Hindi Vidya Prachar Samiti's

Ramniranjan Jhunjhunwala College

of Arts, Science & Commerce

(Autonomous College)

Affiliated to

UNIVERSITY OF MUMBAI

Syllabus for the S.Y.B.Sc.

Program: B.Sc. COMPUTER-SCIENCE

Program Code: RJSUCS

(CBCS 2021-2022)

THE PREAMBLE

Why Computer Science ?

Computer Science(CS) has been evolving as an important branch of science and engineering throughout the world in last couple of decades and it has carved out a space for itself like any other disciplines of basic science and engineering. Computer science is a discipline that spans theory and practice and it requires thinking both in abstract terms and in concrete terms. Nowadays, practically everyone is a computer user, and many people are even computer programmers. Computer Science can be seen on a higher level, as a science of problem solving and problem solving requires precision, creativity, and careful reasoning. The ever-evolving discipline of computer science also has strong connections to other disciplines. Many problems in science, engineering, healthcare, business, and other areas can be solved effectively with computers, but finding a solution requires both computer science expertise and knowledge of the particular application domain. The B.Sc. Computer Science course structure therefore needed a fresh outlook and complete overhaul.

Why Computer Science at R J College?

The Computer Science department was established in the year 1999 with strength of 60 Students and M.Sc CS with strength of 40 Seats was introduced in the year 2001. Today the strength has reached to 120 at UG level and 48 at PG level. The department offers both UG and PG programs in the subject of CS and is affiliated to, and recognized by the University of Mumbai. College facilitate departmental library with near about 1200+ books. There are 3 dedicated well-upgraded laborites for CS department. With the management extensive support, department believes in "**1 Student 1 PC policy**" which helps students to rigorous practice and focus. Projects, hands on training sessions, guest lectures, laboratory experimentation, lecture-based learning, industry visits etc. motivate students to explore more in terms of applications of the subject. Under autonomy, the department has made curriculum more robust by incorporating skill-based learning and value added course that imparts practical knowledge of the subject to the students. Department of CS (DBT), New Delhi has identified CS Department of R J College as DBT Star College Department which has further strengthened our hands in being able to provide hands on training to the students to satisfy their curiosity.

Our Curriculum, Your Strength

The syllabus of CS for the total six semesters is meticulously designed so as to make students understand the various programming languages and other many subjects of CS. FY level syllabus have great potential to serve the need of students for being strong basic foundation in computer science. Then gradually stepping ahead the students at higher complexities at every subsequent semesters, till semester 6. In all, 38 subjects are covered in 6 semesters, which gives adequate knowledge in the fields of computer science. Practical's of all semesters and project at TY level boost high level confidence of students to crack immense career opportunities.

DISTRIBUTION OF TOPICS AND CREDITS

S.Y.B.Sc. COMPUTER-SCIENCE SEMESTER III

Course	Nomenclature	Credits	Topics
RJSUCS301	Theory of Computation	02	1. Automata theory 2. Languages & Grammar 3. Turing Machine
RJSUCS302	Core JAVA	02	1. Object oriented language. 2. Exception Handling and Multithreading 3. Collection Framework and AWT
RJSUCS303	Operating System	02	1. Introduction to OS 2. Process Synchronization and Scheduling 3. Memory and File architecture
RJSUCS304	Database Management Systems	02	1. Introduction to PL/SQL 2. Procedures & Sequences 3. Transaction & Recovery management
RJSUCS305	Combinatorics and Graph Theory	02	1. Introduction to Combinatorics 2. Graph Theory 3. Network Flow
RJSUCS306	Computer Networks	02	1. Introduction to Networks 2. Introduction to OSI layers 3. Access control

RJSUCS307	Skill Enhancement: Web Programming	02	1. HTML & CSS 2. JAVA script & XML 3. AJAX & JQuery
RJSUCSP301	Practical of RJSUCS302 + RJSUCS303	02	Object oriented language. Exception Handling and Multithreading, Collection Framework and AWT, Process Synchronization and Scheduling, Memory and File architecture
RJSUCSP302	Practical of RJSUCS304+RJSUCS305	02	Introduction to PL/SQL, Procedures & Sequences, Transaction & Recovery management, Introduction to Combinatorics, Graph Theory, Network Flow
RJSUCSP303	Practical of RJSUCS306+RJSUCS307	02	Introduction to Networks, Introduction to OSI layers HTML & CSS, JAVA script & XML, AJAX & Jquery

S.Y.B.Sc. COMPUTER-SCIENCE SEMESTER IV

Course	Nomenclature	Credits	Topics
RJSUCS401	Fundamentals of Algorithms	02	1. Introduction to Algorithm 2. Graph & Selection Algorithm 3. Algorithm Design Techniques.
RJSUCS402	Advanced JAVA	02	1. Swings & JDBC 2. Servlet, JSP & beans 3. JSON & struct
RJSUCS403	Physical Computing and IoT Programming	02	1 SoC and Raspberry Pi 2. Programming Raspberry Pi 3. Introduction to IoT
RJSUCS404	Software Engineering	02	1. Introduction to SE. 2. System Design 3. S/W project Management & testing.
RJSUCS405	Linear Algebra using Python	02	1. Field 2. Matrix 3. Gaussian Elimination
RJSUCS406	.Net Technologies	02	1. .NET Frameworks 2. Web Controls 3. ADO.Net & LINQ
RJSUCS407	Skill Enhancement: Android Developer Fundamentals	02	1. Introduction to Android 2. Services 3. Database Connectivity
RJSUCSP401	Practical of RJSUCS401 + RJSUCS402	02	Introduction to Algorithm, Graph & Selection Algorithm, Algorithm Design Techniques, Swings & JDBC, Servlet, JSP & beans, JSON & struct

RJSUCSP402	Practical of RJSUCS403+RJSUCS405	02	SoC and Raspberry Pi,Programming Raspberry Pi, Access control, Field, Matrix Gaussian Elimination
RJSUCSP403	Practical of RJSUCS406+RJSUCS407	02	.NET Frameworks, Web Controls, ADO.Net & LINQ, Introduction to Android, Services, Database Connectivity

SEMESTER III (THEORY)		L	Cr
Paper-I: Theory of Computation	**Paper Code: RJSUCS301**	45	2
UNIT I		15	
AUTOMATA THEORY			
1 **Automata Theory:** Defining Automaton, Finite Automaton, Finite automata and Regular Expressions, Transitions and Its properties, Acceptability by Finite Automaton, Nondeterministic Finite State Machines, DFA and NFA equivalence, Minimizing Automata.			
2 **Formal Languages:** Defining Grammar, Derivations, Languages generated by Grammar, Chomsky Classification of Grammar and Language, Operations on Languages, Languages and Automata.			
UNIT II		15	
LANGUAGES AND GRAMMAR			
1 **Regular Sets and Regular Grammar:** Regular Grammar, Pumping Lemma and its Applications, Closure Properties, Regular Sets and Regular Grammar.			
2 **Context Free Languages:** Context-free Languages, Derivation Tree, Ambiguity of Grammar, CFG simplification, Pumping Lemma for CFG			
3 **Pushdown Automata:** Definitions, Acceptance by PDA, PDA and CFG **Linear Bound Automata:** The Linear Bound Automata Model, Linear Bound Automata and Languages.			
UNIT III		15	

	TURING MACHINE		
1	Turing Machines: Turing Machine , Definition, Representations, Acceptability by Turing Machines, Designing and Description of Turing Machines, Turing Machine Construction.		
2	Variants of Turing Machine, Halting Problem in , turing machine memories.		

S.Y.BSc	Semester III Theory
RJSUCS301 Paper I Theory of Computation	**Course Outcomes 3.1:** To provide comprehensive insight into theory of computation by understanding grammar, languages and other elements of modern language design. Also to develop capabilities to design and develop formulations for computing models and identify its applications in diverse areas. **Learning Outcomes:** 1. Understand Grammar and Languages. 2. Learn about Automata theory and its application in Language Design. 3. Learn about Turing Machines and Pushdown Automata. 4. Understand Linear Bound Automata and its applications.

SEMESTER III (THEORY)		L	Cr
Paper-II: Core JAVA	**Paper Code:** RJSUCS302	45	2
UNIT I		15	
INTRODUCTION TO JAVA			
1	**The Java Language:** Features of Java, Java programming format, Java Tokens, Java Statements, Java Data Types, Typecasting, Arrays. **OOPS**: Introduction, Class, Object, Static Keywords, Constructors, this Key Word, Inheritance, super Key Word, Polymorphism (overloading and overriding), Abstraction, Encapsulation, Abstract Classes, Interfaces.		
2	**String Manipulations**: String, String Buffer, String Tokenizer.		
3	**Packages:** Introduction to predefined packages (java.lang, java.util, java.io, java.sql, java.swing), User Defined Packages, Access specifiers.		
UNIT II		15	
EXCEPTION HANDLING & MULTITHREADING			
1	**Exception Handling:** Introduction, Pre-Defined Exceptions, Try-Catch-Finally, Throws, throw, User Defined Exception examples.		
2	**Multithreading:** Thread Creations, Thread Life Cycle, Life Cycle Methods, Synchronization, Wait() notify() notify all() methods.		

3	**I/O Streams:** Introduction, Byte-oriented streams, Character- oriented streams, File, Random access File, Serialization. **Networking:** Introduction, Socket, Server socket, Client -Server Communication,RMI		
	UNIT III	15	
	WRAPPER CLASSES & AWT		
1	**Wrapper Classes:** Introduction, Byte, Short, Integer, Long, Float, Double, Character, Boolean classes. **Collection Framework**: Introduction, util Package interfaces, List, Set, Map, List interface & its classes, Set interface & its classes, Map interface & its classes		
2	Inner Classes: Introduction, Member inner class, Static inner class, Local inner class, Anonymous inner class		
3	**AWT:** Introduction, Components, Event-Delegation-Model, Listeners, Layouts, Individual components Label, Button, CheckBox, Radio Button, Choice, List, Menu, Text Field, Text Area		

S.Y.BSc	Semester III Theory

RJSUCS302 Paper II Core java	Course Outcomes3.2 :
	The objective of this course is to teach the learner how to use Object Oriented paradigm to develop code and understand the concepts of Core Java and to cover-up with the pre-requisites of Core java..
	Learning outcomes:
	1. Object oriented programming concepts using Java.
	2. Knowledge of input, its processing and getting suitable output.
	3. Understand, design, implement and evaluate classes.
	4. Knowledge and implementation of AWT package.

SEMESTER III (THEORY)		L	Cr
Paper-III: Operating System	**Paper Code: RJSUCS303**	45	2
UNIT I		15	
INTRODUCTION TO OS			
1	**Introduction and Operating-Systems Structures:** Definition of Operating system, Operating System's role, Operating-System Operations, Functions of Operating System, Computing Environments. **Processes**: Process Concept, Process Scheduling, Operations on Processes, Interprocess Communication		
2	**Operating-System Structures:** Operating-System Services, User and Operating-System Interface, System Calls, Types of System Calls, Operating-System Structure.		
3	**Processes**: Process Concept, Process Scheduling, Operations on Processes, Interprocess Communication.		

		15	
	UNIT II		
	PROCESS SYNCHRONIZATION AND SCHEDULING		
1	**Threads:** Overview, Multicore Programming, Multithreading Models		
2	**Process Synchronization:** General structure of a typical process, race condition, The Critical-Section Problem, Peterson's Solution, Synchronization Hardware, Mutex Locks, Semaphores, Classic Problems of Synchronization, Monitors. **Deadlocks:** System Model, Deadlock Characterization, Methods for Handling Deadlocks, Deadlock Prevention, Deadlock Avoidance, Deadlock Detection, Recovery from Deadlock.		
3	**CPU Scheduling:** Basic Concepts, Scheduling Criteria, Scheduling Algorithms (FCFS, SJF, SRTF, Priority, RR, Multilevel Queue Scheduling, Multilevel Feedback Queue Scheduling), Thread Scheduling.		
	UNIT III	15	
	MEMORY & FILE ARCHITECTURE		
1	**Main Memory:** Background, Logical address space, Physical address space, MMU, Swapping, Contiguous Memory Allocation, Segmentation, Paging, Structure of the Page Table **Virtual Memory:** Background, Demand Paging, Copy-on-Write, Page Replacement, Allocation of Frames, Thrashing **Mass-Storage Structure:** Overview, Disk Structure, Disk Scheduling, Disk Management.		
2	**File-System Interface:** File Concept, Access Methods, Directory and Disk Structure, File-System Mounting, File Sharing **File-System Implementation:** File-System Structure, File-System Implementation, Directory Implementation, Allocation Methods, Free-Space Management.		

S.Y.BSc	Semester III Theory
RJSUCS303 Paper III OPERATING SYSTEM	Course Outcomes3.3 : Learners must understand proper working of operating system. To provide a sound understanding of Computer operating system, its structures, functioning and algorithms. Learning Outcome: 1. To provide a understanding of operating system, its structures and functioning 2. Develop and master understanding of algorithms used by operating systems for various purposes.

SEMESTER III (THEORY)		L	Cr
Paper-IV: Database Management Systems	**Paper Code: RJSUCS304**	45	2
UNIT I		15	
INTRODUCTION TO PL/SQL			
1	**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, Datetime and Interval Types.		
2	**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.		

	UNIT II	15	
	PROCEDURES AND SEQUENCES		
1	**Stored Procedures:** Types and benefits of stored procedures, creating stored procedures, executing stored procedures, altering stored procedures, viewing stored procedures.		
2	**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. **Sequences**: creating sequences, referencing, altering and dropping a sequence.		
3	**File Organization and Indexing:** Cluster, Primary and secondary indexing, Index data structure: hash and Tree based indexing, Comparison of file organization: cost model, Heap files, sorted files, clustered files. Creating, dropping and maintaining indexes.		
	UNIT III	15	
	TRANSACTION AND RECOVERY MANAGEMENT		
1	**Transaction Management:** ACID Properties, Serializability, Two-phase Commit Protocol, Concurrency Control, Lock Management, Lost Update Problem, Inconsistent Read Problem , Read-Write Locks, Deadlocks Handling, Two Phase Locking protocol. **DCL Statements:** Defining a transaction, Making Changes Permanent with COMMIT, Undoing Changes with ROLLBACK, Undoing Partial Changes with SAVEPOINT and ROLLBACK.		
2	**Crash Recovery:** ARIES algorithm. The log based recovery, recovery related structures like transaction and dirty page table, Write-ahead log protocol, check points, recovery from a system crash, Redo and Undo phases.		

S.Y.BSc	Semester III Theory
RJSUCS304 Paper IV Database Management System	Course Outcomes3.4 : To develop understanding of concepts and techniques for data management and learn about widely used systems for implementation and usage. **Learning Outcomes:** 1. Master concepts of stored procedure and triggers and its use. 2. Learn about using PL/SQL for data management 3. Understand concepts and implementations of transaction management and crash Recovery

SEMESTER III (THEORY)		L	Cr
Paper-V: Combinatorics and Graph Theory	**Paper Code: RJSUCS305**	45	2
UNIT I		15	
INTRODUCTION TO COMBINATORICS			
1	**Introduction to Combinatorics:** Enumeration, Combinatorics and Graph Theory/ Number Theory/Geometry and Optimization, Sudoku Puzzles.		
2	Strings, Sets, and Binomial Coefficients: Strings- A First Look, Combinations, Combinatorial, The Ubiquitous Nature of Binomial Coefficients, The Binomial, Multinomial Coefficients.		
3	Induction: Introduction, The Positive Integers are Well Ordered, The Meaning of Statements, Binomial Coefficients Revisited, Solving Combinatorial Problems Recursively, Mathematical Induction, and Inductive Definitions Proofs by Induction. Strong Induction		

	UNIT II	15	
	GRAPH THEORY		
1	**Graph Theory:** Basic Notation and Terminology, Multigraphs: Loops and Multiple Edges, Eulerian and Hamiltonian Graphs, Graph Coloring, Planar Counting, Labeled Trees, A Digression into Complexity Theory.		
2	Applying Probability to Combinatorics, Small Ramsey Numbers, Homogenous, Non-Homogenous, Exact & Non-Exact Differential Equation And its types.		
	UNIT III	15	
	NETWORK FLOW		
1	**Network Flows:** Basic Notation and Terminology, Flows and Cuts, Augmenting Paths, The Ford-Fulkerson Labeling Algorithm.		
2	A Concrete Example, Integer Solutions of Linear Programming Problems. Combinatorial Applications of Network Flows: Introduction, Matching in Bipartite Graphs, Chain partitioning. Polya's Enumeration Theorem: Coloring the Vertices of a Square.in a binary search tree		

S.Y.BSc	Semester III Theory

RJSUCS305	Course Outcomes3.5 :
Paper V Combinatorics and Graph Theory	To give the learner a broad exposure of combinatorial Mathematics through applications especially the Computer Science applications. **Learning Outcomes:** 1. Appreciate beauty of combinatorics and how combinatorial problems naturally arise in many settings. 2. Understand the combinatorial features in real world situations and Computer Science applications. 3. Apply combinatorial and graph theoretical concepts to understand Computer Science concepts and apply them to solve problems.

SEMESTER IV (THEORY)		**L**	**Cr**
Paper-VI: Computer Network	**Paper Code: RJSUCS306**	45	2
UNIT I		15	
INTRODUCTION TO NETWORKS			
1	**Introduction to Networks :** Introduction to data communication, Components, Data Representation, Data Flow, Networks, Network Criteria, Physical Structures, Network types, Local Area Network, Wide Area Network, Switching, The Internet, Accessing the Internet, standards and administration Internet Standards.		
2	**Introduction to OSI model:** Network Models, Protocol layering, Scenarios, Principles of Protocol Layering, Logical Connections, TCP/IP Protocol Suite, Layered Architecture, Layers in the TCP/IP Protocol Suite, Encapsulation and Decapsulation, Addressing, Multiplexing and Demultiplexing. Detailed introduction to Physical Layer, Detailed introduction to Data-Link Layer, Detailed introduction to Network Layer, Detailed introduction to Transport Layer, Detailed introduction to Application Layer.		

3	**Physical Layer:** Data and Signals, Analog and Digital Data, Analog and Digital Signals, Sine Wave Phase, Wavelength, Time and Frequency Domains, Composite Signals, Bandwidth, Digital Signal, Bit Rate, Bit Length, Transmission of Digital Signals, Transmission Impairments, Attenuation, Distortion, Noise, Data Rate Limits, Performance, Bandwidth, Throughput, Latency (Delay).		
	UNIT II	15	
	OSI LAYERS		
1	**Introduction to Physical Layer:** Digital Transmission digital-to-digital conversion, Line Coding, Line Coding Schemes, analog-to-digital conversion, Pulse Code Modulation (PCM), Transmission Modes, Parallel Transmission, Serial Transmission. **Analog Transmission**: Analog Transmission, digital-to-analog Conversion, Aspects of Digital-to-Analog Conversion, Amplitude Shift Keying, Frequency Shift Keying, Phase Shift Keying,. analog-to-analog Conversion- Amplitude Modulation (AM), Frequency Modulation (FM), Phase Modulation (PM),		
2	**Multiplexing** –, Frequency-Division Multiplexing, Wavelength-Division Multiplexing, Time-Division Multiplexing. Transmission Media -Guided Media, Twisted-Pair Cable, Coaxial Cable, Fiber-Optic Cable.		
3	**Introduction to Data-Link Layer-** Nodes and Links, Services, Two Sub-layers, Three Types of addresses, Address Resolution Protocol (ARP). Error Detection and Correction, introduction, Types of Errors, Redundancy, Detection versus Correction.		
	UNIT III	15	
	ACCESS CONTROL		

1	**Multiple Access** – Media Access Control (MAC), random access, CSMA, CSMA/CD, CSMA/CA, controlled access, Reservation, Polling, Token Passing, channelization, FDMA, TDMA, CDMA. **Connecting Devices and Virtual LANs**- connecting devices, Hubs, Link-Layer Switches, Routers.		
2	**Introduction to Network Layer**- network layer services, Packetizing, Routing and Forwarding, Other Services, IPv4 addresses, Address Space, Classful Addressing. **Routing Protocols** - Unicast Routing, General Idea, Least-Cost Routing, Routing Algorithms, Distance-Vector Routing, Link-State Routing, Path-Vector Routing.		
3	**Introduction to Transport Layer**- Transport-Layer Services, Connectionless and Connection-Oriented Protocols. Transport-Layer Protocols, Service, Port Numbers, User Datagram Protocol, User Datagram, UDP Services, UDP Applications, Transmission Control Protocol, TCP Services, TCP Features, Segment.		

S.Y.BSc	Semester IV Theory
RJSUCS306 Paper VI Computer Network	COURSE OUTCOMES 4.3: In this era of Information, its computation and its exchange techniques, Learner should be able to conceptualize and understand the framework and working of communication networks. And on completion, will be able to have a firm grip over this very important segment of Internet. Learning Outcomes : 1. Learner will be able to understand the concepts of networking, which are important for them to be known as a '*networking professionals*'. 2. Useful to proceed with industrial requirements and International vendor certifications.

SEMESTER III (THEORY)		**L**	**Cr**
Paper- VII Web Programming	**Paper Code: RJSUCS307**	45	2

	UNIT I	15	
	INTRODUCTION TO HTML AND CSS		
1	**HTML5:** Fundamental Elements of HTML, Formatting Text in HTML, Organizing Text in HTML. **Links and Images in HTML:** Links and URLs in HTML, Tables in HTML, Images on a Web Page, Image Formats, Image Maps, Colors.		
2	**FORMs in HTML:** Interactive Elements of forms **Working with Multimedia** - Audio and Video File Formats, HTML elements for inserting Audio / Video on a web page.		
3	**CSS:** Understanding the Syntax of CSS, CSS Selectors, Inserting CSS in an HTML Document, CSS properties to work with background of a Page, CSS properties to work with Fonts and Text Styles, CSS properties for positioning an element		
	UNIT II	15	
	JAVASCRIPT AND XML		
1	**JavaScript:** Using JavaScript in an HTML Document. **Programming Fundamentals of JavaScript:** - Variables, Operators, Control Flow Statements, Popup Boxes. **Functions:** - Defining and Invoking a Function, Defining Function arguments, Defining a Return Statement, Calling Functions with Timer.		
2	**JavaScript Objects:** - String, RegExp, Math, Date, Browser Objects - Window, Navigator, History, Location, **Cookies:** Creating cookie, Attributes of cookie. **DOM:** Document Object Model, Form Validation using JavaScript.		

3	**XML:** Comparing XML with HTML, Advantages and Disadvantages of XML. **Structure of an XML Document**: XML Structure, XML Entity References, DTD and its types. **XSLT:** XSLT Elements and Attributes - xsl:template, xsl:apply-templates, xsl:import, xsl:call-template, xsl:include, xsl:element, xsl:attribute, e xsl:attribute-set, xsl:value-of.		
	UNIT III	15	
	AJAX, PHP AND JQUERY		
1	**AJAX:** AJAX Web Application Model, How AJAX Works. **XMLHttpRequest Object:** - Properties and Methods, Handling asynchronous requests using AJAX.		
2	**PHP:** Variables and Operators, Program Flow, Arrays. **Files and Directories:** Working with Files and Directories. **Data Base:** Working with Databases, Working with Cookies, Sessions		
3	**Introduction to jQuery:** Fundamentals, Selectors. **JQuery Methods:** Methods to access HTML attributes, methods for traversing, manipulators, events, effects.		

S.Y.BSc	Semester III Theory
RJSUCS307 Paper VII **Web Programming**	Course Outcomes3.7 : To provide insight into emerging technologies to design and develop state of - the art web applications using client-side scripting, server-side scripting, and database connectivity. **Expected Learning Outcomes:** 1. To design valid, well-formed, scalable, and meaningful pages using emerging technologies. 2. Understand the various platforms, devices, display resolutions, viewports, and browsers that render websites 3. To develop and implement client-side and server-side scripting language programs. 4. To develop and implement Database Driven Websites. 5. Design and apply XML to create a markup language for data and document centric applications.

SEMESTER IV (THEORY)		L	Cr
Paper-I: Fundamentals of Algorithms	**Paper Code: RJSUCS401**	45	2
UNIT I		15	
INTRODUCTION TO C ALGORITHM			
1	Introduction to algorithm, Why to analysis algorithm, Running time analysis, How to Compare Algorithms,		
2	**What kinds of problems are solved by algorithms?,** Rate of Growth, Commonly Used Rates of Growth, Types of Analysis, Asymptotic Notation, Big-O Notation, Omega-Q Notation, Theta-0 Notation, Asymptotic Analysis, Properties of Notations, Performance characteristics of algorithms.		
3	Time complexity of sorting algorithms(Insertion sort, Merge sort, Quick sort).		
UNIT II		15	
GRAPH & SELECTION ALGORITHM			
1	Graph Algorithms: Introduction, Glossary, Applications of Graphs, Graph Representation, Graph Traversals, Topological Sort, Shortest Path Algorithms, Minimal Spanning Tree. .		
2	Selection Algorithms: What are Selection Algorithms? Selection by Sorting, Partition-based Selection Algorithm, Linear Selection Algorithm - Median of Medians Algorithm, Finding the K Smallest Elements in Sorted Order.		
UNIT III		15	

	ALGORITHM TECHNIQUES		
1	Algorithms Design Techniques: Introduction, Classification, Classification by Implementation Method, Classification by Design Method. Greedy Algorithms: Introduction, Greedy Strategy, Elements of Greedy Algorithms, Advantages and Disadvantages of Greedy Method, Greedy Applications, Understanding Greedy Technique with Huffman coding and Knapsack problem .		
2	Divide and Conquer Algorithms: Introduction, What is Divide and Conquer Strategy? Divide and Conquer Visualization, Understanding Divide and Conquer, Advantages of Divide and Conquer, Disadvantages of Divide and Conquer, Divide and Conquer Applications like strassen's matrix multiplication.		
3	Dynamic Programming: Introduction, What is Dynamic Programming Strategy? Properties of Dynamic Programming Strategy, Problems which can be solved using Dynamic Programming, Dynamic Programming Approaches, Examples of Dynamic Programming Algorithms, Understanding Dynamic Programming, Longest Common Subsequence.		

S.Y.BSc	Semester IV Theory
RJSUCS401 Paper I **Fundamentals of Algorithms**	Course Outcomes 4.1: 1. To understand basic principles of algorithm design and why algorithm analysis is important 2. To understand how to implement algorithms in Python 3. To understand how to transform new problems into algorithmic problems with efficient solutions 4. To understand algorithm design techniques for solving different problems Learning Outcomes: 1. Understand the concepts of algorithms for designing good program 2. Implement algorithms using Python

SEMESTER IV (THEORY)		L	Cr
Paper-II: Advanced Java	**Paper Code: RJSUCS402**	45	2
UNIT I		15	
SWINGS AND JDBC			
1	**Swing:** Need for swing components, Difference between AWT and swing, Components hierarchy, Panes, Swing components: Jlabel, JTextField and JPasswordField, JTextAres, JButton, JCheckBox, JRadioButton, JComboBox,JList, JScrollPane,JTable,JTabbedPane,JMenu,JTree		
2	**JDBC:** Introduction, JDBC Architecture, Types of Drivers, Statement, ResultSet, Read Only ResultSet, Updatable ResultSet, Forward Only ResultSet, Scrollable ResultSet, PreparedStatement, Connection Modes, SavePoint, Batch Updations, CallableStatement, BLOB & CLOB.		
UNIT II		15	
SERVLET , BEANS & JSP			
1	**Servlets:** Introduction, Web application Architecture, Http Protocol & Http Methods, Web Server & Web Container, Servlet Interface, GenericServlet, HttpServlet, Servlet Life Cycle, ServletConfig, ServletContext, Servlet Communication, Session Tracking Mechanisms **Java Beans:** Introduction, JavaBeans Properties, Examples.		
2	**JSP:** Introduction, JSP LifeCycle, JSP Implicit Objects & Scopes, JSP Directives, JSP Scripting Elements, JSP Actions: Standard actions and customized actions.		
3	**Java Beans:** Introduction, JavaBeans Properties, Examples.		

UNIT III	15	
JSON & STRUCT		
1 **JSON:** Overview, Syntax, DataTypes, Objects, Schema, Comparison with XML, JSON with Java.		
2 **Struts 2:** Basic MVC Architecture, Struts 2 framework features, Struts 2 MVC pattern, Request life cycle, Examples, Configuration Files, Actions, Interceptors, Results & Result Types, Value Stack/OGNL		

S.Y.BSc	Semester IV Theory
RJSUCS402 Paper II **Advanced Java**	COURSE OUTCOMES 4.2: Explore advanced topic of Java programming for solving problems. Learning Outcomes: 1) Understand the concepts related to Java Technology 2) Explore and understand use of Java Server Programming.

SEMESTER III (THEORY)		L	Cr
Paper- III Physical Computing and IoT Programming	**Paper Code: RJSUCS403**	45	2
UNIT I		15	
SOC AND RASPBERRY PI			
1	**System on Chip:** What is System on chip? Structure of System on Chip. **SoC products:** FPGA**,** GPU, APU, Compute Units.		
2	**ARM 8 Architecture:** SoC on ARM 8. ARM 8 Architecture Introduction **Introduction to Raspberry Pi:** Introduction to Raspberry Pi, Raspberry Pi Hardware, Preparing your raspberry Pi.		
3	**Raspberry Pi Boot:** Learn how this small SoC boots without BIOS. Configuring boot sequences and hardware.		
UNIT II		15	
PROGRAMMING RASPBERRY PI			
1	**Raspberry Pi and Linux:** About Raspbian, Linux Commands, Configuring Raspberry Pi with Linux Commands		
2	**Programing interfaces:** Introduction to Node.js, Python. **Raspberry Pi Interfaces:** UART, GPIO, I2C, SPI		
3	**Useful Implementations:** Cross Compilation, Pulse Width Modulation, SPI for Camera.		
UNIT III		15	
IOT SECURITY			
1	**Introduction to IoT:** What is IoT? IoT examples, Simple IoT LED Program. IoT and Protocols		
2	**IoT Security:** HTTP, UPnp, CoAP, MQTT, XMPP**.** **IoT Service as a Platform:** Clayster, Thinger.io, SenseIoT, carriots and Node RED.		

3	**IoT Security and Interoperability:** Risks, Modes of Attacks, Tools for Security and Interoperability.− P(A) ≤ P(B) if A ⊂ B		

S.Y.BSc	Semester III Theory
RJSUCS403 Paper III **Physical Computing and IoT Programming**	Course Outcomes3.6 : To learn about SoC architectures; Learn how Raspberry Pi. Learn to program Raspberry Pi. Implementation of the Internet of Things and Protocols. **Learning Outcomes**: 1. Enable learners to understand System On Chip Architectures. 2. Introduction and preparing Raspberry Pi with hardware and installation. 3. Learn physical interfaces and electronics of Raspberry Pi and program them using practical's 4. Learn how to make consumer grade IoT safe and secure with proper use of protocols.

SEMESTER IV (THEORY)		L	Cr
Paper-IV: Software Engineering	**Paper Code: RJSUCS404**	45	2
UNIT I		15	
INTRODUCTION			
1	**Introduction:** The Nature of Software, Software Engineering, The Software Process, Generic Process Model, The Waterfall Model, Incremental Process Models, Evolutionary Process Models, Concurrent Models, Component-Based Development, The Unified Process Phases, Agile Development- Agility, Agile Process, Extreme Programming.		
2	**Requirement Analysis and System Modeling:** Requirements Engineering, Eliciting Requirements, SRS Validation, Components of SRS, Characteristics of SRS , Object-oriented design using the UML - Class diagram, Object diagram, Use case diagram, Sequence diagram, Collaboration diagram, State chart diagram, Activity diagram, Component diagram, Deployment diagram.		
UNIT II		15	
SYSTEM DESIGN & PROJECT MANAGEMENT			
1	**System Design:** System/Software Design, Architectural Design, Low-Level Design Coupling and Cohesion, Functional-Oriented Versus The Object-Oriented Approach, Design Specifications, Verification for Design, Monitoring and Control for Design.		
2	**Software Measurement and Metrics:** Product Metrics - Measures, Metrics, and Indicators, Function-Based Metrics, Metrics for Object-Oriented Design, Operation-Oriented Metrics, User Interface Design Metrics, Metrics for Source Code, Halstead Metrics Applied to Testing, Metrics for Maintenance, Cyclomatic Complexity, Software Measurement - Size-Oriented, Function-Oriented Metrics, Metrics for Software Quality.		

3	**Software Project Management:** Estimation in Project Planning Process -Software Scope And Feasibility, Resource Estimation, Empirical.		
	UNIT III	15	
	RISK MANAGEMENT AND S/W TESTING		
1	**Risk Management** - Software Risks, Risk Identification, Risk Projection and Risk Refinement, RMMM Plan.		
2	**Software Quality Assurance:** Elements of SQA, SQA Tasks, Goals, and Metrics, Formal Approaches to SQA, Six Sigma, Software Reliability, The ISO 9000 Quality Standards, Capability Maturity Model.		
3	**Software Testing :** Verification and Validation, Introduction to Testing, Testing Principles, Testing Objectives, Test Oracles, Levels of Testing, White-Box Testing/Structural Testing, Functional/Black-Box Testing, Test Plan, Test-Case Design.		

S.Y.BSc	Semester IV Theory

RJSUCS404 Paper IV **Software Engineering**	COURSE OUTCOMES 4.4: 1. Knowledge of basic SW engineering methods and practices, and their appropriate application. 2. Describe software engineering layer technology and Process framework. 3. A general understanding of software process models such as the waterfall and evolutionary models. 4. Understanding of software requirements and the SRS documents. 5. Understanding of the role of project management including planning, scheduling, risk management, etc. 6. Describe data models, object models, context models and behavioural models. Learning Outcomes: 1. Basic knowledge and understanding of the analysis and design of complex systems. 2. Ability to apply software engineering principles and techniques. 3. Ability to develop, maintain and evaluate large-scale software systems.

SEMESTER IV (THEORY)		**L**	**Cr**
Paper-V: Linear Algebra using Python	**Paper Code: RJSUCS405**	45	2
UNIT I		15	
FIELD			
1	Introduction to complex numbers, numbers in Python , Abstracting over fields, Playing with GF(2), Vector Space: Vectors are functions, Vector addition, Scalar-vector multiplication, Combining vector addition and scalar multiplication, Dictionary-based representations of vectors, Dot-product, Solving a triangular system of linear equations.		
2	Linear combination, Span, The geometry of sets of vectors, Vector spaces, Linear systems, homogeneous and otherwise.		

	UNIT II	15	
	MATRIX,BASIS & DIMENSION		
1	**Matrix:** Matrices as vectors, Transpose, Matrix-vector and vector-matrix multiplication in terms of linear combinations, Matrix-vector multiplication in terms of dot-products, Null space, Computing sparse matrix-vector product, Linear functions, Matrix-matrix multiplication, Inner product and outer product, From function inverse to matrix inverse		
2	**Basis:** Coordinate systems, Two greedy algorithms for finding a set of generators, Minimum Spanning Forest and GF(2), Linear dependence, Basis , Unique representation, Change of basis, first look, Computational problems involving finding a basis		
3	**Dimension:** Dimension and rank, Direct sum, Dimension and linear functions, The annihilator.		
	UNIT III	15	
	GAUSSIAN ELIMINATION		
1	**Gaussian elimination:** Echelon form, Gaussian elimination over GF(2), Solving a matrix-vector equation using Gaussian elimination, Finding a basis for the null space, Factoring integers.		
2.	**Inner Product:** The inner product for vectors over the reals, Orthogonality, Orthogonalization: Projection orthogonal to multiple vectors, Projecting orthogonal to mutually orthogonal vectors		
3	**Eigenvector:** Modeling discrete dynamic processes, Diagonalization of the Fibonacci matrix, Eigenvalues and eigenvectors, Coordinate representation in terms of eigenvector Variables.		

S.Y.BSc	Semester IV Theory
RJSUCS405 Paper V **Linear Algebra using Python**	COURSE OUTCOMES 4.5: To offer the learner the relevant linear algebra concepts through computer science applications. Learning Outcomes: 1. Appreciate the relevance of linear algebra in the field of computer science. 2. Understand the concepts through program implementation 3. In still a computational thinking while learning linear algebra.

SEMESTER IV (THEORY)		L	Cr
Paper-VI: .Net Technologies	**Paper Code: RJSUCS406**	45	2
UNIT I		15	
.NET FRAMEWORK			
1	The .NET Framework: .NET Languages, Common Language Runtime, .NET Class Library C# Language Basics: Comments, Variables and Data Types, Variable Operations, Object-Based Manipulation, Conditional Logic, Loops, Methods, Classes, Value Types and Reference Types, Namespaces and Assemblies, Inheritance, Static Members, Casting Objects, Partial Classes.		
2	ASP.NET: Creating Websites, Anatomy of a Web Form - Page Directive, Doctype, Writing Code - Code-Behind Class, Adding Event Handlers, Anatomy of an ASP.NET Application - ASP.NET File Types, ASP.NET Web Folders.		
3	HTML Server Controls - View State, HTML Control Classes, HTML Control Events, HtmlControl Base Class, HtmlContainerControl Class, HtmlInputControl Class, Page Class, global.asax File, web.config File.		
UNIT II		15	
WEB CONTROLS			
1	Web Controls: Web Control Classes, WebControl Base Class, List Controls, Table Controls, Web Control Events and AutoPostBack, Page Life Cycle State Management: ViewState, Cross-Page Posting, Query String, Cookies, Session State, Configuring Session State, Application State.		
2	Validation: Validation Controls, Server-Side Validation, Client-Side Validation, HTML5 Validation, Manual Validation, Validation with Regular Expressions.		

3	Rich Controls: Calendar Control, AdRotator Control, MultiView Control Themes and Master Pages: How Themes Work, Applying a Simple Theme, Handling Theme Conflicts, Simple Master Page and Content Page, Connecting Master pages and Content Pages, Master Page with Multiple Content Regions, Master Pages and Relative Paths Website Navigation: Site Maps, URL Mapping and Routing, SiteMapPath Control, TreeView Control, Menu Control		
	UNIT III	15	
	AOD.NET & LINQ		
1	ADO.NET: Data Provider Model, Direct Data Access - Creating a Connection, Select Command, DataReader, Disconnected Data Access Data Binding: Introduction, Single-Value Data Binding, Repeated-Value Data Binding, Data Source Controls - SqlDataSource		
2	Data Controls: GridView, DetailsView, FormView Working with XML: XML Classes - XMLTextWriter, XMLTextReader Caching: When to Use Caching, Output Caching, Data Caching		
3	LINQ: Understanding LINQ, LINQ Basics, ASP.NET AJAX: ScriptManager, Partial Refreshes, Progress Notification, Timed Refreshes.		

S.Y.BSc	Semester IV Theory

RJSUCS406 Paper VI **.Net Technologies**	COURSE OUTCOMES 4.6: To explore .NET technologies for designing and developing dynamic, interactive and responsive web applications. Learning Outcomes: 1. Understand the .NET framework 2. Develop a proficiency in the C# programming language 3. Proficiently develop ASP.NET web applications using C# 4. Use ADO.NET for data persistence in a web application.

SEMESTER IV (THEORY)		**L**	**Cr**
Paper-VII: Android Developer Fundamentals	**Paper Code: RJSUCS407**	45	2
UNIT I		15	
INTRODUCTION TO ANDROID			
1	What is Android? Obtaining the required tools, creating first android app, understanding the components of screen, adapting display orientation, action bar, Activities and Intents, Activity Lifecycle and Saving State.		
2	Basic Views: TextView, Button, ImageButton, EditText, CheckBox, ToggleButton, RadioButton, and RadioGroup Views, ProgressBar View, AutoCompleteTextView, TimePicker View, DatePicker View, ListView View, Spinner View. User Input Controls, Menus,Drawables.		
UNIT II		15	
SERVICES			

1	AsyncTask and AsyncTaskLoader, Connecting to the Internet, Broadcast receivers, Services, Notifications, Alarm managers, Transferring data efficiently Web Services: Characteristics, Architecture, Components , Examples, Security.		
	UNIT III	15	
	DATABASE		
1	Data - saving, retrieving, and loading: Overview to storing data, Shared preferences, SQLite primer, store data using SQLite database, ContentProviders, loaders to load and display data, Permissions, performance and security, Firebase and AdMob, Publish your app.		

S.Y.BSc	Semester IV Theory
RJSUCS407 Paper VII **Android Developer Fundamentals**	COURSE OUTCOMES 4.7: To provide the comprehensive insight into developing applications running on smart mobile devices and demonstrate programming skills for managing task on mobile. To provide systematic approach for studying definition, methods and its applications for Mobile-App development. Learning Outcomes: 1) Understand the requirements of Mobile programming environment. 2) Learn about basic methods, tools and techniques for developing Apps 3) Explore and practice App development on Android Platform 4) Develop working prototypes of working systems for various uses in daily lives.Use ADO.NET for green IT data persistence in a web application.

			L	Cr
	Semester III (PRACTICALS)			
Practical-I: Core Java + OS		**Paper Code: RJSUCSP301 (RJSUCS302+RJSUCS303)**		2
	Core Java			
1	Write a program to create a class and object in java.			
2	Demonstrate Java inheritance using extends keyword.			
3	Demonstrate polymorphism in Java. a. Bank Example b. Shape Example			
4	Demonstrate concept of method overloading in Java.			
5	Demonstrate String manipulation in java.			
6	Demonstrate the concept of multithreading in Java.			
7	Demonstrate creating your own exception in Java.			
8	Create a package: Animals. In package animals create interface Animal with suitable behaviors.Implement the interface Animal in the same package animals.			
9	Demonstrate the concept of networking (client-server communication) in Java.			
10	Using various swing components design Java application to accept a student's resume. (Design form).			

11	Design a form to accept a number and display result in label whether it is even or odd.		
12	Write a Java List example and demonstrate methods of Java List interface.		
OS			
1	Give the solution to Producer-Consumer Problem.		
2	Java Program for Synchronization.		
3	Implement FCFS Scheduling algorithm in java.		
4	Implement SJF (with no preemption) scheduling algorithm in Java		
5	Implement RR scheduling algorithm in Java.		
6	Write a Java program that implements the banker's algorithm		
7	Write a Java Program to implement Disk Scheduling algorithm (SSTF)		
8	Write a Java Program to implement Optimal page replacement algorithm of memory management.		
Practical-II: Database Management System + Combinatorics and Graph Theory	**Paper Code: RJSUCSP302 (RJSUCS304+ RJSUCS305)**		2
Database Management System			

1	Creating and working with Insert/Update/Delete Trigger using Before/After clause.		

2	Writing PL/SQL Blocks with basic programming constructs by including following:
	    a. Sequential Statements.
	    b. unconstrained loop.		

3	Sequences:
	    a. Creating simple Sequences with clauses like START WITH, INCREMENT BY, MAXVALUE, MINVALUE, CYCLE | NOCYCLE, CACHE | NOCACHE, ORDER | NOORECER.
	    b. Creating and using Sequences for tables.		

4	Writing PL/SQL Blocks with basic programming constructs by including following:
	    a. If...then...Else, IF...ELSEIF...ELSE... END IF.
	    b. Case statement.		

5	Writing PL/SQL Blocks with basic programming constructs for following Iterative Structure:
	    a. While-loop Statements.
	    b. For-loop Statements.		

6	Writing PL/SQL Blocks with basic programming constructs by including a GoTO to jump out of a loop and NULL as a statement inside IF .		

7	Writing Procedures in PL/SQL Block:
	
	    a. Create an empty procedure, replace a procedure and call procedure.
	    b. Create a stored procedure and call it.
	    c. Define procedure to insert data.
	    d. A forward declaration of procedure.		

8	Writing Functions in PL/SQL Block.
	     a. Define and call functions.
	     b. Define and use function in select clause.
	     c. Call function in dbms_output.put_line.
	     d. Recursive function.
	     e. Count Employees from a function and return value back.
	     f. Call function and store the return value to a variable.		

9	Writing recursive Functions in PL/SQL Block.		
10	Study of Transactions and Locks.		
	Combinatorics and Graph Theory		
1	Solving problems on strings, sets and binomial coefficients.		
2	Solving problem using induction.		
3	Solving problems on Chromatic number and coloring		
4	Solving problems on Eulerian and Hamiltonian graphs.		
5	Solving problems using kruskal's Algorithm		
6	Solving problems using Prim's Algorithm .		
7	Solving problems using Dijkstra's Algorithm .		
8	Solving problems on posets and their associated networks.		
9	Solving problems using Bell-Man Ford Algorithm .		
10	Solving problems on network flows using Ford-Fulkerson Labeling Algorithm.		

Practical-III: Computer Network + Web Programming	Paper Code: RJSUCSP303 (RJSUCS306 + RJSUCS307)		2
Computer Network			
1	Using Packet Tracer Create a Basic Network of Two Computers using appropriate network Wire.		
2	Using Packet Tracer connect Multiple (Minimum 6) Computers using Layer to Switch.		
3	Using packet Tracer Connect a network in Triangular shape with three Layers Two Switches and every switch have three Computers. Verify their Connectivity with Each other.		
4	Using Packet Tracer create a Wireless Network of Multiple PC's using appropriate access Point.		
5	Using a Wire Shark Network Analyzer set the Filter for ICMP, TCP, HTTP, UDP, FTP and perform the Respective Transactions to Show or Prove that network analyzer is Working.		
6	Using Cisco Packet Tracer Create a connection between Router, Switch and Pc's.		
7	Using Linux Terminal or Windows CMD execute the following network Command and note the output.		
8	Using Cisco Packet tracer establish between Server and PC with the help of Router and Switch.		
9	Perform Mesh Topology network connection using Cisco packet tracer.		
10	Perform Mesh Topology network connection using Cisco packet tracer.)		
Web Programming			

1	Design a webpage that makes use of a. Document Structure Tags b. Various Text Formatting Tags c. List Tags d. Image and Image Maps		
2	Design a webpage that makes use of a. Table tags b. Form Tags (forms with various form elements) c. Navigation across multiple pages d. Embedded Multimedia elements		
3	Design a webpage that make use of Cascading Style Sheets with a. CSS properties to change the background of a Page b. CSS properties to change Fonts and Text Styles c. CSS properties for positioning an element		
4	Write JavaScript code for a. Performing various mathematical operations such as calculating factorial / finding Fibonacci Series / Displaying Prime Numbers in a given range / Evaluating Expressions / Calculating reverse of a number b. Validating the various Form Elements		

5	5. Write JavaScript code for a. Demonstrating different JavaScript Objects such as String, RegExp, Math, Date b. Demonstrating different JavaScript Objects such as Window, Navigator, History, Location, Document, c. Storing and Retrieving Cookies , dispersion)		
6	Create a XML file with Internal / External DTD and display it using a. CSS b. XSL		
7	Design a webpage to handle asynchronous requests using AJAX on a. button click b. mouse over		
8	Write PHP scripts for a. Retrieving data from HTML forms b. Performing certain mathematical operations such as calculating factorial / finding Fibonacci Series / Displaying Prime Numbers in a given range / Evaluating Expressions / Calculating reverse of a number. c. Working with Files (Reading / Writing)		
9	Write PHP scripts for a. Working with Databases (Storing Records / Reprieving Records and Display them)		
10	Design a webpage with some jQuery animation effects.		

S.Y.B.Sc	Semester III (Practical)

RJSUCSP301
 	
(RJSUCS302+
 	
RJSUCS303)
	Core Java:
	
	Course Outcomes:
	
	The objective of this course is to teach the learner how to create classes and there objects and how to implement concept of OOP practically.
	
	Learning outcomes:
	
	1. How to create classes and objects in java.
	
	2. How to implement concept of OOP.
	
	3. Implementing Multi threading and Networking.
	
	4.Knowledge and implementation of AWT package.
	
	Operating System
	
	Course Outcomes:
	
	   1. To understand threads in java.
	   2. To implement OS concepts in java
	   3. To implement & test various OS algorithms in java
	
	Learning outcomes:
	
	   1. Understanding of scheduling algorithms implementation in java
	   2. Understanding of deadlock algorithms implementation in java
	Understanding of memory management algorithms implementation in java.

RJSUCSP302 (RJSUCS304+ RJSUCS305)	PL/SQL Course Outcomes: 1. Describe stored procedures and functions. 2. Design PL/SQL anonymous block that executes efficiently. 3. Describe the features and syntax of PL/SQL. 4. Use PL/SQL programming constructs and conditionally control code flow (loops, Control structures, and explicit cursors). Learning Outcomes: 1. write stored procedures, functions, and triggers, and implement complex business rules with oracle 11g. 2. They learn programming, management, and security issues of working with PL/SQL program units, Programming topics will include the built-in packages that come with Oracle, the creation of triggers, and stored procedure features. **Combinatorics and Graph theory:** Course Outcomes: To give the learner a broad exposure of combinatorial Mathematics through applications especially the Computer Science applications. **Learning Outcomes:** 1. Appreciate beauty of combinatorics and how combinatorial problems naturally arise in many settings. 2. Understand the combinatorial features in real world situations and Computer Science applications. 3. Apply combinatorial and graph theoretical concepts to understand Computer Science concepts and apply them to solve problems.

RJSUCSP303 (RJSUCS306+ RJSUCS307)	**Computer Networks:** Course Outcomes: Designed to impart knowledge about detailed knowledge of Computer Networks, various protocols used in Communication, Managing and configuring Cisco Switches and Routers and various WAN technologies. Learning outcomes: 1.Describe the general principles of data communication. 2.Describe how computer networks are organized with the concept of layered approach. 3.Implement a simple LAN with hubs and switches. 4.Describe how packets in the Internet are delivered. **Web Programming**: Course Outcomes: The Objective of this practical is how to implement concept of web application practically. Learning outcomes: 1. To design valid, well-formed, scalable, and meaningful pages using emerging technologies. 2.Understand the various platforms, devices, display resolutions, viewports, and browsers that render websites 3.To develop and implement client-side and server-side scripting language programs. 4.To develop and implement Databases in Websites using PHP. 5.Design and apply XML to create a markup language for data and document centric applications.

		L	Cr
Semester IV (PRACTICALS)			
Practical-I: Fundamentals of algorithm + ADV. Java	**Paper Code: RJSUCSP401 (RJSUCS401+ RJSUCS402)**		2
Fundamentals of algorithm			
1	Write Python program to perform matrix multiplication.		
2	Write a python program for matrix multiplication using strassen's method		
3	Write a python program for quick sort algorithm		
4	Write a python program for merge sort algorithm		
5	Write a python program for checking whether there is a path between any two given vertices		
6	Write a python program for finding smallest and largest of the given array		
7	Write a python program for finding second largest element of the given array using tournament method		
8	Write a python program for finding mutually compatible activities from the given set of activities		
9	Write a python program for knapsack problem .		
10	Write a python program for finding largest common subsequence of the two given sequences		

	Adv. Java			

1	Design applications in java by using Swing Controls :-
	        a. JLabel,JTextField,JComboBox,JRadioButton,JButton
	          b. JTable
	          c. JScrollPane,JTabbedPane
	          d. JMenu
	          e. JTree		

2	Write a jdbc program to implement ResultSet by accepting query by command line.		
3	Write a jdbc program to insert and show records in a database using Swing controls.		
4	Write a program to implement Servlet Life Cycle.		

5	Write a Servlet program
	        a. to calculate product of two numbers.
	        b. to calculate Net Salary.		

6	Write a Servlet & jdbc program to design login form.		

7	Write a jsp program :
	        a. to insert record in a database.
	        b. to display date.		

8	Write a JavaBean program to display date.		
9	Write a JSON program to display data.		
10	Write a JSON program with HTML to display data.		
Practical-II: Physical Computing and IoT Programming + Linear Algebra using Python	**Paper Code: RJSUCSP402 (RJSUCS403+ RJSUCS405)**		2

	Physical Computing and IoT Programming		
1	Preparing Raspberry Pi: Hardware preparation and Installation.		
2	Linux Commands: Exploring the Raspbian		
3	GPIO: Light the LED with Python		
4	GPIO: LED Grid Module: Program the 8X8 Grid with Different Formulas		
5	SPI: Camera Connection and capturing Images using SPI		
6	Real Time Clock display using PWM.		
7	Stepper Motor Control: PWM to manage stepper motor speed. 8.		
8	Node RED: Connect LED to Internet of Preparing Raspberry Pi		
9	Things Create a simple Web server using Raspberry Pi:		
	Linear Algebra using Python		
1	Write a program which demonstrates the following: • Addition of two complex numbers • Displaying the conjugate of a complex number • Plotting a set of complex numbers • Creating a new plot by rotating the given number by a degree 90, 180, 270 degrees and also by scaling by a number a=1/2, a=1/3, a=2 etc.		
2	Write a program to do the following: • Enter a vector u as a n-list • Enter another vector v as a n-list • Find the vector au+bv for different values of a and b • Find the dot product of u and v		

3	Write a program to do the following: • Enter two distinct faces as vectors u and v. • Find a new face as a linear combination of u and v i.e. au+bv for a and b in R. • Find the average face of the original faces.		
4	Write a program to do the following: • Enter an r by c matrix M (r and c being positive integers) • Display M in matrix format • Display the rows and columns of the matrix M • Find the scalar multiplication of M for a given scalar. • Find the transpose of the matrix M.		
5	Write a program to do the following: • Find the vector -matrix multiplication of a r by c matrix M with an c vector u. • Find the matrix-matrix product of M with a c by p matrix N.		
6	Write a program to enter a matrix and check if it is invertible. If the inverse exists, find the inverse.		
7	Write a program to convert a matrix into its row echelon form.		
8	Write a program to do the following: • Enter a positive number N and find numbers a and b such that a - b = N • Find the gcd of two numbers using Euclid's algorithm.		
9	Write a program to do the following: • Enter a vector b and find the projection of b orthogonal to a given vector u. • Find the projection of b orthogonal to a set of given vectors 10. Write a program to enter a given matrix and an eigen value of the same. Find its eigen vector		
Practical-III: .NET Technologies + **Android Developer Fundamentals**	**Paper Code: RJSUCSP403** **(RJSUCS406+ RJSUCS407)**		2

	.NET Technologies		
1	**Basic C# Programs using Object Oriented Programming** a. Factorial b. Prime Number c. Palindrome Number d. Reverse Number e. Fibonacci Series		
2	**Standard Validation Controls** a. RequiredFieldValidator Control b. RangeValidator Control c. CompareValidator Control d. RegularExpressionValidator Control e. CustomValidator Control f. ValidationSummary		
3	**Control Design ASP.NET Pages with** a. Rich Controls (Calendar / Ad Rotator/ MultiView Control)		
4	**Design ASP.NET Pages for State Management using** a. Cookies b. Session State c. Application State		
5	**Perform the following activities** a. Design ASP.NET page and perform validation using various Validation Controls b. Design an APS.NET master web page and use it other (at least 2-3) content pages. c. Design ASP.NET Pages with various Navigation Controls		
6	**Performing ADO.NET data access in ASP.NET for** a. Simple Data Binding b. Repeated Value Data Binding		
7	**. Design ASP.NET Pages for Performance improvement using Caching.**		
8	**8. Design ASP.NET application to query a Database using LINQ**		

9	**9. Design and use AJAX based ASP.NET pages.**		
10	Creating and Consuming Web Services(Design a CalculatorWebApplication by using Addition/Subtraction/Division/Multiplication)		
	Android Developer Fundamentals		
1	Install Android Studio and Run Hello World Program.		
2	Create an android app with Interactive User Interface using Layouts.		
3	Create an android app that demonstrates working with TextView Elements.		
4	Create an android app that demonstrates Activity Lifecycle and Instance State.		
5	Create an android app that demonstrates the use of Keyboards, Input Controls, Alerts, and Pickers.		
6	Create an android app that demonstrates the use of an Options Menu.		
7	Create an android app that demonstrate Screen Navigation Using the App Bar and Tabs.		
8	Create an android app to Connect to the Internet and use BroadcastReceiver.		
9	Create an android app to show Notifications and Alarm manager. 10. Create an android app to save user data in a database and use of different queries.		

S.Y.B.Sc	Semester IV (Practical)
RJSUCSP401 (RJSUCS401+ RJSUCS402)	**Fundamentals of algorithm** Course outcomes: To study sorting algorithms in python To implement graph and selection algorithms in python. To implement greedy as well as divide and conquer algorithms. Learning outcomes: Understanding sorting algorithms like merge sort , quick sort etc. Understanding graph and selection algorithms. Understanding divide and conquer algorithms. Understanding greedy algorithms. **Advanced Java:** Course Outcomes: Learning advanced topics of java like servlet, jsp, json etc. and how to implement it practically. Learning outcomes: 1) Understand the concept of Swing Components for GUI based application. 2) How to implement servlet in practically. 3) How to create jsp application 4) How to connect java application with database. 5) Implementing JSON practically.

RJSUCSP402 (RJSUCS403+ RJSUCS405)	**Physical Computing and IoT Programming:**
	Course Outcomes :
	To learn about SoC architectures; Learn how Raspberry Pi. Learn to program Raspberry Pi. Implementation of the Internet of Things and Protocols.
	Learning Outcomes: 1. Enable learners to understand System On Chip Architectures. 2. Introduction and preparing Raspberry Pi with hardware and installation. 3. Learn physical interfaces and electronics of Raspberry Pi and program them using practical's 4. Learn how to make consumer grade IoT safe and secure with proper use of protocols.
	Linear Algebra Using Python:
	COURSE OUTCOMES :
	To offer the learner the relevant linear algebra concepts through computer science applications.
	Learning Outcomes:
	1. Appreciate the relevance of linear algebra in the field of computer science. 2. Understand the concepts through program implementation 3. In still a computational thinking while learning linear algebra.

RJSUCSP403 (RJSUCS406+ RJSUCS407)	**.NET Technologies** Course Outcomes: Specifically designed to address the requirements of developers who want to become experts in .NET environment. Learning outcomes: 1.Students will learn to develop applications using C# . 2. They will also learn to apply these languages to develop server-side applications which make use of ADO.NET, ASP.NET, Web Services etc. **Android Developer Fundamentals** COURSE OUTCOMES : To provide the comprehensive insight into developing applications running on smart mobile devices and demonstrate programming skills for managing task on mobile. To provide systematic approach for studying definition, methods and its applications for Mobile-App development. **Learning Outcomes:** 1) Understand the requirements of Mobile programming environment. 2) Learn about basic methods, tools and techniques for developing Apps 3) Explore and practice App development on Android Platform.

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Scheme of Examinations

1.   Two Internals of 20 marks each. Duration 30min for each.

2.   One External (Semester End Examination) of 60 marks. Duration 2 hours.

3.   One Practical at the end of Semester consisting of Groups and each group have 2 practicals each of 50 marks but passing combined out of 100.

4.   Minimum marks for passing Semester End Theory and Practical Exam is 40 %.

5.   Student must appear for at least one of the two Internal Tests to be eligible for the Semester End Examination.

6.   For any KT examinations, there shall be ODD-ODD/EVEN-EVEN pattern followed.

7.   Two short field excursions for habitat studies are compulsory.

8.   Field work of not less than eight hours duration is equivalent to one period per week for a batch of 15students.

9.   A candidate will be allowed to appear for the practical examinations if he/she submits a certified journal of S.Y.B.Sc. Computer-Science or a certificate from the Head of the department / Institute to the effect that the candidate has completed the practical course of S.Y.B.Sc. Computer-Science as per the minimum requirements.

10.   In case of loss of journal, a candidate must produce a certificate from the Head of the department /Institute that the practicals for the academic year were completed by the student. However, such a candidate will be allowed to appear for the practical examination, but the marks allotted for the journal will not be granted.

11.   HOD's decision, in consultation with the Principal, shall remain final and abiding to all.

Evaluation (Theory): Total marks per course - 100.

      CIA- 40 marks

      CIA 1: Written test -20 marks

      CIA 2: Written Test / Assignment / Field Trip/mini project/ & Report -20 marks

      Semester End Examination – 60 marks

      Question paper covering all units

Evaluation of Practicals 100 marks /group (RJSUCSP301, RJSUCSP302, RJSUCSP303,RJSUCSP401, RJSUCSP402, RJSUCSP403)

Course SemesterEnd Examination in Semester1 and II Paper I to VII (RJSUCS301 To RJSUCS307, RJSUCS401 To RJSUCS407)

Question	KNOWLEDGE	UNDERSTANDING	APPLICATION and ANALYSES	TOTAL MARKS- Per unit
Unit 1	08	03	04	15
Unit 2	08	03	04	15
Unit 3	08	03	04	15
Short notes from topics covering all the units	08	03	04	15
-TOTAL- Per objective	32	12	16	**60**
% WEIGHTAGE	53	20	27	**100 %**

Evaluation of Practicals 100 marks /group (RJSUCSP301, RJSUCSP302, RJSUCSP303,RJSUCSP401, RJSUCSP402, RJSUCSP403)

Continuous Evaluation of components which require adequate duration for completion of the task, observation and interpretation: 25%
Course end Practical Evaluation of skills of students in terms of skill, analysis, interpretation and conclusion.

Mapping of the course to employability/ Entrepreneurship/skill development

Class	Course Name	Course Code	Unit No. And topics focusing on Employability / Entrepreneurship / Skill development	Employability / Entrepreneurship / Skill development
SYBSC SEM III				
SYBSC	Theory of Computation	RJSUGCS301	**Employability** **UNIT 1:** Automata Theory, Formal Languages **UNIT 2:** Regular Sets and Regular Grammar, Context Free Languages, Pushdown Automata, Linear Bound Automata **UNIT 3:** Turing Machine	Employability in the field of compiler design

SYBSC	Core JAVA	RJSUGCS302	**Employability** **UNIT 1:** The Java Language, OOPS, String Manipulations, Packages, **UNIT 2:** Exception Handling, Multithreading**,** I/O Stream, Networking, Wrapper Classes, Collection Framework, **UNIT 3:** Inner Classes, AWT	Employability in the field of development
SYBSC	Operating System	RJSUGCS303	**Employability** **UNIT 1:** Introduction and Operating-Systems Structures, Operating-System Structures, Processes, Threads **UNIT 2:** Process Synchronization, CPU Scheduling, Deadlocks **UNIT 3:** Main Memory, Virtual Memory, Mass-Storage Structure, File-System Implementation	Employability in the field of OS design

SYBSC	Database Management Systems	RJSUGCS304	**Employability** **UNIT 1:** Fundamentals of PL/SQL, Overview of PL/SQL Control Structures, **UNIT 2:** Stored Procedures, Triggers, Sequences, File Organization and Indexing **UNIT 3:** Transaction Management, DCL Statements, Crash Recovery,	Employability in the field of back end developer & data management
SYBSC	Combinatorics and Graph Theory	RJSUGCS305	**Employability** **UNIT 1:** Introduction to Combinatorics **UNIT 2:** Graph Theory **UNIT 3:** Network Flows	Employability in the field of teaching

SYBSC	Computer Networks	RJSUGCS306	**Employability** **UNIT 1:** Introduction to Networks, Introduction to OSI model, Physical Layer **UNIT 2:** Physical Layer, Analog Transmission, Multiplexing, Transmission Media, Introduction to Data-Link Layer- **UNIT 3:** Multiple Access, Connecting Devices and Virtual LANs, Introduction to Network Layer, Routing Protocols , Introduction to Transport Layer	Employability in the field of networking
SYBSC	Skill Enhancement: Web Programming	RJSUGCS307	**Skill Development** **UNIT 1:** HTML5, CSS, **UNIT 2:** JavaScript, XML **UNIT 3:** AJAX, PHP, Introduction to j Query	
SYBSC SEM IV				

SYBSC	Fundamentals of Algorithms	RJSUGCS401	**Employability** **UNIT 1:** Introduction, Running time analysis, Asymptotic Analysis **UNIT 2:** Graph Algorithms, Selection Algorithms, Partition-based Selection Algorithm, Algorithms Design Techniques **UNIT 3:** Greedy Algorithms, Divide and Conquer Algorithms, Dynamic Programming,	Employability in the field of development
SYBSC	Advanced JAVA	RJSUGCS402	**Employability** **UNIT 1:** Swing, JDBC **UNIT 2:** Servlets, JSP, Java Beans **UNIT 3:** JSON, Struts 2	Employability in the field of development

SYBSC	Physical Computing and IoT Programming	RJSUGCS403	**Entrepreneurship** **UNIT 1:** SoC and Raspberry Pi, System on Chip, SoC products, ARM 8 Architecture, Introduction to Raspberry Pi, Raspberry Pi Boot **UNIT 2:** Programming Raspberry Pi, Raspberry Pi and Linux, Programming interfaces, Raspberry Pi Interfaces, Useful Implementations: **UNIT 3:** Introduction to IoT, IoT Security, IoT Service as a Platform, IoT Security and Interoperability	Employability in the field of IOT & embedded system design
SYBSC	Software Engineering	RJSUGCS404	**Employability** **UNIT 1:** Requirement Analysis and System Modeling**:** **UNIT 2:** System Design, Software Measurement and Metrics **UNIT 3:** Risk Management, Software Quality Assurance, Software Testing	Employability in the field of system requirement

SYBSC	Linear Algebra using Python	RJSUGCS405	**Employability** **UNIT 1:** Field, Matrix, Basis, Dimension **UNIT 2:** Gaussian elimination, Inner Product, Eigenvector **UNIT 3:** Gaussian elimination, Inner Product, Eigenvector	Employability in the field of teaching
SYBSC	.Net Technologies	RJSUGCS406	**Employability** **UNIT 1:** NET Framework, Language Basics, ASP.NET, **UNIT 2:** Web Controls, State Management, Validation, Rich Controls, Website Navigation **UNIT 3:** ADO.NET, Data Binding, Data Controls, Working with XML, Caching, LINQ, ASP.NET AJAX	Employability in the field of front end development
SYBSC	Skill Enhancement: Android Developer Fundamentals	RJSUGCS407	**Skill Development** **UNIT 1:** Introduction, Basic view **UNIT 2:** Connecting to the Internet, web services **UNIT 3: Data -** saving, retrieving, and loading	