fundamentals of PL/SQL:** Defining variables and constants, PL/SQL expressions and comparisons: Logical Operators, Boolean Expressions, CASE Expressions Handling, Null Values in Comparisons and Conditional Statements, PL/SQL Datatypes: Number Types, Character Types, Boolean Type, Date time and Interval Types. The %TYPE Attribute ,The %ROWTYPE Attribute **Overview of PL/SQL Control Structures:** Conditional Control: IF and CASE Statements, IF-THEN Statement, IF-THEN-ELSE Statement, IF THEN-ELSEIF Statement, CASE Statement, Iterative Control: LOOP and EXIT Statements, WHILE-LOOP, FOR-LOOP, Sequential Control: GOTO and NULL Statements, Continue **Sequences:** creating sequences, referencing, altering and dropping a sequence	15 Hrs
Unit II	**Stored Procedures & Functions:** Types and benefits of stored procedures, creating stored procedures, executing stored procedures, altering stored procedures, viewing stored procedures. Create a Simple Function, Execute a Simple Function, recursive function. **Triggers:** Concept of triggers, Implementing triggers – creating triggers, Insert, delete, and update triggers, nested triggers, viewing, deleting and modifying triggers, and enforcing data integrity through triggers. **Cursors:** Concept of a cursor, types of cursors: implicit cursors; explicit cursor, Cursor for loops, Cursor variables, parameterized cursors, nested cursors, FOR UPDATE Clause and WHERE CURRENT Clause	15 Hrs
Unit III	**Exception Handling:** Understand Exceptions, Handle Exceptions with PL/SQL, Trap Predefined Oracle Server Errors, Trap Non-Predefined Oracle Server Errors, Trap User-Defined Exceptions, Propagate Exceptions, RAISE_APPLICATION_ERROR Procedure. **Query optimization:**Query Cost Estimation,Query Operations,Evaluation of Expressions,Query Optimization	15 Hrs

F.Y.B.Sc. (RUSCS.E112) (DSC):
Theory Course:Advanced DBMS (2024-25)

COURSE OUTCOMES

A student completing successfully completing this course will be able to:

CO#	Description
CO1	Describe core syntax and semantics of python
CO2	Explain data storing and processing mechanism on String, List, Dictionary, Tuples
CO3	Summarize File And exception handling techniques
CO4	Design GUI Applications
CO 5	Interpret Object-oriented Programming concepts

PRACTICAL

COURSE CODE: RUSCSP.E112	
Sr. No.	**PRACTICAL TITLE**
1	PL/SQL Blocks
2	Control Structure in PL/SQL .
3	conditional statement using PL/SQL
4	Sequence
5	Stored procedures
6	Functions
7	Triggers
8	Cursors
9	Exception handling
10	Packages

References:

1. Ivan Bayross, “SQL,PL/SQL -The Programming language of Oracle”, B.P.B. Publications , 4th edition.
2. Michael Abbey, Michael J. Corey, Ian Abramson, Oracle 8i – A Beginner’s Guide, TataMcGraw-Hill, 3rd edition
3. PL/SQL Language Reference 11g, , Sheila Moore, E. Belden, 2nd edition.
4. Ramakrishnam, Gehrke, “Database Management Systems”, McGraw- Hill, 3rd edition.

Additional References:

- Ramez Elmasri & Shamkant B.Navathe, Fundamentals of Database Systems, Pearson Education
- Robert Sheldon, Geoff Moes, Beginning MySQL, Wrox Press.
- Joel Murach, Murach’s MySQL, Murach
- https://docs.oracle.com

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**