Rajarshi Shahu Mahavidyalaya (Autonomous), Latur
Department of Computer Science
Syllabus outline of M. Sc. (Computer Science) Second Year
Effective from Academic Year 2020-21

Semester	**Course Code**	**Course Name**	**Marks**		**Total**	
			Internal	**End Semester**		
					Marks	**Credits**
semester - III	**Core Course (CC) (Compulsory Course)**					
	M. Sc. CS-CC-7	Web Application Development using PHP	40	60	100	4
	M. Sc. CS-CC-8	Linux Administration	40	60	100	4
	Discipline Specific Elective (DSE) Course (Choose Any One)					
	M. Sc. CS - DSE-5	Computer Graphics	40	60	100	4
	M. Sc. CS -DSE-6	Digital Image Processing	40	60	100	4
	Skill Development Course					
	M.Sc. CS –SDC-3	Software Testing **or** 8 Week SWAYAM NPTEL Online Course	40	60	100	4
	Practical / Lab Course					
	M. Sc. CS – Lab 5	Lab-Course5 (PHP+ Linux)	40	60	100	4
	M. Sc. CS –Lab 6	Lab Course 6 (DIP+ST)	40	60	100	4
	M. Sc. CS -SDC-4	Seminar			25	1
		Total(I)			625	25
Semester	**Course Code**	**Course Name**	**Marks**		**Total**	
			Internal	**End Semester**		
					Marks	**Credits**
Sem- IV	**Core Course (CC) (Compulsory Course)**					
	M.Sc.CS-CC-09	Big Data Analysis	40	60	100	4
	M.Sc.CS-CC-10	Advance Java Programming	40	60	100	4
	Discipline Specific Elective (DSE) Course (Choose Any One)					
	M.Sc. CS-DSE-7	Information Security	40	60	100	4
	M.Sc. CS-DSE-8	Soft Computing	40	60	100	4
	M. Sc. CS -SDC-5	Project			100	4
	Practical / Lab Course Skill Development Course					
	M. Sc.CS-Lab-7	LabCourse7 (BDA + Soft Comp)	40	60	100	4
	M. Sc.CS-Lab-8	Lab Course8 Adv Java	40	60	100	4
	M. Sc. CS -SDC-6	Seminar			25	1
		Total (II)			625	25
	Total (I + II i.e. Sem III + Sem IV)				**1250**	**50**

M. Sc. CS-CC-7

Web Application Development using PHP and MYSQL

Teaching Hours: 60 **Total Marks: 100**

Learning Objectives:

- Learn Core-PHP, Server-Side Scripting Language
- Learn PHP-Data base handling.
- One PHP frame work for effective design of web application.
- Learn Java Script to program the behavior of webpages.
- Learn Basic AJAX and CSS.

Learning Outcomes:

After completion of this Course students should be able to-

- Create PHP scripts that: use object-oriented PHP,
- Implement business logic with in the database,
- Use stored procedures and triggers,
- Create and deploy a portable web-based system.
- Test and debug object-oriented PHP scripts.

Contents	Teaching Hours
UNIT I: Introduction and PHP Basics Introduction to web techniques HTTP basics, Introduction to Webserver and Web browser, Introduction to PHP, what does PHP do? Function and String: Defining and calling a function, Default parameters, Variable parameters, Missing parameters, Variable function, Anonymous function, Types of strings in PHP, printing functions, Encoding.	10
UNIT II: Working with Data, Arrays and Object-Oriented Programming Arrays: Indexed Vs Associative arrays, identifying elements of an array, storing data in arrays, Multidimensional arrays, extracting multiple values, Converting between arrays and variables Introduction to Object Oriented Programming: Classes, Objects, Serialization, Inheritance	20

Interfaces, Encapsulation Working with Data: FORM element, INPUT elements, validating user input, passing variables between pages, passing variables through a GET, passing variables through a POST, Passing variables through REQUEST, MVC Architecture.	
UNIT III: Web Techniques and MYSQL Cookies & Sessions (JavaScript) Anatomy of a cookie, setting a cookie with PHP, deleting a cookie, creating session cookie, starting a session, working with session variables, destroying a session, Encoding and decoding session variables. Introduction to MySQL Introduction to MySql, Benefits of MySql, Basics: reserve words, keywords, variables, data types, Types of commands: Data Definition Commands, Data Manipulation Commands, Data Control Commands Clauses: where, order by, group by, having, like, between, Database connectivity PHP framework and Handling email with php Introduction to PHP framework, Features, Applications, One example like CodeIgniter Sending email with php, Email id validation and verification.	20
UNIT IV: Web Designing Technologies and Ajax Overview of JavaScript, Basic Syntax (JS datatypes, JS variables), Primitives, Operations and Expressions, Screen Output and keyboard input (Verification and Validation), JS Control statements, JS Functions, JS popup boxes (alert, confirm, prompt), Introduction to CSS, Introduction to AJAX Introduction of AJAX, Simple AJAX Example, Performing simple AJAX validation	10

Reference Books:

1. Programming PHP By Rasmus Lerd or fand Kevin Tatroe, O'Reilly publication
2. Beginning PHP5, Wrox Publication
3. AJAX Black Book, Kogent Solution
4. PHP cookbook, O'Reilly Publication
5. PHP for Beginners, SPD Publication

M. Sc. CS-CC-8
Linux Administration

Total Teaching Hours: 60 **Total Marks: 100**

Learning Objective:

- To familiarize students with the Linux environment
- To learn the fundamentals of shell scripting/programming
- To familiarize students with basic Linux administration

Learning Outcomes:

After completion of this Course Students should be able to-

- Work confidently in Unix/Linux environment.
- Write shell scripts to automate various tasks.
- Master the basics of Linux administration.

Contents	Teaching Hours
UNIT I Introduction to Linux and Linux Files and Directories Introducing Linux, Installing RedHat Linux, Features of Linux, Basic Architecture of Linux system, features of Kernel and Shell. Linux File System-Boot block, Super block and Data blocks, how Unix/Linux kernel access files. The shell Scripts, Linux standard file system, Structure of file system, Essential Linux commands Listing, Displaying, and Printing Files Displaying Files: cat, less and more Printing Files: lpr, lpq and lprm Managing Directories: mkdir, rmdir, ls, cd and pwd File and Directory Operations: find, cp, mv, rm, and ln Archiving and compressing files Filters and pipes: head, tail, wc, pr, cut, paste, sort, uniq, grep, egrep, fgrep, tee	15
UNIT II Managing Users and Filesystem User Accounts, Managing Groups, Managing Users, Managing Passwords, Getting System Administrator Privileges to Regular Users, The User Login Process, Creating Users with the GUI tools, Disk Quotas, Communicating with users, The chroot command. File System Hierarchy standard: Root Directory, System Directories, Program Directories, Mounting File Systems automatically:/etc/fstab	15

Mounting File Systems Manually: mount and unmount Converting an existing ext2 File system to ext3 Creating a File systems: mkfs, mke2fs, mkswap, parted and fdisk, Relocating a FileSystem	
UNITIII Backing Up, Recovery and Printing with Linux Choosing a Backup Strategy, choosing a Backup Hardware and Media, Using Backup Software, Copying Files, deleting Files, System Recovery Overview of Linux Printing, Configuring and Managing Print Services, Creating and Configuring Local Printers, Creating Network Printers, Console Print Control, Using the Common UNIX Printing System (CUPS) GUI	15
UNIT IV Network Connectivity and Managing DNS Networking with TCP/IP Network Organization Hardware Devices for Networking Using Network Configuration Tools Dynamic Host Configuration Protocol Using the Network File System Managing DNS, Configuring DNS, Essential DNS concept Overview of DNS Tools, Configuring Name servers with BIND, Providing DNS for Real Domain.	15

Reference Books:

RedHatLinux7.2–By Bill Ball and Hoyt Duff.
Enterprise Linux & Fedora Edition–The Complete Reference-By Richard L. Petersen
Linux-The Complete Reference-Richard Petersen
Linux Administration Handbook–Evi. Nemeth Prentice Hall

M. Sc. CS-DSE-5
Computer Graphics

Total Teaching Hours: 60 **Total Marks: 100**

Learning Objectives:

- To learn the fundamentals of 3D graphics pipeline, 3D transformation, camera manipulation, lighting, texture mapping, frame buffer operations, etc.
- The basics of Graphics Processing Unit, shaders and shader programming
- The fundamentals of 3D modeling and animation.
- The current state of the art in computer graphics and expected near term advances.

Learning Outcomes:

After learning the course, the students should be able to:

- Understand the various computer graphics hardware and display technologies.
- Understand the 2D and 3D viewing techniques.
- Understand various 2D and 3D objects transformation techniques.

Contents	Teaching Hours
Unit IIntroduction to Computer Graphics A survey of computer graphics: Computer Aided Design, Presentation graphics, Computer Art, Entertainment, Education and training, Visualization, Image processing, Graphical User Interfaces. Overview of graphics Systems: Video display devices, Raster Scan Displays, Random Scan Displays, Input devices, Hard-copy devices, Graphics software. Output Primitives: Points and Lines, Line drawing Algorithms (DDA and Bradenham's Line algorithm), Mid-point circle algorithm, Ellipse generating algorithms, Filled-Area Primitives. Attributes of Output Primitives: Line Attributes, Curve Attributes, Color and Grayscale Levels, Area-Fill Attributes and Character Attributes, Bundled attributes and anti-aliasing.	15
Unit II Transformation and Clipping Two-dimensional geometric Transformation: Basic	15

Transformation (Translation, Rotation, Scaling), Matrix representation and Homogenous Coordination, Composite Transformation, Reflection Shear, Transformation between coordinate systems, two-dimensional viewing: The Viewing Pipeline, viewing coordinate reference frame, window to view port coordinate transformation, Line Clipping: (Cohen-Sutherland & Liang-Barsky algorithm) and Polygon Clipping (Sutherland-HodgemanAlgorithm).	
Unit III Three-Dimensional Graphics Three-dimensional object Representation: Polygon Surfaces, Quadratic Surfaces, Spline Representation, Bezier Curves and Surfaces, B-Spline Curves and Surfaces, Fractal Geometry Methods: Fractal Generation Procedures, Classification of Fractals, Fractal Dimension, Geometric Construction of Deterministic Self Similar Fractals, Self-Squaring fractals. Three Dimensional Geometric and Modeling Transformations: Translation, Rotation, Scaling, Reflections, Shears, Composite Transformations, Modeling and coordinate Transformations. Three-dimensional Viewing: Viewing Pipeline, Viewing Coordinates, Projections (Parallel and Perspective) Clipping.	15
Unit IV Illumination and Color Models Visible Surface Detection Methods: Classification of Visible-Surface Detection Algorithms, Back-Face Detection, Depth-Buffer Method, A-Buffer Method, Scan line and Depth Sorting, Illumination Models and Surface-Rendering Methods: Basic Illumination Models, Displaying Light Intensities, Halftone Patterns and Dithering Techniques, Polygon- Rendering Methods (Ground Shading, Phong Shading), Light sources – basic illumination models–half tone patterns and dithering techniques; Properties of light–Standard primaries and chromaticity diagram; Intuitive colour concepts–RGB colour model–YIQ colour model–CMY colour model–HSV colour model–HLS colour model; Colour selection.	15

Reference Books:

1. Computer Graphics (Principles and Practice) by Foley, vanDam, Feiner and Hughes, Addison Wesley (Indian Edition).
2. Computer Graphics by D Hearn and PM Baker, Prentice Hall of India (Indian Edition).
3. Procedural Elements for Computer Graphics by D F Rogers, McGrawHill (Indian Edition).
4. Interactive Computer Graphics, A top-down approach with OpenGL by Edward Angele, Addison Wesley.

M.Sc.CS-DSE-6
Digital Image Processing

Total Teaching Hours: 60 **Total Marks: 100**

Learning Objective:

- To study the fundamental concepts of Digital Image Processing(DIP)
- To study MATLAB Tool Box for DIP.
- To study and implement intensity transformation and filtering.
- To study and implement image restoration methods.
- To study and color image processing.

Learning Outcome:

After completion of this course, students should be able to:

- Understand the basics of fundamentals of digital image processing
- Understand how images are represented and manipulated in MATLAB.
- Understand image arithmetic and convert between different data classes
- Understand basics of intensity transformations and filtering
- Perform color image processing

Contents	**Teaching Hours**
Unit- I Introduction of Image Processing What is digital image processing? Applications of digital image processing, fundamental steps in digital image processing, Components of digital image processing, Elements of visual perception, Light and Electromagnetic Spectrum, image sensing and acquisition devices, a simple image formation model, image sampling and quantization, representing digital images.	15
Unit – II Digital Image Representation and Introduction to M-Function Programming Digital Image Representation: Coordinate Conventions, Images as Matrices, Reading Images, Displaying Images, Writing Images, Data Classes, Image Types, Intensity Images, Binary Images, A Note on Terminology, converting between Data Classes and Image Types, converting between Data Classes, converting between Image Classes and Types, Array Indexing: Vector Indexing, Matrix Indexing, Selecting Array Dimensions, Some Important Standard Arrays Introduction to M Function Programming: M-Files, Operators, Flow Control, Code Optimization, Interactive I/O.	15

Unit III Intensity Transformation and Filtering Intensity Transformation Functions: Function imadjust, Logarithmic and Contrast- Stretching Transformations, Histogram Processing and Function Plotting: Generating and Plotting Image Histograms, Histogram Equalization, Histogram Matching (Specification), Spatial Filtering, Linear Spatial Filtering, Nonlinear Spatial Filtering, Image Processing Toolbox standard Spatial Filters, Frequency Domain Processing: The 2-D Discrete Fourier Transform, Computing and Visualizing the 2-D DFT in MATLAB, Filtering in the Frequency Domain, Basic Steps in DFT Filtering. Obtaining Frequency Domain Filters from Spatial Filters, Generating Filters Directly in the Frequency Domain, Sharpening Frequency Domain Filters.	15
Unit – IV Image Degradation/Restoration and Color Image Processing A Model of the Image Degradation/Restoration Process, Noise Models, Geometric Transformations and Image Registration: Geometric Spatial Transformations, Applying Spatial Transformations to Images, Image Registration, Color Image Representation in MATLAB: RGB Images, Indexed Images, IPT Functions for Manipulating RGB and Indexed Images, Converting to Other Color Spaces: NTSC Color Space, The YCbCr Color Space, The HSV Color Space, The CMY and CMYK Color Spaces, The HIS Color Space, The Basics of Color Image Processing, color Transformations, Spatial Filtering of Color Images and working directly in RGB vector space.	15

Reference Books:

1. R. C. Gonsales R. E. Woods, Digital Image Processing, Second Edition, Pearson Education
2. R.C. Gonsales R. E. Woods, Digital Image Processing using MATLAB, Second Edition, Pearson Education

M.Sc.CS-SDC-3
Software Testing

Total Teaching Hours: 60 Total Marks: 100

Learning Objectives:

- Various test processes and continuous quality improvement.
- Types of errors and fault models.
- Methods of test generation from requirements.
- Test adequacy assessment using: control flow, data flow, and program mutations.
- The use of various test tools.
- Application of software testing techniques in commercial environments.

Learning Outcomes:

After completion of this course, students should be able to:

- Apply their knowledge and skills to be employed and excel in IT professional careers and/or to continue their education in IT and/or related postgraduate programs.

Contents	Teaching Hours
Unit I: Software Testing Background and the Software Development Process The Psychology of Testing, Software Testing Principles., Software Testing Background: What Is a Bug?, Terms for Software Failures, Software Bug: A Formal Definition, Why Do Bugs Occur?, What Exactly Does a Software Tester Do?, What Makes a Good Software Tester?, The Software Development Process: Product Components, What Effort Goes Into a Software Product?, Product Components, What Effort Goes Into a Software Product?, What Parts Make Up a Software Product?, Software Development Life cycle Models: Big-Bang, Code-and-Fix, Waterfall, Spiral.	15
Unit II: The Realities of Software Testing and Testing Fundamentals Introduction, Testing Axioms, Software Testing Terms and Definitions: Precision and Accuracy, Verification and Validation,	15

Quality and Reliability, Testing and Quality Assurance (QA). Testing the Software with Blinders On: Dynamic Black-Box Testing: Testing the Software While Blindfolded, Test-to-Pass and Test-to-Fail, Equivalence Partitioning, Data Testing, Boundary Conditions, Sub-Boundary Conditions, Default, Empty, Blank, Null, Zero, and None, Invalid, Wrong, Incorrect, and Garbage Data, State Testing, Testing the Software's Logic Flow, Testing States to Fail.	
Unit-III: Applying Your Testing Skills An Overview of Configuration Testing, Compatibility Testing Overview, The overall course of a test: Planning, Execution, Evaluation. Testing Strategies: Explorative Testing, Automated Testing, testing by document, Smoke Test. Testing Methods: Blackbox, Whitebox, Gray Box) Tool support for testing: Type softest tool, Effective use of tools, Potential benefits and risks, Introducing a tool in to an organization.	15
Unit IV: Testing Web Applications Testing Concepts for Web Apps: Dimensions of Quality, Errors within a WebApp Environment, Testing Strategy, Test Planning. The Testing Process an Overview. Content Testing: Content Testing Objectives, Database Testing. User Interface Testing: Interface Testing Strategy, Testing Interface Mechanisms, Testing Interface Semantics Usability Tests, Compatibility Tests. Component-Level Testing. Navigation Testing: Testing Navigation Syntax, Testing Navigation Semantics. Configuration Testing: Server-Side Issues,	15

Reference Books:

1. Software Engineering by Rajib Mall, PHI2014
2. Software Testing: A Craftsman's Approach, by Paul C. Jorgensen, Third Edition

M. Sc. CS -Lab-5
(PHP)

Learning Objectives:

- Learn Core- PHP, Server-Side Scripting Language
- Learn PHP-Database handling.
- One PHP framework for effective design of web application.
- Learn JavaScript to program the behavior of webpages.
- Learn Basic AJAX and CSS.

Learning Outcomes:

After completion of Course students should be able to-

- Create PHP scripts that: use object-oriented PHP,
- Implement business logic with in the database,
- Use stored procedures and triggers,
- Create and deploy a portable web-based system.
- Test and debug object-oriented PHP scripts.

LIST OF PRACTICALS

1. Write a Program for

a. Print "HelloWorld" in PHP
b. Defining variables in php with all datatypes
c. Variable scope
d. To differentiate print and echo statement

2. Write a Program for

a. Checking number is even or odd
b. Add numbers using function

3. Write a Program for

a. Anonymous function
b. Default parameter
c. Missing parameter
d. Variable function
e. Variable parameter

4. Write a Program for

a. All String functions
b. Encode a string using encoding function in php

5. Write a Program for
a. Creating and Accessing Indexed Array
b. Creating and Accessing Associative Array
c. Creating and Accessing Multidimensional Array

6. Write a Program for Extracting Multiple values from array using
a. Array_slice()
b. Array_chunk()
c. Array_keys()
d. Array_values()
e. Array_key_exists
f. isset()
g. array_splice()
7. Write a Program for creating forms in PHP using
a. GET
b. POST
8. Write a program for creating sessions and destroying a session in php.
9. Working with MySql Commands Like DML, DDL
10. Write a Program for Data base connectivity in PHP

11. Write a Program for
a. Printing “HelloWorld” in JavaScript
b. Working with variables in JavaScript
c. Working with Control Statements in JavaScript

12. Write a Program for
a. JavaScript Functions
b. JavaScript Pop up Boxes
13. Working with Form and validating the forms in PHP
14. Working with Advance CSS.
15. Mini Project

M. Sc. CS Lab-6
Linux Administration

Learning Objectives

- To familiarize students with the Linux environment
- To learn the fundamentals of shell scripting/programming
- To familiarize students with basic Linux administration

Learning Outcomes

- Work confidently in Unix/Linux environment
- Write shell scripts to automate various tasks
- Master the basics of Linux administration

LIST OF PRACTICALS

1. File related commands in Linux
2. Directory related commands in Linux
3. Installation steps of LinuxOS.
4. User management commands in Linux.
5. Group management commands in Linux.
6. Password management in Linux
7. Communication commands
8. Piping Commands
9. Wild Card characters in Linux
10. Vi editor
11. Shell scripts (5 Pro

M. Sc. CS -Lab-6
Computer Graphics

Learning Objectives:

- The fundamentals of 3D graphics pipeline
- 3D transformation, camera manipulation, lighting, texture mapping, frame buffer operations etc.
- The basics of Graphics Processing Unit, shaders and shader programming
- The fundamentals of 3D modeling and animation.
- The current state of the art in computer graphics and expected near term advances

Learning Outcomes:

- After learning the course, the students should be able to:
- Understand the various computer graphics hardware and display technologies.
- Understand the 2D and 3D viewing techniques.
- Understand Various 2D and 3D objects transformation techniques**.**

LIST OF PRACTICALS

1. Program to demonstrate line(), circle(), rectangle(), ellipse().
2. Program to demonstrate setlinestyle()and setfillstyle().
3. Program to draw the emoji faces.
4. Program to draw a car.
5. Program to implement DDA algorithm.
6. Program to implement Bresenham's integer line drawing algorithm.
7. Program to implement Bresenham's General line drawing algorithm.
8. Program to implement Translation Transformation.
9. Program to implement Scaling Transformation.
10. Program to implement Rotation Transformation**.**

M. Sc. CS -Lab-6
Digital Image Processing

Learning Objective:

- To study the fundamental concepts of Digital Image Processing (DIP)
- To study MATLAB Tool Box for DIP.
- To implement intensity transformation and filtering.
- To implement image restoration methods.
- To implement color image processing.

Learning Outcome:

After completion of this course, students should be able to:

- Implement the fundamentals steps of digital image processing
- Represent and manipulate images in MATLAB.
- Work with image arithmetic and convert between different data classes
- Work with intensity transformations and filtering
- Perform color image processing

LIST OF PRACTICALS

1. Programs to demonstrate read, write and display images in MATLAB.
2. Programs to demonstrate Data classes and image types in MATLAB.
3. Programs to demonstrate Image Operations in MATLAB.
4. Programs to demonstrate Functions in MATLAB.
5. Programs to demonstrate Flow control sin MATLAB
6. Programs to demonstrate Intensity Transformations in MATLAB.
7. Programs to demonstrate Histogram, Histogram Equalization and Histogram Matching.
8. Programs to demonstrate Linear Spatial Filtering and Nonlinear Spatial Filtering.
9. Programs to demonstrate Filtering in Frequency Domain.
10. Programs to demonstrate Geometric Transformation.
11. Programs to demonstrate Image Restoration and Registration.
12. Programs to demonstrate Color Image Processing.
13. IPT Functions for Manipulating RGB and Indexed Images, Converting to Other Color Spaces: NTSC Color Space, The YCbCr Color Space, The HSV Color Space, The CMY and CMYK Color Spaces, The HIS Color.

M. Sc. SY Semester IV
M. Sc. CS-CC-9
Big Data Analysis

Total Teaching Hours: 60 **Total Marks: 100**

Learning Objectives:

- This course provides an overview of approaches facilitating data analytics on huge datasets.
- Different strategies are presented including sampling to make classical analytics tool Sam enable for big data sets, analytics tools that can be applied in the batch or the speed layer of a lambda architecture, stream analytics, and commercial attempts to make big data manageable in massively distributed or in-memory databases.
- Learners will be able to realistically assess the application of big data analytics technologies for different usage scenarios and start with their own experiments.

Learning Outcomes:

- Upon completion of the subject, students will be able to:
- Understand the concept and challenge of bigdata and why existing technology is in adequate to analyze the bigdata,
- Collect, manage, store, query, and analyze various form of bigdata;
- Gain hands-on experience on large-scale analytics tools to solve some open bigdata problems;
- Understand the impact of bigdata for business decisions and strategy.

Contents	Teaching Hours
Unit I: Introduction to Big Data Analytics & Data Analytics Lifecycle Big Data Overview, Data Structures, Analyst Perspective on Data Repositories, State of the Practice in Analytics, Bl Versus Data Science, Current Analytical Architecture, Drivers of Big Data, Emerging Big Data Ecosystem and a New Approach to Analytics, Key Roles for the New Big Data Ecosystem.	20

Data Analytics Lifecycle Overview Key Roles for a Successful Analytics, Project Background and Overview of Data Analytics Lifecycle Phase 1: Discovery: Learning the Business Domain, Resources, Framing the Problem, Identifying Key Stakeholders, Interviewing the Analytics Sponsor, Developing Initial Hypotheses, identifying Potential Data Sources. Phase2: Data Preparation: Preparing the Analytic Sandbox, Performing ETLT, Learning About the Data, Data Conditioning, Survey and Visualize, Common Tools for the Data Preparation Phase. Phase 3: Model Planning: Data Exploration and Variable Selection, Model Selection, Common Tools for the Model Planning Phase. Phase4: Model Building Common Tools for the Mode/Building Phase. Phase5: Communicate Results. Phase 6: Operationalize.	
Unit- II: Review of Basic Data Analytic Methods Using R Introduction to R: Graphical User Interfaces, Data Import and Export, Attribute and Data Types, Descriptive Statistics, Exploratory Data Analysis, Visualization Before Analysis, Dirty Data, visualizing a Single Variable, Examining Multiple Variables, Data Exploration Versus Presentation Statistical Methods for Evaluation: Hypothesis Testing, Difference of Means, Wilcoxon Rank- SumTest, Type I and Type II Errors, Power and Sample Size, ANOVA.	10
Unit III: Advanced Analytical Theory and Methods: Classification and Clustering. Decision Trees: Overview of a Decision Tree, Decision tree Algorithms, Decision Trees in R, Naïve Bayes, Naïve Bayes in R. Overview of Clustering, K-means, Use Cases, Overview of the Method, Determining the Number of Clusters, Diagnostics, Contents, Reasons to Choose and Cautions.	15
Unit IV: Advanced Analytical Theory and Methods: Association Rules and Regression Overview of Association, Evaluation of Candidate rules, Applications of Association Rules, An Example: Transaction in a	15

Grocery Store, Validations & testing. Linear Regression: Use cases, model description, and diagnostics. Logistic Regression: Use cases, model description, and diagnostics. Reasons to choose & cautions.	

Reference Books:

1. Data Science &Big Data Analytics, Discovering, Analyzing, Visualizing and Presenting Data, EMC Education Services. By WILEY Publication
2. Big Data, Black Book: Covers Hadoop2, Map Reduce, Hive, YARN, Pig, Rand Data Visualization Paperback–2016

M. Sc. CS CC-10

Advanced Java Programming

Total Teaching Hours: 60 **Total Marks: 100**

Learning Objectives:

- Student can learn basic of Java programming, and OOP's concepts.
- They can learn Threading, Packages, and how to handle runtime errors.
- Students should get the knowledge of how to develop GUI based application using swing, and awt components.
- Students should able to handle events, store data in back end and create web application in java.

Learning Outcomes:

After completion of this course, students should be able to:

- Write, compile and execute simple java programs.
- Write programs using OOP's concepts.
- Design graphical application, work with events, JDBC and develop web-based applications.

Contents	Teaching Hours
Unit-I Introduction and Object-Oriented Programming Programming language Types and Paradigms, Computer Programming Hierarchy, How Computer Architecture Affects a Language? Why Java? Flavors of Java, Java Designing Goal, Role of Java Programmer in Industry, Features of Java Language, JVM– The heart of Java, Java's Magic Byte code. Installing Java, Java Program Development, Java Source File Structure, Compilation, Executions. Object Oriented Programming Class Fundamentals, Object & Object reference, Object Life time & Garbage Collection, Creating and Operating Objects, Constructor & initialization code block, Access Control, Modifiers, methods Nested, Inner Class & Anonymous Classes, Abstract Class & Interfaces Defining	15

Methods, Argument Passing Mechanism, Method Overloading, Recursion, Dealing with Static Members, Finalize() Method, Native Method.	
Unit II Extending Classes Inheritance and Packages Use and Benefits of Inheritance in OOP, Types of Inheritance in Java, Inheriting Data members and Methods, Role of Constructors in inheritance, Overriding Super Class Methods, Use of "super" , Package, Organizing Classes and Interfaces in Packages, Package as Access Protection, Defining Package, CLASSPATH Setting for Packages, Naming Convention for Packages.	15
Unit III Exception Handling, Thread and GUI Programming Exception Handling The Idea behind Exception, Exceptions & Errors, Types of Exception, Control Flow In Exceptions, JVM reaction to Exceptions, Use of try, catch, finally, throw, throws in Exception Handling, In-built and User Defined Exceptions, Checked and Un-Checked Exceptions. Thread: Understanding Threads, Needs of Multi-Threaded Programming, Thread Life-Cycle, Thread Priorities, Synchronizing Threads, Inter Communication of Threads, Critical Factor in Thread –Dead Locks. GUI Programming Designing Graphical User Interfaces in Java, Components and Containers, Basics of Components, Using Containers, Layout Managers, AWT Components, Adding a Menu to Window, Extending GUI Features Using Swing Components, Java Utilities (java.util Package) The Collection Framework: Collections of Objects, Collection Types, Sets, Sequence, Map, Understanding Hashing, Use of ArrayList & Vector.	15
Unit IV Event Handling, JDBC and Servlets Event Handling Event-Driven Programming in Java, Event-Handling Process, Event-Handling Mechanism, The Delegation Model of Event Handling, Event Classes, Event Sources, Event Listeners, Adapter Classes as Helper Classes in Event Handling. Database Programming using JDBC Introduction to JDBC, JDBC Drivers & Architecture, CURD	15

operation Using JDBC, Connecting to non-conventional Databases. Java Server Technologies Servlet Web Application Basics, Architecture and challenges of Web Application, Introduction to servlet, Servlet life cycle Developing and Deploying Servlets, Exploring Deployment, Descriptor (web.xml), Handling Request and Response.	

Reference Books:

1. Core Java Volume I - Cay H. Hortsman and G. Cornell
2. Core Java Volume II: Advanced Features - Cay H. Hortsman and G. Cornell
3. The Complete Reference Java Seventh Edition, Herbert Schildt

M.Sc.CS-DSE-7

Information Security

Total Teaching Hours: 60 **Total Marks: 100**

Learning Objectives:

Students are expected to demonstrate the ability to:

- Identify computer and network security threats, classify the threats and develop a security model to prevent, detect and recover from the attacks. (ABET Outcomes: a, c, e, j, k)
- Encrypt and decrypt messages using block ciphers, sign and verify messages using well known signature generation and verification algorithms. (ABET Outcomes: c, e, k)
- Analyze existing authentication and key agreement protocols, identify the weaknesses of the se protocols. (ABET Outcomes: c, e, k)
- Download and install an e-mail and file security software, PGP, and efficiently use the code to encrypt and sign messages. (ABET Outcomes: c, e, k)

Learning Outcomes:

- After studying this course, you should be able to:
- Define what information is
- Appreciate the value of information to the modern organization
- Understand the CI Atrial of Confidentiality, Integrity and Availability
- Appreciate the difficulties that arise when valuable information needs to be shared
- Identify the five leading-edge resources that have up-to-date information on information security.

Contents	Teaching Hours
UNIT I Introduction What is Information Security & Why do you need it? –Basics Principles of Confidentiality, Integrity Availability Concepts	15

Policies, procedures, Guidelines, Standards Administrative Measures and Technical Measures, People, Process, Technology	
UNIT II Current Trends in information Security Current Trends in information Security, Cloud Computing: benefits and Issues related to info Security Standards available for InfoSec: Cobit, Cadbury, ISO27001, OWASP, OSSTMM, etc.-An Overview, Certifiable Standards: How, What, When, Who	15
UNIT III Threat and Risk Vulnerability, Threat and Risk, Risk Assessment and Mitigation + Quick fixes, Introduction to BCP/DRP/Incident management, Segregation and Separation of Duties & Roles and responsibilities, ITACT2000	12
UNIT IV assessments for Information Security Types of assessments for Information Security 1. VAPT of Networks 2. Web Application Audits 3. IT assessments or audits 4. Assessment of Network Equipment's 5. Assessment of Security Devices (Web Filtering, Firewalls, IDS/IPS, Routers 6. Data Center Assessment 7. Security of Application Software 8. SAP Security 9. Desktop Security 10. RDBMS Security 11. BCP/DRP assessments 12. Policy reviews	18

Reference Books:

1. Security Engineering: A Guide to Building Dependable Distributed Systems (Hardcover)by Ross J. Anderson
2. The Web Application Hacker's Handbook: Discovering and Exploiting Security Flaws (Paperback) by Dafydd Stuttard

M. Sc. CS-DSE-8

Soft Computing

Total Teaching Hours: 60 **Total Marks: 100**

Learning Objectives:

- Understanding principles of neural networks and Fuzzy Logic fundamentals.
- Design the required and related systems

Learning Outcomes:

- After studying this course, you should be able to:
- Understand properties, Operations and relations; Fuzzy sets
- Understand Organization of the Brain and develop the artificial model
- Understand Applications of ANN and develop the models using different algorithms

Contents	**Teaching Hours**
UNIT I: Introduction to Fuzzy Logic Crisp Sets: an Overview, Fuzzy Sets: Basic Types, Fuzzy Sets: Basic Concepts, Fuzzy Sets Vs Crisp Sets, Additional Properties of alpha cuts, Presentation of fuzzy sets, Extension principle for fuzzy sets. Operations on fuzzy sets Fuzzy complements, Fuzzy Union, Fuzzy Intersections, Crisp & Fuzzy Relation, Binary Fuzzy Relation, Binary Relation on single set, Fuzzy Equivalence Relations, Fuzzy Compatibility Relation.	15
UNIT II Introduction to Neural Networks Introduction to Neural Networks Biological Neuron and their Artificial Neuron, McCulloch-Pits Neuron Model, Perceptron Classification, Linearly Seperatability, NOR Problem, Overview of Neural Network Architecture, Learning Rules-Supervised Learning- Unsupervised Learning- Perceptron Learning-Reinforcement Learning-Delta Learning Rule	15

UNIT III: Multilayer Feed Forward Network Multilayer Feed forward Network Generalized Delta Learning, Back propagations training algorithm and derivation of weight, Variant in Back propagations, Radial Basis Function (RBF), Application of BP and RBF N/W	15
UNIT IV: Recurrent Network and Neuro Fuzzy System Recurrent Network, Hopfield Network, Counter propagation networks, Boltzmann Machine, Adaptive Resonance theory (ART). Fuzzy System, Neuro Fuzzy System and Applications Fuzzy neurons, Fuzzy Neural Network, Fuzzy associative memory, Application in Pattern Recognition, Character, Face, Finger, Palm, Iris Recognitions, Application in Expert System	15

Reference Books:

1. Fuzzy Sets and Fuzzy Logic Theory and Application by George J. Klir, Bo Yuan, Seventh Edition, Prentice Hall
2. Fuzzy Sets Uncertainty and Information by George J. Klir, Tina A. Floger, Pearson education, First Edition, ISBN 978-0133459845
3. Introduction to the Theory of Neural Competition by John hertz, Krogh and Richard
4. Introduction to Artificial Neural Network by Jaeck M. Zurada, Jaico publishing house
5. Neural Network and Fuzzy System-A Dynamic System by-Koska PHI Edition.
6. Programming MATLAB by E. Herniter Thomson Brooks

M. Sc. CS-Lab-7

(Big Data Analysis)

Learning Objectives

- This course provides an overview of approaches facilitating data analytics on huge datasets.
- Different strategies are presented including sampling to make classical analytics tool same enable for big data sets, analytics tools that can be applied in the batch or the speed layer of a lambda architecture, stream analytics, and commercial attempts to make big data manageable in massively distributed or in-memory databases.
- Learners will be able to realistically assess the application of big data analytics technologies for different usage scenarios and start with their own experiments.

Learning Outcomes:

Upon completion of the subject, students will be able to:

- Collect, manage, store, query, and analyze various form of big data in R.
- Gain hands-on experience on large-scale analytics tools to solve some open bigdata problems.
- Understand the impact of bigdata for business decisions and strategy.

LIST OF PRACTICALS:

1. Introduction to R Software and Programming
2. Importing and Exporting datasets in R Software
3. Study of Different attributes, datatypes and storage data types in R
4. Study of Descriptive statistics and Exploratory data analysis in R
5. Study of Visualization of single variables in R
6. Study of Examining multiple variables in R
7. Study of Data exploration vs. Data Presentation in R
8. Study of Statistical methods for evaluation in R

a) HypothesisTesting

b) Difference of means

9. Study of Statistical methods for evaluation in R–

a) Wilcox on Rank-sumtest

b) Type I and Type II errors

c) Power and sample size

10. Implementation of K-mean clusters in R

11. Implementation of Decision Trees in R.

12. Implementation of Linear Regression in R

13. Implementation od association rules in R

M. Sc. CS Lab-7

(Soft Computing)

Learning Objectives:

- Understanding principles of neural networks and Fuzzy Logic fundamentals.
- Design the required and related systems

Learning Outcomes:

- After studying this course, you should be able to:
- Understand properties, Operations and relations; Fuzzy sets
- Understand Organization of the Brain and develop the artificial model
- Understand Applications of ANN and develop the models using different algorithms

LIST OF PRACTICALS:

1.Explain Fuzzy Logic with example.

2.Programs in MATLAB to implement intersection of two fuzzy sets.

3.Programs in MATLAB to implement union of two fuzzy sets.

4.Programs in MATLAB to find complement of fuzzy set.

5.Programs in MATLAB to find A∩B' , A'∩B',AUB',A'UB for fuzzy sets.

6.Program in MATLAB to implement and Prove Demorgan's laws for two fuzzy sets.

7.Program in MATLAB to implement and explain perceptron learning rule for two inputs.

8.Program in MATLAB to implement and explain perceptron learning rule for more inputs.

9.Program in MATLAB to implement and explain delta learning rule for two inputs.

10.Program in MATLAB to implement and explain delta learning rule for more inputs.

M. Sc. CS Lab-8

(Advance Java Programming)

Learning Objectives:

- Student can learn basic of Java programming, and OOP's concepts.
- They can learn Threading, Packages, and how to handle runtime errors.
- Students should get the knowledge of how to develop GUI based application using awt components.
- Students should able to handle events, store data in back end and create web application in java.

Learning Outcomes:

After completion of this course, students should be able to:

- Write simple java program that demonstrates the concepts of oops.
- Write and use user defined packages and servlets.
- Implement the program that uses exception handling, multi-threading, event handling concepts.
- Write the front-end application that uses data stored in database with help of JDBC concept.

List of Practical

1.Write a java program to check weather a given number is prime or not?

2.Write a java program that demonstrates the fundamental concepts of oops.

3.Write a java program that demonstrates various types of constructors.

4.Write a java program for demonstrating inner class.

5.Demonstrate the concept of Interface with the help of suitable java program.

6.Write a java program that demonstrates the creation and use of user define package.

7.Write a java program that discusses exception handling with the help of any standard exception available in java.

8.Write a java program to implement user defined exception handling.

9.Write a java program that implements the multi-threading concepts.

10.Write a java program that demonstrates the use of AWT components.

11.Explain collection framework with help of suitable java program.

12.Implement java program that generates and handles anyone type of event.

13.Write a java program that demonstrates the concepts of JDBC.

14.Develop a simple java servlet.

15.Develop a mini project in java.