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

S. P. Mandali's

Ramnarain Ruia Autonomous College

(Affiliated to University of Mumbai)

Syllabus for

Program: S.Y.B.Sc.

Program Code: RUSCS

(As per the guidelines of National Education Policy 2020-Academic year 2024-25)

(Choice Based Credit System)

GRADUATE PROGRAM

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 in the field of Computer Science
PO 2	Identify , analyse 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 optimised 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
SY B.Sc.	III	RUSCSMJO 201	DSC Subject I	Advanced Java	3
		RUSMJCSP O201	Practical based on DSE Subject I	Practical of Advanced Java	1
	III	RUSMJCSO 202	DSC Subject I	Software Engineering & Testing	3
		RUSMJCSP O202	Practical based on DSE Subject I	Practical of Software Engineering & Testing	1
	III	RUSMICSO2 03	DSC Subject II	Foundational Mathematics	3
		RUSMICSP O203	Practical based on DSE Subject II	Practical of Foundational Mathematics	1
SY B.Sc.	IV	RUAMJCSE 211	DSC Subject I	Operating System	3
		RUSMJCSP E211	Practical based on DSE Subject I	Practical of Operating System	1
	IV	RUSMJCSE 212	DSC Subject I	Computer Networks	3
		RUSMJCSP E211	Practical based on DSE Subject I	Practical of Computer Networks	1

	IV	RUSMICSE213	DSC Subject II	Statistical Fundamentals	3
		RUSMICSPE213	Practical based on DSE Subject II	Practical of Statistical Fundamentals	1

SEMESTER III

Course Code: RUSCSMJO201

Course Title: Advanced Java

Type of Course: Discipline Specific Core Course

Academic year 2024-25

COURSE OUTCOMES:

COURSE OUTCOME	DESCRIPTION After Completing this course student will be able to:
CO 1	Develop GUI based desktop applications using AWT, Swing.
CO 2	Apply Database connectivity across applications.
CO 3	Develop web based applications using Servlets and JSP.
CO 4	Understand and implement JSON.

DETAILED SYLLABUS

Course Code	Unit	Advanced Java	Lectures
	I	**Collection Framework:** Introduction, java.util Package interfaces, List,Set, Map,List interface & its classes, Set interface & its classes, Map interface & its classes. **Introduction to JFC and Swing-** Features of the Java Foundation Classes, Swing API Components, JComponent Class, Windows, Dialog Boxes, and Panels, Labels, Buttons, Check Boxes, Menus, Toolbars, Implementing Action interface, Pane, JScrollPane, Desktop pane, Scrollbars, Lists and Combo Boxes, Text-Entry Components, Colors and File Choosers, Tables and Trees, Printing with 2D API and Java Print Service API. **AWT and Event Handling:** AWT Components(Button, Label, TextField,TextArea,CheckBox,CheckBoxGroup,List,MenuItem,Menu,Scrollbar, Panel, Toolkit), The Delegation Event Model, Event classes (ActionEvent, FocusEvent, InputEvent, ItemEvent, KeyEvent, MouseEvent, MouseWheelEvent, TextEvent, and WindowEvent) and various listener interfaces (ActionListener, FocusListener, ItemListener, KeyListener,MouseListener, MouseMotionListener,MouseWheelListener, TextListener, WindowFocusListener, WindowListener).	15 L

	II	**JDBC:**Introduction, JDBC Architecture, JDBC Drivers, JDBC Connectivity Model, java.sql package, Using Statement, PreparedStatement, CallableStatement, ResultSet, Scrollable and Updatable ResultSet, Navigating and manipulating data, ResultSetMetaData, Managing Transactions in JDBC, JDBC Exception classes, BLOB & CLOB **Servlets:** Introduction, Servlet Life Cycle, Types of Servlet, Servlet Configuration with Deployment Descriptor, Working with ServletContext and ServletConfig Object, Attributes in Servlet,, Response and Redirect using Request Dispacher and using sendRedirect Method, Filter API, Manipulating Responses using Filter API, Session Tracking: using Cookies, HTTPSession, Hidden Form Fields and URL Rewriting,Types of Servlet Event: ContextLevel and SessionLevel.	15 L
	III	**Java Server Pages (JSP):** Introduction to JSP , Comparison with Servlet, JSP Architecture, JSP Life Cycle, JSP Scripting Elements, JSP Directives, JSP Action, JSP Implicit Objects, JSP Expression Language, JSP Standard Tag Libraries, JSP Custom Tag, JSP Session Management, JSP Exception Handling, JSP CRUD Applications **JSON:** Overview, Syntax, DataTypes, Objects, Schema, Comparison with XML, JSON with Java **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	15 L

Subject Code:RUSMJCSPO201

Practical of Advanced Java

COURSE OUTCOMES

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

CO	Description
CO1	Implement concepts of interfaces
CO2	Develop applications using Swing & AWT Components
CO3	Design applications using Servlet and JSP, JDBC

Course Code	Practical of Advanced Java	Credits
	Implement the following topics 1. List Interface, Map Interface, Set Interface 2. GUI Programming using Swing components. 3. GUI Programming using AWT components. 4. Event Handling 5. JDBC 6. Servlet 7. Servlet with Database Connectivity 8. JSP 9. Encoding and Decoding JSON 10. Struts	1

References:

1. Horstmann & Cornell, "CORE JAVA 2 Advanced Features – VOL-II", Pearson Education, 10th Edition, 2017.
2. Herbert Schildt, Java The Complete Reference, Eleventh Edition, McGraw-Hill Education, 2020
3. Bryan Basham, Kathy Sierra, Bert Bates, Head First Servlets and JSP, O'reilly (SPD), 2018
4. Ivan Bayross, Web Enabled Commercial Applications Development Using Java 2, BPB Publications
5. Joe Wigglesworth and Paula McMillan, Java Programming: Advanced Topics, Thomson Course Technology (SPD) ,3rd Edition
6. Java XML and JSON: Document Processing for Java SE by Jeff Friesen January 2019, Apress

Additional References:

- Joe Wigglesworth and Paula McMillan, Java Programming: Advanced Topics, Thomson Course Technology (SPD)
- Eric Jendrock, Jennifer Ball, D Carson and others, The Java EE 5 Tutorial, Pearson Education
- The Java Tutorials: http://docs.oracle.com/javase/tutorial/
- Java Parsing Collection XML JSON: Map List XML JSON Transform by Yang Hu, 2019

Course Code: RUSMJCSO202

Course Title: SOFTWARE ENGINEERING

Academic year 2024-25

COURSE OUTCOMES:

COURSE OUTCOME	DESCRIPTION **After Completing this course student will be able to :**
CO 1	Understand the disciplinary process to develop software and to know different software testing methods.

CO 2	Illustrate the different phases in software development.
CO 3	Interpret project management and risk management process.
CO 4	Apply software testing methods.

DETAILED SYLLABUS

Course Code	Unit	SOFTWARE ENGINEERING	Credits 2 / 45 Hours
RUSCS404	**I**	**Software Engineering Fundamentals**: Introduction to Software Engineering, Types of Software, System Development Approaches. **Software Development Life Cycle Models:** SDLC, Prescriptive Process Model, Specialized Process Model. **Changing trends in software development:** Unified process & its phases, Agile Development, Extreme Programming and SCRUM. **The Analyst as Project Manager**: Project Management, Project Management Knowledge Areas, Project Initiation & Project Planning, Project Scheduling, Project Feasibility Study, Staffing & Launching the Project. **Software Requirements Specification:** Introduction to SRS, Components of SRS, Characteristics of SRS, Investigating System Requirements.	15 Hrs
	II	**System Analysis:** Events & event table, Introduction to UML, Class Diagram, Use Case Diagram - Use Case Scenario, Interaction Diagram, Activity Diagram, State-chart Diagram. **System Design:** Design Class Diagram, Package Diagram, Component Diagram, Deployment Diagram. **Project Management Process:** Software Configuration Management Process, Change Management Process, CMM, Risk Management, RMMM Plan. **Software Measurement and Metrics:** Product Metrics, Function-Based Metrics, Operation-Oriented Metrics, Halstead Metrics Applied to Testing, Empirical Estimation Models – COCOMO II, Estimation for Agile Development.	15 Hrs
	III	**Software Quality Assurance:** Elements of SQA, SQA Tasks, Goals, and Metrics, Formal Approaches to SQA, Six Sigma, The ISO 9000 Quality Standards. **Software Testing Fundamentals:** Purpose, Goals & Objective of Testing, Challenges & Issues in Testing, Types of Testing, Software Testing Terminologies. **Black Box Testing:** Introduction, Equivalence partitioning, Boundary value analysis, Robustness testing, Cause Effect Graph. **White Box Testing:** Statement Coverage, Branch/Decision Coverage, Condition Coverage, Graph Matrix, Cyclomatic complexity, Mutation Testing. **Planning Software Testing:** Test Plan, Test Plan Specification, Test Case Execution and Analysis, Defect logging and tracking.	15 Hrs

References:

1. System Analysis and Design in the Changing World, Satzinger, Jackson, Burd, Thomas Learning
2. System Analysis and Design in the Changing World, Satzinger, Jackson, Burd, CengageLearning (India Edition)
3. Software Engineering, A Practitioner's Approach, Roger S, Pressman.(2014).
4. An Integrated Approach to Software Engineering, Pankaj Jalote, Narosa,3rd edition.
5. Software Testing - Concepts & Practices, K. Mustafa, R. A. Khan, Narosa,Reprint 2009

Subject Code:RUSMJCSPO202
Practicals of Software Engineering

COURSE OUTCOMES

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

CO	Description
CO1	Apply the phases of SDLC from requirement analysis to maintenance.
CO2	Develop and implement testing strategies to ensure software quality.
CO3	project management principles in planning, scheduling, and managing software projects.

Sr. No.	PRACTICAL TITLE
1	To draw an ENTITY-RELATIONSHIP DIAGRAM for real project or system in Star UML
2	Draw the data flow diagrams at level 0 and level 1.
2	Draw use case diagram in argo UML & Activity diagram in argo UML.
3	Draw class diagram in argo UML & Component diagram in argo UML.
4	Draw a sequence diagram in argo UML & Collaboration diagram in argo uml.
5	Implementation of COCOMO Model for **cost estimation & Time estimation.** 1) Input the number of lines of code 2) Predict the type of project – organic, semi-detached or embedded 3) Calculate the effort applied, average staff size, productivity and cost
6	Design of Test suits for Black Box Testing
7	Design of Test suits for White Box Testing
8	Prepare a SRS document in line with the IEEE recommended standards
9	Solve Case Study on any topic with blue prints

Course Code: RUSMICSO203

Course Title: Foundational Mathematics

Academic year 2024-25

COURSE OUTCOMES:

COURSE OUTCOME	DESCRIPTION **After Completing this course student will be able to :**
CO 1	Analyse mathematical structures and operations for problem-solving in diverse fields.
CO 2	Apply critical thinking skills to formulate and solve real-world problems using mathematical concepts and techniques.
CO 3	Enhance computational skills to address complex scenarios and understand the practical implications of mathematical solutions.

DETAILED SYLLABUS

Course Code	Unit	FOUNDATIONAL MATHEMATICS	Lectures
	I	**Functions:** Definition of function. Domain, co domain and the range of a function. Direct and inverse images. Injective, surjective and bijective functions. Composite and inverse functions. **Relations:** Definition and examples. Properties of relations , Representing Relations, Partial Ordering sets, Linear Ordering Hasse Diagrams , Maximum and Minimum elements,Recurrence Relations **Permutations and Combinations:** Partition and Distribution of objects, Permutation with distinct and indistinct objects, Combination with distinct and indistinct objects ,Binomial theorem,Multinomial theorem, Pascal triangle, Tree diagram for solving counting problems,Pigeonhole Principle **Languages, Grammars and Machines:** Languages , regular Expression and Regular languages, Finite state Automata, grammars, Finite State Machine with output, Finite State Machine with no output.	15 L
	II	**Derivatives and its Applications:** Review of Functions, limit of a function, continuity of a function, derivative function, Analysis of Functions: Increase, Decrease, Concavity, Relative	15 L

		Extrema,Absolute Maxima and Minima, Applied Maximum and Minimum Problems **Partial Derivatives and its Applications:** Functions of Two or More Variables , Chain Rule, Directional Derivatives and Gradients, Tangent Planes and Normal, Vectors, Maxima and Minima of Functions of Two Variables, **Integration and its Applications:** An Overview of the Area Problem, Indefinite Integral, Definite Integral, Evaluating Definite Integrals by Substitution, Area Between Two Curves, Length of a Plane Curve,Numerical Integration: Simpson's Rule.,Modelling with Differential Equations, Separation of Variables, Euler's Method, First-Order Differential Equations and Applications.	
	III	**Vector:** Vectors are functions, Vector addition, Scalar-vector multiplication, Combining vector addition and scalar multiplication, Dictionary-based representations of vectors, Dot-product. Solving $Ax = 0$ and $Ax = b$. **Vector Space**: Linear combination of vectors, Span, Vector spaces, Linear Dependence and Independence. **Matrix:** Matrices as vectors, Transpose,Linear functions, Matrix-matrix multiplication, From function inverse to matrix inverse , Basis and Dimension**,**.Singular Value Decomposition and its Applications, Principal Component Analysis and its Applications **Gaussian elimination:** Row Echelon form, Solving a matrix-vector equation using Gaussian elimination. **Eigenvector:** Eigenvalues and eigenvectors, The Internet worm, Markov chains, Modelling a web surfer: PageRank.	15 L

Subject Code:RUSMICSPO203
Practical of FOUNDATIONAL MATHEMATICS

COURSE OUTCOMES

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

CO	Description
CO1	Apply mathematical concepts practically to analyse functions, permutations, and combinations, enhancing problem-solving skills.
CO2	Implement derivatives and integration concepts.
CO3	Evaluate various matrix and vector operations and interpret their results.

Course Code	PRACTICAL OF Foundational Mathematics	Credits
	Practicals on 1. Functions and Relations 2. Permutation and Combinations 3. Analysis of functions 4. Partial Derivatives 5. Area under curve and length of a curve 6. Numerical Integration(Simpson's rule, Euler's Method) 7. Vector operations	**1**

	8. Matrix Operations 9. Projection of vectors 10. Eigen Vector and Eigen values	

1.

Additional References:

- Discrete Mathematics, Norman L. Biggs, Clarendon Press, Oxford 1989, Revised Edition.
- Discrete Mathematics: Semyour Lipschutz, Marc Lipson, Schaum's out lines, McGraw- Hill Inc.
- Calculus: Early transcendental, Howard Anton, Irl Bivens, Stephen Davis, John Wiley & sons, 2012, 10th Edition.
- Linear Algebra and Probability for Computer Science Applications, Ernest Davis, A K Peters/CRC Press (2012).

SEMESTER IV

Course Code: RUAMJCSE211

Course Title: Operating System

Type of Course: Discipline Specific Core Course

Academic year 2024-25

COURSE OUTCOMES:

COURSE OUTCOME	DESCRIPTION **After Completing this course student will be able to :**
CO 1	Explain various components of computer hardware and how processes are working in operating systems.
CO 2	Discuss the structure of the operating system, its functions and algorithms.
CO 3	Understanding the working of operating system, its structures and functioning
CO 4	Compare various algorithms used in operating systems.

DETAILED SYLLABUS

Course Code	Unit	OPERATING SYSTEM	Lectures
	I	**Introduction and Operating-Systems Structures:** Definition of Operating system, Operating System's role, Operating-System Operations, Functions of Operating System, Computing Environments **Operating-System Structures:** Operating-System Services, User and Operating-System Interface, System Calls, Types of System Calls, Operating-System Structure **Processes:** Process Concept, Process Scheduling, Operations on Processes, Inter-process Communication **Threads:** Overview, Multicore Programming, Multithreading Models	15 L
	II	**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 **CPU Scheduling:** Basic Concepts, Scheduling Criteria, Scheduling Algorithms (FCFS, SJF, SRTF, Priority, RR, Multilevel Queue Scheduling, Multilevel Feedback Queue Scheduling), Thread Scheduling **Deadlocks:** System Model, Deadlock Characterization, Methods for Handling Deadlocks, Deadlock Prevention, Deadlock Avoidance, Deadlock Detection, Recovery from Deadlock	15 L

	III	**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 **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	15 L

Subject Code:RUSMJCSPE211
Practicals of Operating System

COURSE OUTCOMES

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

CO	Description
CO1	Apply various algorithms used in operating systems.
CO2	Illustrate the structure of the operating system, its functions, and algorithms.
CO3	Demonstrate how processes are working in operating systems.

Course Code	Practical Of OPERATING SYSTEM	Credits
	1. Write a Program to implement First Come First Serve(FCFS) Scheduling. 2. Write a Program to implement Shortest Job First (SJF) Scheduling. 3. Write a Program to implement Priority based Scheduling. 4. Write a Program to implement Round Robin. 5. Write a Program to implement FIFO page replacement algorithm. 6. Write a Program to implement LRU Page replacement algorithm. 7. Write a Program to implement an Optimal page replacement algorithm 8. Write a Program to implement Dinning Philosophers. 9. Write a Program to implement DeadLock Detection. 10. Write a Program to implement the Worst FIT Algorithm.	**1**

References:

1. Abraham Silberschatz, Peter Galvin, Greg Gagne, Operating System Concepts, Wiley,8th Edition

Additional References:

- Achyut S. Godbole, Atul Kahate, Operating Systems, Tata McGraw Hill
- Naresh Chauhan, Principles of Operating Systems, Oxford Press
- Andrew S Tanenbaum, Herbert Bos, Modern Operating Systems, 4e Fourth Edition, Pearson Education, 2016

Course Code:RUSMJCSE212

Course Title:Computer Networks

Type of Course: Discipline Specific Core Course

Academic year 2024-25

COURSE OUTCOMES:

COURSE OUTCOME	DESCRIPTION **After Completing this course student will be able to :**
CO 1	Enumerate the layers functionality of the TCP/IP Model
CO 2	Apply Protocols to Network design and implementation for specific use case
CO 3	Evaluate and assess the use of network components, protocols in real networks.
CO 4	Use tools and technologies for network design, monitoring and maintenance.

DETAILED SYLLABUS

Course Code	Unit	COMPUTER NETWORKS	Lectures
RUSCS403	**I**	**Introduction Network Models:** 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. 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. 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)	15 L
	II	**Introduction to Physical Layer and Data-Link 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, 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), Multiplexing, Frequency-Division Multiplexing, Wavelength-Division Multiplexing, Time-Division Multiplexing. Transmission Media, Guided Media, Twisted-Pair Cable, Coaxial Cable, Fiber-Optic	15 L

		Cable. Switching, Three Methods of Switching , Circuit Switched Networks, Packet Switching, 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.	
	III	**Network layer, Transport Layer** 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, Introduction to Network Layer, network layer services, Packetizing, Routing and Forwarding, Other Services, IPv4 addresses, Address Space, Classful Addressing. Unicast Routing, General Idea, Least-Cost Routing, Routing Algorithms, Distance-Vector Routing, Link-State Routing, Path-Vector Routing, 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.	15 L

Subject Code:RUSMJCSPE211
Practicals of Computer Networks

COURSE OUTCOMES

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

CO	Description
CO1	Implement the Networking concepts with Tools for monitoring,maintenance of networks
CO2	Examine the networking support provided by different OS
CO3	Design the suitable Network for real world case study and Evaluate the performance

Course Code	PRACTICAL OF COMPUTER NETWORKS	Credits
RUSCSP403	1. Understanding the working of NIC cards, Ethernet/Fast Ethernet/Gigabit Ethernet. 2. Crimping of Twisted-Pair Cable with RJ45connector for Straight-Through, Cross-Over, Roll-Over. 3. To understand their respective role in networks/internet. 4. Problem solving with IPv4, which will include the concept of Classful addressing. (supportive Hint: use Cisco Binary Game) 5. Using linux-terminal or Windows-cmd, execute following networking commands and note the output: *ping, traceroute, netstat, arp, ipconfig.* 6. Create a basic network of two computers using appropriate network wire. 7. Connect multiple (min.6) computers using layer 2 switch. 8. Connect a network in triangular shape with three layer two switches and every switch will have four computers. Verify their connectivity with each other.	**1**

	9. Create a wireless network of multiple PCs using appropriate access points. 10. Using Wireshark, network analyzer, set the filter for ICMP, TCP, HTTP, UDP, FTP and perform respective protocol transactions to show/prove that the network analyzer is working.	

References:

1. Data Communications and Networking, Behrouz A. Forouzan, Fifth Edition, TMH, 2013.
2. Computer Network, Andrew S. Tanenbaum, David J. Wetherall, Fifth Edition, Pearson Education, 2011.

Additional References:

- Computer Network, Bhushan Trivedi, Oxford University Press

Data and Computer Communication, William Stallings, PHI

Course Code:RUSMICSE213

Course Title: Statistical Fundamentals

Academic year 2024-25

COURSE OUTCOMES:

COURSE OUTCOME	DESCRIPTION After Completing this course student will be able to:
CO 1	Analyse Statistical data using measures of central tendency and dispersion.
CO 2	Study the relationship between variables using techniques of correlation and regression.
CO 3	Calculate probability, conditional probability and independence.
CO 4	Apply the given discrete and continuous distributions whenever necessary.
CO 5	Define null hypothesis, alternative hypothesis, level of significance, test statistic, p value and perform test of Hypothesis
CO 6	Conduct and interpret one-way and two-way ANOVA and non-parametric test.

DETAILED SYLLABUS

Course Code	Unit	Statistical Fundamentals	Lectures

	I	**Data Types and Data Presentation:** Data types: Attribute, Variable, Discrete and Continuous variable, Univariate and Bivariate distribution. Types of Characteristics, Different types of scales: nominal, ordinal, interval and ratio, Frequency distribution, Histogram, Ogive curves. **Measures of Central tendency:** Concept of average/central tendency, characteristics of good measure of central tendency. Arithmetic Mean (A.M.), Median, Mode - Definition, examples for ungrouped and grouped data, effect of shift of origin and change of scale, merits and demerits. Combined arithmetic mean. Partition Values: Quartiles, Deciles and Percentiles - examples for ungrouped and grouped data **Measures dispersion:** Concept of dispersion, Absolute and Relative measure of dispersion, characteristics of good measure of dispersion. Range, Semi-interquartile range, Quartile deviation, Standard deviation - Definition, examples for ungrouped and grouped data, effect of shift of origin and change of scale, merits and demerits. Combined standard deviation, Variance. Coefficient of range, Coefficient of quartile deviation and Coefficient of variation (C.V.) **Measures of Skewness and Kurtosis:** Concept of Skewness and Kurtosis, measures based on moments, quartiles.	15 L
	II	**Correlation:** Concept of correlation, Types and interpretation, Measure of Correlation: Scatter diagram and interpretation; Karl Pearson‟s coefficient of correlation (r): Definition, examples for ungrouped and grouped data, effect of shift of origin and change of scale, properties; Spearman‟s rank correlation coefficient: Definition, examples of with and without repetition. Concept of Multiple correlation. **Regression:** Concept of dependent (response) and independent (predictor) variables, concept of regression, Types and prediction, difference between correlation and regression, Relation between correlation and regression. Linear Regression - Definition, examples using least square method and regression coefficient, coefficient of determination, properties. Concept of Multiple regression and Logistic regression. **Probability:** Random experiment, sample space, events types and operations of events, Probability definition: classical, axiomatic, Elementary Theorems of probability (without proof). Conditional probability,Bayes‟ theorem, independence, Examples on Probability. **Random Variables:** Concept and definition of a discrete random variable and continuous random variable. Probability mass function, Probability density function and cumulative distribution function of discrete and continuous random variable, Properties of cumulative distribution function	15 L
	III	**Mathematical Expectation and Variance:** Expectation of a function, Variance and S.D of a random variable, properties. **Standard Probability distributions:** Introduction, properties, examples and applications of each of the following distributions: Binomial distribution, Normal distribution, Chi-square distribution, t distribution, F Distribution **Hypothesis testing:** One sided, Two sided hypothesis, critical region, p value, tests based on t, Normal and F, confidence intervals. **Analysis of Variance:** One-way, two-way analysis of variance. Non-parametric tests: Need of non-parametric tests, Sign test,	15 L

		Wilicoxon‟s signed rank test, run test, Kruskal-Walistests, Chisquare test.	

Subject Code:RUSMICSPE213
Practical of Statistical Fundamentals

COURSE OUTCOMES

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

CO	Description
CO1	Apply measures of central tendency and dispersion practically to understand and summarise data distributions.
CO2	Explore statistical moments, skewness, and kurtosis to assess the shape and variability of data distributions accurately.
CO3	Use advanced statistical techniques including correlation and regression to explore relationships and make predictions based on empirical data.
CO4	Implement hypothesis testing methodologies.

Course Code	Practical of Statistical Fundamentals	Credits
	1.Introduction to R 2.Measures of central tendency 3.Measures of dispersion 4.Moments 5.Measures of skewness and Kurtosis 6.Correlation 7.Regression 8.Summary Statistics using R 9.Conditional probability and independence 10.Discrete and Continuous random variable 11.Mathematical Expectation and Variance 12.Standard probability distributions 13.Large Sample tests based on Normal (Z) 14.Small sample tests based on t and F 15.Analysis of variance 16.Non-parametric tests	1

References:

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

2. Gupta, S.C. and Kapoor, V.K. (1987): Fundamentals of Mathematical Statistics, S. Chand and Sons, New Delhi

Additional References:

- 1. Sarma, K. V. S. (2001). Statistics Made it Simple: Do it yourself on PC. Prentice Hall of India, NewDelhi.
- 2. Agarwal, B. L. (2003). Programmed Statistics, Second Edition, New Age International Publishers, NewDelhi.
- 3. Purohit, S. G., Gore S. D., Deshmukh S. R. (2008). Statistics Using R, Narosa Publishing House, NewDelhi.
- 4. Schaum"s Outline Of Theory And Problems Of Beginning Statistics, Larry J. Stephens, Schaum"s Outline Series Mcgraw-Hill
- 5. Mood, A. M. and Graybill, F. A. and Boes D.C. (1974). Introduction to the Theory of Statistics,Ed. 3, McGraw Hill Book Company.
- 6. Hoel P. G. (1971). Introduction to Mathematical Statistics, John Wiley and Sons,New York.
- 7. Hogg, R.V. and Craig R.G. (1989). Introduction to Mathematical Statistics, Ed. MacMillan Publishing Co., New York.
- 8. Walpole R. E., Myers R. H. and Myers S. L. (1985), Probability and Statistics for Engineers and Scientists

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**